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Session A

The Impacts of the Global Financial Crisis On Financial Ratios: Evidence from Istanbul Stock Exchange

Burcu Dinçergök (Atılım University, Turkey)

Several businesses around the globe were hit very hard by the global economic crisis which started in the USA in 2007. The aim of this study is to analyze the impacts of this global financial crisis on financial ratios of Turkish real sector firms that were quoted on Istanbul Stock Exchange 100 index over the period 2005-2009. Using paired *t*-test and Wilcoxon sign rank test it was determined that the impacts of the global financial crisis on profitability ratios (the Net Margin, Operating Margin and Return on Equity Ratios) and the Operating Ratios (the Inventory Turnover and Receivable Turnover Ratios) were statistically significant. The mean values of these ratios decreased significantly in the crisis period compared to their values in the pre-crisis period. It was also determined that the Total Financial Debt to Equity and Total Liabilities to Total Assets ratios of Turkish real sector firms' were also significantly affected by the global financial crisis. The analyzed real sector firms increased the share of the financial debt and the total liabilities in their capital structures. The impacts on Current Liabilities to Total Liabilities ratio and the impacts on Liquidity Ratios were found to be insignificant.

I. Introduction

The global financial crisis which started in the U.S.A due to the collapse of the US subprime mortgage market in 2007 has spread over to the global financial system by deteriorating the balance sheets of financial institutions that had significant exposures to mortgage related assets. Interconnectedness of the financial systems among countries caused the crisis to be global. The problems in developed countries spread to the other countries financial systems and inevitably undermined the real sector activities.

Turkey is familiar with macroeconomic crises. After the year of 1990, the recent economic crisis was the fifth economic crisis that Turkey faced (The 1994 crisis, the 1998 crisis, the 2000 and 2001 crises). In the aftermath of 2001 crisis, Turkey adopted several structural reforms. These reforms helped the Turkish economy be more stable. As a result of these reforms, Turkish banks achieved a healthier and stronger capital structure, and managed their risks effectively thereafter. One of the main advantages of Turkish banks is that they do not hold toxic assets in their portfolios. According to the Financial Stability Report of the Central Bank of the Republic of Turkey (November 2009); Turkish banking sector maintained its strength after the crisis. It is also stated in the report that, although the profitability of Turkish banks declined moderately in the third quarter of 2008, the Profitability Ratios increased by 42.3% in the first nine months of 2009, compared to the same period of the previous year.

Although Turkish banking sector is said not to have been affected dramatically by the global financial crisis, the effects of the crisis on the Turkish real sector firms remains as an important question to answer.

The aim of this study is to analyze the effects of the global financial crisis on the financial ratios of Istanbul Stock Exchange (ISE) 100 real sector firms. Because of this reason, financial sector firms have been omitted. Using paired *t* test and Wilcoxon sign rank test, it is determined whether the mean and median values of the pre-crisis and the crisis period financial ratios significantly differ from each other. The tests are performed for Liquidity Ratios (such as Current Ratio, Quick Ratio, Working Capital Ratio), Operating Ratios (Inventory turnover and Receivable turnover ratios), Capital Structure Ratios (Total Financial Debt Ratio, Total Liabilities to Total Assets Ratio, Current Liabilities to Total Liabilities Ratios) and Profitability Ratios (Net Margin ratio, Operating Margin and Return on Equity ratios).

According to the results of the analysis, all of the Profitability Ratios used in the study namely; Net Margin, Operating Margin and Return on Equity ratios decreased significantly after the crisis. Total Financial Debt to Equity ratio, Total Liabilities to Total Assets Ratio rose significantly compared to those of the pre-crisis period. As for the Operating Ratios; Receivable Turnover Ratio and Inventory Turnover Ratio significantly decreased after the crisis. The effect of the crisis on Liquidity Ratios is not statistically significant. These results reveal that after the crisis the Profitability Ratios and the Operating Ratios of the Turkish real sector firms decreased significantly and the share of the liabilities in their capital structures increased significantly.

This paper is organized as follows. The following part explains the Turkish economy before and after the global crisis, the third part is the literature review, the fourth part explains the data and the methodology, the results are presented in the fifth part and the last part is conclusion.

II. Turkey's Economic Overview

In the aftermath of the 2001 economic crisis, Turkey adopted a policy of high interest rate- low exchange rate in order to slow down the inflation rate and attract foreign capital flows. In the year of 2004, the inflation rate in Turkey was lowered to one digit level. Capital inflows to Turkey reached high levels during the period 2002-2007, which supported the high growth rates. Due to the large capital inflows, Turkish lira began to appreciate after 2002. Although the appreciation of Turkish lira led the import costs to decline, it became more difficult for Turkish exporting firms to compete in international markets. While the Turkish economy was growing, current account deficit kept on widening in the years between 2002-2007. One of the interesting points is that annual real GDP growth rate had begun to decline before the recent economic crisis affected Turkey's economy. The private consumption expenditures had started to fall in the mid of 2006, however the main reason was the decline in domestic demand which began in the year of 2007 (Uygur, 2010).

One of the important impacts of the recent global crisis on Turkish the economy is that the capital inflows quickly evaporated after the second quarter of 2008. This contributed to the sharp declines in real GDP growth rates. However, stabilization in global market conditions caused financial inflows to turn into positive in the third quarter of 2009 (Rodrik, 2009). After the global crisis, Turkish central bank decreased the interest rates significantly due to the declining world interest rates. The borrowing rates of Turkish central bank reached its bottom levels- 6.5%- at the end of 2009. Dollar/TL parity rose up to 1.56 on the average in the year of 2009. Due to the significant slowdown in her major trading partners, Turkey's exports began to decline in October 2008 and the decline in exports reached approximately -%23 in the year of 2009 despite the depreciation in Turkish Lira. The decline in exports contributed to the decline in real GDP growth. Table 1

presents some of the main economic indicators over the period of 2005-2009. As seen in Table 1, the decline in imports is more than the decline in exports in 2009. It led to smaller current account deficit.

According to the Financial Stability Reports of the Central Bank of the Republic of Turkey approximately 58% of the financial debt of the corporate sector consisted of foreign exchange loans over the period of 2005-2009. The real interest rates were quite high. This made borrowing from abroad cheaper.

The decline in domestic and foreign demands as well as the declining exports and the depreciation of Turkish lira against dollar probably caused the deterioration on the financial statements of the real sector firms. The decrease in sales may have caused a decrease in the profitability and Operating Ratios. Therefore this may also have deteriorated the creditworthiness of firms and made acquiring loans more difficult. The real sector may have faced liquidity problems. Besides, the depreciation of Turkish Lira may have increased the foreign exchange liabilities of real sector firms.

III. Literature Review

In a recent survey study that covers six countries' real sector firms (namely, Bulgaria, Hungary, Latvia, Lithuania, Romania and Turkey) it has been concluded that the global financial crisis decreased the sales and capacity utilization in all of the analyzed countries and also decreased permanent employment in five of them. Besides, the study has also revealed that firms used more internal funds to finance their working capital except for Romania (Correa et al. 2009).

Another study related to the effects of the global crisis on the real sector was made by Hodorogel (2009) who investigated the effects of the global financial crisis on Romanian small and medium size enterprises comprising 80% of Romanian GDP. The article also explains the anti-crisis measures taken by Italian, Slovak, Hungarian and German governments. It is stated that, sudden rises in the prices of raw materials, energy, and food, decline in demand, worsening credit conditions as well as variations in the key macroeconomic factors such as inflation and exchange rate were the problems which the Romanian companies had to cope with. According to the analysis, the main effects of the crisis were declining exports, diminishing investment, and liquidity blockage.

Tanrıöven and Aksoy (2009) examined the effects of all of the crises between the years 1996 and 2009 on the Turkish real sector firms on an industrial basis. Using *t* test and One Way ANOVA test the effects of the crises on Profitability, Risk, Capital structure, Size, Growth, Asset Structure Ratios, and Operating Ratios were analyzed. According to the results of the study, it is denoted that especially technology and communication sectors showed significant differences from other sectors in terms of profitability, size, risk, and capital structure.

By the help of financial instability theories, Çabuk and Özkan (2009) investigated how the global crisis affected and would affect the Turkish economy. In the study it is denoted that the increase in short term foreign currency liabilities, decreasing demand and limited credit conditions negatively affected the Turkish real sector. Especially automotive, textile, and real estate sectors were negatively affected from the crisis. The authors anticipated that if the crisis deepened, the Turkish real sector would be affected severely because of its foreign debts and declining demand.

Orhan and Yazarkan (2011) analyzed the effects of the recent financial crisis on the real sector firms that are quoted on Istanbul Stock Exchange 30 Index. The authors analyzed the effects of the crisis on Liquidity Ratios, Operating Ratios, Capital Structure Ratios, and Profitability Ratios. According to the results of the study, the Current Debt to Total Assets ratios significantly decreased after the crisis and also between the years 2007-2008. The Current Ratio also significantly decreased during the 2007-2008 period. But the results were insignificant for the pre-crisis and the crisis periods. Other ratios did not show any significant results.

Kesimli and Gunay (2011) analyzed the impacts of the global financial crisis on the working capital of 45 ISE real sector companies in Turkey. According to the results of their two-tail significance and Mann-Whitney U Tests, it was found that the global financial crisis affected the ISE traded companies on a limited basis and further research is required. In their study two different pre-crisis and crisis periods were examined. Firstly, the period 2004-2007 was accepted as the pre-crisis era and the years of 2008 and 2009 were accepted as crisis era. Then, the same tests were conducted for different periods. The period starting from the first quarter of 2004 till the second quarter of 2007 was described as the pre-crisis era and the period covering the third quarter of 2007 till the end of third quarter of 2009 was accepted as the crisis era. The last quarters of 2007 and 2008 were also compared. According to the results; the crisis didn't have any significant effects on the Current Ratio, Liquidity Ratio, Cash Ratio, Short-term Receivables to Current Assets Ratio, Current Assets to Total Assets Ratio, Short-term Liabilities to Total Liabilities Ratio, Short-term Liabilities to Total Assets Ratio Inventory Turnover Ratio, and Net Working Capital Ratio. The effects on the Inventory to Current Assets ratio, Receivable Turnover Ratio, Working Capital Ratio were limited.

IV. Data and Methodology

Yearly data over the period of 2005-2009 were used in this study. The companies' yearly balance sheets and income statements were gathered from the Data Stream database. The study covers the real sector firms of the ISE 100 index, so financial sector firms have been excluded from the study. Also, the firms that could not provide continuous information over the analyzed period have been omitted. The calculated financial ratios of the remaining 55 real sector firms that are listed on ISE 100 index have been analyzed. The financial ratios have been evaluated using STATA 10.0 data analysis and statistical software. All results have been evaluated on $p < 0.05$ significance level. Descriptions of the ratios are presented in Table 2.

The year of 2007 is a transition year so it is hard to determine whether this year was in the pre-crisis period or in the crisis period. Therefore, the tests were performed for different periods. Firstly, the period of 2005- 2007 was accepted as the pre-crisis period and the years 2008-2009 were accepted as the crisis period. In the second case, the period of 2005-2006 was accepted as the pre-crisis period and the period of 2007-2009 was accepted as crisis period. The results show that when the year of 2007 was accepted in the crisis period, most of the differences between pre-crisis and crisis periods related to financial ratios were found to be insignificant. In the third case, the year of 2007 was eliminated from the study, the results of the third case were similar to the results of the first case, but the normality of the data was distorted for some of the ratios. According to these results, in this study, the period of 2005-2007 was accepted as the pre-crisis period and the years 2008-2009 were accepted as the crisis period.

In order to check for the normality of the data, Shapiro-Wilk test was applied to the differences between the means of pre-crisis and crisis periods ratios. According to the results, Shapiro-Wilk test rejected the hypothesis that the differences between the means of the pre-crisis and the crisis periods are normally distributed for the Current Ratio, Quick Ratio, Operating Margin ratio, and Total Financial Debt Ratio with p values below 0.05. However the hypothesis was accepted for the Working Capital Ratio, Inventory Turnover Ratio, Receivable Turnover Ratio, Net Margin ratio, Return on Equity ratio, Total Liabilities / Total Assets ratio, and Current Liabilities/ Total assets ratio. The results of Shapiro-Wilk test are presented in Table 3.

To analyze whether the mean differences between paired observations (The ratios of the pre-crisis and the crisis periods) are significantly different from zero, a parametric test, namely, paired *t*-test was conducted. One of the main assumptions of the paired *t*-test is that the differences between pairs are identically distributed normal random variables. Since the underlying assumption of the *t*-test was not justified for some of the ratios stated above, a nonparametric alternative of the *t*-test namely; Wilcoxon sign rank test was used in order to determine whether the median of the differences between the pre-crisis and the crisis periods ratios are significantly different from zero (Conover, 1999). Although it is known that parametric procedures are more efficient than nonparametric ones, non-parametric methods have much to offer when the underlying distributions are not close to normal (Montgomery, Runger, 2006).

V. Results

Table 4 presents the average values of the financial ratios over the period of 2005-2009 and also reports the mean values of the pre-crisis and the crisis periods. As seen in Table 4, Liquidity Ratios namely; the Current Ratio and the Quick Ratio decreased by 5% and 7%, respectively on the average compared to those of the pre-crisis period. The declining trend began in the year of 2007 for these ratios. As for the Working Capital Ratio; there was a %14 decrease after the crisis compared to that of the pre-crises period. The Working Capital Ratio began to decrease in the year of 2008 but increased by 5% in 2009.

The statistics show that the Operating Ratios also fell after the crisis. The Inventory Turnover Ratio, decreased from 6.59 to 5.83 while the Receivable Turnover Ratio decreased from 5.82 to 5.37. Although some problems in receivable collection started in the year of 2006, the huge decline occurred in the year of 2007. The Operating Ratios began to decline in 2007.

The Profitability Ratios started to decrease in the year of 2008. The Operating Margin fell by %40, the Net Margin fell by 25%, and the Return on Equity ratio fell by 35% compared to those of the pre-crisis period. Although the profits increased slightly in 2009, the profits couldn't reach the pre-crisis levels.

As for the Capital Structure Ratios, the Total Financial Debt/ Equity, and the Total Liabilities/ Total Assets ratios slightly decreased in the year of 2007. The Total Financial Debt/ Equity ratio increased by 48% between the years 2007 and 2008. As it was stated in the Turkey's economic overview, 58% of the financial debt of the corporate sector consists of foreign exchange loans. For this reason, the dominant factor behind this rise is thought to be the depreciation of Turkish Lira against dollar. The Total Liabilities to Total Assets ratio increased by 14% over the same period. The Current Liabilities to Total Liabilities ratio didn't show remarkable changes over the analyzed period.

Table 5 shows the t-test results of the paired samples. The results of the Wilcoxon sign rank test required for the Current Ratio, the Quick Ratio, the Operating Margin ratio, and the Total Financial Debt/Equity are also given for the specified ratios.

According to the results of the Wilcoxon sign rank test, it is concluded that the global financial crisis didn't have a remarkable effect on the Current Ratio and the Quick Ratio of the analyzed firms. The median of the differences is not significantly different from zero. The results of the *t*-test are no different than the results of the Wilcoxon sign rank test. The *t*-value related to the comparison of Working Capital Ratios of pre-crisis and crisis periods is 1.65, which implies that the mean value of the pre-crisis period Working Capital Ratio is not significantly different from the mean value of crisis period Working Capital Ratio. Similar to the Current Ratio and Quick Ratio, the global financial crisis didn't have a significant effect on the Working Capital Ratios of the analyzed ISE firms.

As for the Operating Ratios, the result reveals that the pre-crisis period Inventory Turnover Ratio is significantly differing from crisis period Inventory Turnover Ratio. The *t*-value of the comparison is 3.0537 at 0.05 significance level (*p*-value is equal to 0.0038). The result of Receivable Turnover Ratio is no different than the result of Inventory Turnover Ratio. With a *p*-value of 0.0408 and a *t*-value of 2.1013, it is accepted that the mean values of the compared periods are significantly different from zero. Since the mean differences are positive, it can be concluded that the Operating Ratios were significantly negatively affected by the global financial crisis.

The mean Net Margin ratio of the pre-crisis period significantly differs from the mean Net Margin ratio of the crisis period at 0.01 significance level (*p*-value is equal to 0.000). Return on Equity ratios were also significantly affected by the crisis with a *p*-value of 0.0007 and a *t*-value of 3.6147. As seen on Table 5, the results of the Wilcoxon sign test for the Operating Margin ratio indicates that the median of the differences is significantly different from zero. The result of the *t*-test also is in conformity with this finding. The positive mean differences imply that the global financial crisis negatively affected the profitability ratios.

As for the Capital Structure Ratios, according to the results of the Wilcoxon sign rank test it is accepted that the median differences between the Total Financial Debt to Equity ratios of the pre-crisis and the crisis periods significantly differs from zero. The hypothesis is accepted at 0.01 significance level (*p*-value: 0.0070). The *t*-test result for the Total Financial Debt to Equity ratio also supports this finding. The Total Liabilities to Total assets ratio was also significantly affected by the crisis, the mean values of pre-crisis and crisis periods significantly differ from zero at 0.01 significance level (*p*-value: 0.0017). The *t*-value related to the test is -3.3019. The result for the Current Liabilities to Total Liabilities ratio is found to be insignificant. Except for the Current Liabilities to Total Liabilities ratio, the Capital Structure Ratios are found to have been significantly affected by the global financial crisis. Negative mean differences imply that the analyzed Turkish real sector firms increased the share of their financial debt and total liabilities in their capital structures.

The limitation of the study is that firms listed on the Istanbul Stock Exchange are large firms and they have many financing alternatives. They also have high export opportunities. The results obtained from this study may not be generalized to non-listed firms which have limited financing alternatives and limited export opportunities.

VI. Conclusion

This study analyzed the impacts of the global financial crisis on the financial ratios of the Turkish real sector that were quoted on Istanbul Stock Exchange 100 index over the period of 2005-2009. Using paired *t*-test and Wilcoxon sign rank test it was found that, the Operating Ratios namely, the Inventory Turnover Ratio and the Receivable Turnover ratio were significantly affected by the global financial crisis. Both of these ratios decreased significantly compared to their values in the pre-crisis period. As for the Profitability Ratios, the global financial crisis significantly affected the Net Margin Ratio, the Operating Margin Ratio, and the Return on Equity ratio. The decline in domestic and foreign demand, high interest rates, depreciation of Turkish Lira against the US dollar is thought to have affected the firms' Operating and Profitability Ratios negatively in the crisis period. Interestingly, after the crisis, ISE 100 Turkish real sector firms increased the share of the Total Financial Debt and Total Liabilities in their capital structures. Although it was expected that the creditworthiness of these firms might be deteriorated by the decline in the Profitability Ratios and the Operating Ratios, the rise in the share of the liabilities in the capital structures of these firms is thought to be related with the depreciation of Turkish Lira against dollar. This is because high portion of financial debt of corporate sector consist of foreign exchange loans. The effect of the global crisis on Current Liabilities to Total Liabilities ratio was found to be insignificant. Furthermore, liquidity ratios were not found to be significantly affected by the global crisis. The results of the study may not be generalized to the other non-listed real sector firms which may have different financial ratios.

Tables

Table 1: Some of The Main Economic Indicators

Years	Annual Real GDP Growth Rate %	Annual Inflation Rate %	Interest Rate %	Dollar/ Turkish Lira	Yearly Current Account Deficit (Million Dollars)	Change in Exports %	Change in Imports %
2005	8.4	7.7	13.50	1.34	22.9	16.3	19.7
2006	6.9	9.7	17.50	1.42	31.8	16.4	19.5
2007	4.7	8.4	15.75	1.17	37.5	25.4	21.8
2008	0.7	10.1	15.00	1.57	41.62	23.1	18.8
2009	- 4.8	6.5	6.5	1.51	37.5	-22.6	-30.2

Source: Under secretariat of Treasury (Annual Real GDP growth rate, current account deficit), Turkish Statistical Institution (Annual Inflation rate, change in exports and imports) , Central bank of Turkey (Dollar/ TL parity, Central Bank Interest Rates- Overnight

Table 2: Descriptions of Financial Ratios

FINANCIAL RATIOS	DESCRIPTIONS
Current Ratio	Current Assets/Current Liabilities
Quick Ratio	(Current Assets-Inventories)/Current Liabilities
Working Capital Ratio	(Current Assets-Current Liabilities) / Total Assets
Inventory Turnover Ratio	Cost of Goods Sold/ Average Inventory
Receivable Turnover Ratio	Net Sales / (Average Accounts Receivable)
Total Financial Debt Ratio	Total Financial Debt / Common Equity
Total Liabilities to Total Assets	Total Liabilities / Total Assets
Current Liabilities to Total Liabilities	Current Liabilities / Total Liabilities
Net Margin	Net Income / Sales
Operating Margin	Operating Income/ Sales
Return on Equity	Net Income/ Common Equity

Table 3: Results of Shapiro-Wilk Test

Ratios	W	Z	P>Z
Current Ratio	0.85229	7.382	0.00001
Quick Ratio	0.78823	5.054	0.00000
Working Capital Ratio	0.98453	-0.490	0.68783
Inventory Turnover Ratio	0.97506	0.200	0.42084
Receivable Turnover Ratio	0.96217	1.229	0.10961
Net Margin Ratio	0.97534	0.247	0.40245
Operating Margin Ratio	0.95003	1.858	0.03161
Return on Equity	0.96822	0.857	0.19568
Total Financial Debt/ Equity	0.91872	2.784	0.00268
Total Liabilities/Total Assets	0.96006	1.447	0.07390
Current Liabilities/Total Liabilities	0.97071	0.816	0.20712

Table 4 Mean Values of the Financial Ratios

Years		2005	2006	2007	2008	2009	Pre-crisis	Crisis
LIQUIDITY RATIOS	Current Ratio	2.33	2.37	2.30	2.21	2.15	2.33	2.22
	Quick Ratio	1.70	1.77	1.65	1.53	1.64	1.71	1.59
	Working Capital ratio	0.20	0.21	0.22	0.17	0.18	0.21	0.18
OPERATING RATIOS	Inventory Turnover Ratio	6.57	6.86	6.32	6.04	5.60	6.59	5.83
	Receivable Turnover Ratio	6.04	5.91	5.51	5.71	5.04	5.82	5.37
	Net Margin	0.09	0.10	0.11	0.05	0.07	0.10	0.06
PROFITABILITY RATIOS	Operating Margin	0.11	0.12	0.13	0.09	0.09	0.12	0.09
	Return on Equity	0.13	0.14	0.17	0.08	0.09	0.14	0.09
	Total Financial Debt/Equity	0.40	0.36	0.33	0.49	0.47	0.36	0.48
CAPITAL STRUCTURE RATIOS	Total Liabilities/Total Assets	0.43	0.44	0.43	0.49	0.46	0.44	0.48
	Current Liabilities/Total Liabilities	0.66	0.65	0.67	0.64	0.64	0.66	0.64

Table 5: Paired Samples T-Test Results and Wilcoxon Sign Rank Test Results

Comparison of Pre-crisis and Crisis Periods	Mean Differences	Standard Deviation	t- Values	P-Values (t-test)	P-Values (WSR)
Current Ratio	0.1246	1.233	0.7213	0.2371	0.3963
Quick Ratio	0.1222	1.3574	0.6616	0.2555	0.5212
Working Capital Ratio	0.0314	0.1419	1.6573	0.1031	
Inventory Turnover Ratio	0.7607	1.6897	3.0537	0.0038**	
Receivable Turnover Ratio	0.5606	1.886	2.1013	0.0408*	
Net Margin	4.08520	6.0096	4.7096	0.0000**	
Operating Margin	3.0286	7.7544	2.7892	0.0037**	0.0022**
Return on Equity	5.9847	11.7073	3.6147	0.0007**	
Total Financial Debt/Equity	-12.277	31.552	-2.6958	0.0097**	0.0070**
Total Liabilities/Total Assets	-0.0444	0.0979	-3.3019	0.0017**	
Current Liabilities/Total Liabilities	0.2486	0.1551	1.1778	0.1221	

* refers to 0.05, ** refers to 0.01 level of significance respectively.

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“An empirical model of daily highs and lows of West Texas Intermediate crude oil prices”

Alan Wan (City University of Hong Kong, Hong Kong)

There is a large collection of literature on energy price forecasting, but most studies typically use monthly average or close-to-close daily price data. In practice, the daily price range constructed from the daily high and low also contains useful information on price volatility and is used frequently in technical analysis. The interaction between the daily high and low and the associated daily range has been examined in several recent studies on stock price and exchange rate forecasts. The present paper adopts a similar approach to analyze the behaviour of the West Texas Intermediate (WTI) crude oil price over a ten-year period. We find that daily highs and lows of the WTI oil price are cointegrated, with the error correction term being closely approximated by the daily price range. Two forecasting models, one based on a vector error correction mechanism and the other based on a transfer function framework with the range taken as a driver variable, are presented for forecasting the daily highs and lows. The results show that both of these models offer significant advantages over the naive random walk and univariate ARIMA models in terms of out-of-sample forecast accuracy. A trading strategy that makes use of the daily high and low forecasts is further developed. It is found that this strategy generally yields very reasonable trading returns over an evaluation period of about two years.

“Creating A Study of the Relationships among Green Management, Environmental Performance and Competitive Advantages”

Ling-Yu Melody Wen (National Changhua University of Education, Taiwan)

The environmental protection problems are caused by human being's economic activities have arising the pressures and demands for implementing environmental practices. Under this circumstance, enterprises shouldn't only concern the profitability, the competitive position and advantages in the future are also important that all to be included in strategies of enterprises. Especially, enterprises must concern green management to reduce the impact on nature environment and improve the competitive advantages in the future. According to the literature review, people perceive green management as a powerful strategy that influences the performances of enterprises to gain competitive advantages. Today, green management has become a trend worldwide. However, the relationships among green management, environmental performance and competitive advantage are still argued until recent years.

The major purpose of the study was to explore the relationships among green management, environmental performance and competitive advantages. The results of this study would provide meaningful information for enterprises to develop competitive strategies and contribute to future research as a reference.

A survey questionnaire was applied to this study. The total items of the questionnaire were 36 items: green management including 8 domains with 24 items, environmental performance containing 5 items, and competitive containing 7 items. Six hundred and eighty questionnaires were sent out. Five hundred and eighty-eight valid questionnaires returned, with 86% return rate. Structural equation model (SEM) was adopted as the statistical method for analyzing the data. The research results showed the good fit of model and positive significant relationships among variables. (1) The impact of “green management” to “environmental performance” is positively significant; (2) “Environmental performance” has positively significant impact to “competitive advantage”; (3) “Green management is also positive associated with competitive advantage significantly; (4) There was partial mediation on impact of “green management” to “competitive advantages.”

“Information Institutions, Signaling Strategy and Target Firm Return”

Jessie Qi Zhou (Southern Methodist University, United States)

Jeff Jiewei Yu (Southern Methodist University, United States)

Information institutions are the rules governing financial disclosure in different countries. Firms in information opaque countries often found it difficult to signal out their true values to their international acquirers. This paper investigates the impact of information institutions on returns of target firms in different countries and the strategic choices made by firms to signal their value in information opaque countries. In analyzing international acquisitions made by U.S. firms from 1995 to 2007 in 32 countries, we found that poor development of information institutions in a target country hurts a target firm's return. In addition, institutions that are weak on investor protection also lower a target's return. Target firms can more effectively communicate their value by hiring multiple investment banks, forming alliance relationship with acquirers, and encouraging bidding competition. These coping strategies significantly increase the target firm's return in opaque countries.

“Voluntary Disclosures of Strategic Information in Company Annual Reports: An Evaluation of South African Listed Companies”

Stephen O Migiro (UNISA-School of Business Leadership, South Africa)

Recent trends in financial reporting have seen companies around the globe voluntarily disclosing strategic information in their annual reports, with the objective of providing investors and other stakeholders with additional information that is useful for their decision making. This study investigates the extent of voluntary disclosures of strategic information made by ten companies randomly selected from the Johannesburg Stock Exchange (JSE) top 100 companies list. The study, also establishes factors that influence managers to voluntarily disclose strategic information. A content analysis approach was used to conduct an in depth analysis of information contained in company annual reports, identifying elements of strategic information that were visible. A disclosure scorecard was developed, where findings from the analysis were rated on a Likert scale ranging from zero (no disclosure) to five (excellent disclosure). In order to determine factors that influence managers to disclose strategic information, interviews were conducted with five executives selected from companies listed on the JSE. The results indicate that companies generally provide extensive disclosures on sustainability issues (economic, social and environmental); broad strategic guidelines; objectives and performance against objectives. However, certain elements of strategic information, which are useful for decision making needs of users, were not sufficiently disclosed. A lot of improvement is required on disclosure of actions to improve operations; resources allocated; targets set against objectives and the related time frames set to execute the strategic initiatives. These elements enhance the sufficiency and usefulness of information disclosed.

1.1 INTRODUCTION AND STATEMENT OF THE PROBLEM

In the wake of increasing corporate failures and scandals involving big businesses such as Enron, World Com, Global Crossing and many others, mandatory financial reporting has faced enormous criticism from various stakeholders (Carroll and Buchholtz 2006, p. 3). In expressing their loss of confidence and dissatisfaction with mandatory financial reporting, investors and other stakeholders call on companies to voluntarily provide additional information about their long term strategies and performance (Kumar, 2008). The Financial Accounting Standards Board (FASB) (2001) has been instrumental in encouraging companies to provide additional information through voluntary disclosures. Recent reporting patterns reveal that South African listed companies have joined the rest of the world in responding to the call by voluntarily disclosing strategic information in the annual financial reports.

The study on disclosure of strategic information was largely motivated by the fact that most research on voluntary disclosures has been conducted in the United States of America (USA), Europe, Asia and Latin America. Very little work has been done to evaluate the extent of voluntary disclosures in Africa and in particular South Africa. Besides, prior researchers have paid more attention to disclosure of financial information, primarily due to the need to comply with mandatory financial reporting requirements (See Gao ,2010; Leuz and Verrecchia ,2000; Kumar ,2008; Merkl-Davies and Brennan ,2007;Verrecchia ,1990; and Baginski, Hassell and Kimbrough ,2002).

This study therefore bridges this gap by focusing on the extent of voluntary disclosures of strategic information as contained in the annual reports of South African listed companies.

The researchers therefore sought to explore whether South African listed companies disclose sufficient strategic information to satisfy the needs of users. Hence, the following questions were raised:

1. Are South African listed companies disclosing sufficient strategic information in their annual reports?
2. What factors influence managers of South African listed companies to disclose strategic information?

1.2 LITERATURE REVIEW

The FASB (2001) defines voluntary disclosures as 'disclosures primarily outside the financial statements that are not explicitly required by Generally Accepted Accounting Practice (GAAP) or any SEC rule'. Voluntary disclosures are 'disclosures in excess of requirements – representing choices on the part of company management to provide accounting and other information deemed relevant to the decision making needs of users of corporate annual reports' (Meek, Roberts and Gray, 1995).

What is peculiar about voluntary disclosures is that managers are not compelled to disclose information that is outside mandatory requirements, but they elect to do so at their own discretion. Providing additional information at will presents a number of challenges. The first challenge being that the most prominent users of external financial reports, (investors and creditors and their advisors) generally lack the ability to prescribe all of the information they need from an entity (FASB, 2006). As a result they rely on what managers choose to disclose and the challenge in this regard is that managers may not disclose all the information at their disposal. The second challenge is that strategic information may be regarded as confidential and strictly for internal purposes only, and that disclosure may expose the company's competitive strengths and weaknesses to competitors who may use it to the detriment of the company. When managers decide on the information they want to disclose externally, such information may never be communicated to the public. In this view, Meek, Roberts and Gray (1995) assert that managers may vary their disclosures depending on the type of information. Similarly, Givler (1994) stated that no firm will completely disclose its private information. This therefore raises the question: Do companies disclose information that is sufficient to meet the increasing demands from the various stakeholders? The third challenge is that voluntary information is non-verifiable. As Ferreira and Rezende (2007) put it, 'Information about managerial intentions (strategy) tends to be "soft" and cannot be directly verified before the plan is implemented'. The softness of the information raises questions about its credibility. Verrecchia (1990) stated that 'managers exercise discretion when making voluntary disclosures and there may be motivation for managers to withhold unfavourable reports'. Ferreira and Rezende (2007) agreed with Verrecchia (1990) in this regard, but also pointed out that, in the absence of proprietary costs, truthful disclosures by management benefit investors as they can make informed decisions.

Stocken (2000), examined the credibility of voluntary disclosures, describing them as 'cheap-talk game setting', suggesting that voluntary disclosures may not be credible. According to Givler (1994), the desire by both managers and current investors is to influence potential investors making it difficult to have credible disclosures.

Merkl-Davies and Brennan (2007), tried to balance these two opposing views, the view that 'disclosure constitutes opportunistic and impression management as well as the view that disclosures constitute value-adding information aimed at improving investors' decision making" (incremental information). Despite taking a balanced view, Merkl-Davies and Brennan (2007), highlighted seven strategies of impression management under two broad categories of concealment and attribution of negative outcomes. According to them, impression management in financial reporting contributed to Enron's downfall.

In light of the challenges around voluntary disclosures, it is necessary to look at information that could be considered to be sufficient, first by reference to elements that make up strategic information, usefulness of information to users and influencers of voluntary disclosures.

1.2. Elements of strategic information

Various scholars, including Thompson, Strickland and Gamble (2007), Ferreira and Rezende (2007) and Meek, Roberts and Gray (1995) analyzed strategic information into various components, such as 'vision and mission statements, goals and objectives, activities in the market place and the statements of senior managers about the current business approaches, future plans, efforts to strengthen competitiveness and performance'. For the purpose of this paper, the researchers grouped the various elements of strategic information into five broad categories, which included:

- (i) General corporate strategic information – which may include the nature of business, vision, mission statements, goals, objectives and strategic positioning.
- (ii) Financial performance – which may include, revenue and earnings growth, sensitivity analysis and ratios on performance; efficiency; liquidity and solvency.
- (iii) Market performance and customer focus – which may include products selection and features, markets served, pricing strategies and customer service efforts.
- (iv) Conducting operations and competing successfully – which may include actions to improve value chain activities (research and development, production, sales, supply chain management) and support functions (finance, information technology and human resources).
- (v) Future prospects and business growth – which may include actions to capture emerging market opportunities, strategic alliances and acquisitions, current and future investment plans, revenue and earnings forecasts and targets for the ensuing year.

The extent to which the above elements are visible in the annual reports determines the sufficiency of information disclosed, omissions may render the information deficient in terms of relevance.

1.2.2 Usefulness of information to users

Another way of looking at whether information disclosed is sufficient or not is by making reference to its usefulness to the needs of targeted users. The FASB (2006) in its accounting framework asserts that 'qualitative characteristics are the attributes that make the information provided in financial statements useful to users. The FASB (2006) provides the four principal qualitative characteristics to be understandability, relevance, reliability and comparability.

According to The FASB (2006) information is useful when it can be 'readily understood' by users who are assumed to have a reasonable knowledge of government, the entity's activities and environment, accounting and have a willingness to study the information with reasonable diligence'. Information is understandable if its reporting is less ambiguous or not vague. To be relevant, strategic information disclosed must help investors / creditors to evaluate past, present or future ability of an entity to generate net cash inflows (FASB, 2006). Information 'has the quality of reliability when it is free from material error and bias and can be depended upon by users to represent faithfully that which it either purports to represent, or could reasonably be expected to represent' (FASB, 2006). Lastly, the financial statements of an entity must be comparable through time in order to identify trends in its financial position and financial performance (FASB, 2006). Reporting must be consistent over time, so that users are able to compare the financial statements of different entities in order to evaluate their relative financial position, financial performance and changes in net assets (FASB, 2006).

1.2.3 Factors influencing voluntary disclosures

Empirical evidence has shown that the amount of voluntary disclosures varies with a number of variables. Variables sighted include, size of the firm; country of origin; industry type; degree of financial leverage; extent of multinational operations; profitability and international listing status (Meek, Roberts and Gray 1995). According to Meek, Roberts and Gray (1995), 'large firms disclose more information than smaller ones'. Meek, Roberts and Gray (1995) further asserts that variations in national and regional reporting requirements, political costs, cultural and social norms also play a role in the amount of voluntary disclosures made, as firms go international. This view was supported by Kumar (2008), in an empirical study of Italian and United States companies, where a comparison of voluntary disclosures made revealed differences in amount and quality of disclosures by country of origin. Verrecchia (1990) sites that relevance and sensitivity to disclosure of information to competitors and the public vary depending on the nature of the industry. Meek, Roberts and Gray (1995) pointed out that companies with high gearing have high agency costs, thus increased voluntary disclosures are expected with more leverage. Lastly, well-run organisations have incentives to distinguish themselves from less profitable organisations, to allow them to raise capital on the best available terms, as a result such firms are expected to make increased disclosures.

The above empirical variables are all expected to be positively associated with voluntary disclosures however, empirical tests conducted in other countries produced mixed results, for instance, McNally, Lee and Haseldine (1982) did not find profitability to be positively associated with the amount of voluntary disclosures in New Zealand. Baginski, Hassell and Kimbrough (2002), in a study of US and Canadian markets, found that disclosure of management forecasts in different countries will differ due to differences in the countries' legal environments. Results from the Standard & Poor's (2002) T&D study revealed 'dramatic differences in the amount of disclosures by companies, both among regions, and countries and within regions and countries.

1.3 METHODS AND PROCEDURES

Both qualitative and quantitative research methods were used. Content analysis, a qualitative research design was used to conduct an in depth analysis of annual reports and identifying elements of strategic information that were visible. The

findings from the analysis were evaluated using a quantitative rating scale, the Likert scale, where the extent of strategic information disclosed was rated on a scale from zero (no disclosure) to five (excellent disclosure).

Besides, interviews were conducted to obtain factors that influence managers to disclose strategic information. Thus, for this purpose, interviews were conducted with five executives from companies listed on the JSE so as to obtain an understanding of their experiences, perspectives and views and establish factors that influence or motivate them to voluntarily disclose strategic information.

1.3.1. Population and Sampling

The 2009 JSE Top 100 companies comprised the population for the study. The companies were ranked in terms of turnover, total assets, market capitalisation, equity funds and net profit. A sample size of ten companies, representing 10% of the population was randomly selected from companies in proportion to the number of companies in each industry segment. To ensure that the sampling elements were representative, the companies were stratified according to industry segments and stratified random sampling method described by Diamantopoulos and Schlegelmilch (2000, p.15) applied.

1.3.2 Data Collection Methods

The data collection instruments that were used for this study included a scorecard (disclosure checklist) and an interview guide. The development of the scorecard broadly followed the line of thought reflected by the Standard & Poor's (2002) Disclosure Rankings, which they developed for their study on Transparency and Disclosure (T&D) practices by public companies around the globe. In addition the researchers also followed the Coy and Dixon (2004) disclosure index parameters. The Coy and Dixon index was developed from a public accountability perspective, capturing stakeholder opinions. The disclosures made by companies were summarised on the scorecard and the extent of disclosure was rated on a Likert scale.

The interview guide was used as an aid in performing interviews with the five executives selected from companies listed on the JSE. The executives were selected on the basis of their role and availability and most importantly on their understanding of financial reporting and corporate strategy. Due to time and financial constraints it was not practical to interview a large sample of executives. The fact that executives were selected from companies listed on the JSE, means that they are all governed by the same reporting standards, stock exchange and other disclosure requirements and therefore a large sample size was not expected to give results that would be materially different from those from a smaller one.

1.3.3 Validity and Reliability

To ensure that the data collected for this study was valid and reliable, a representative sample was selected using the stratified random sampling method in proportion to the number of units in each segment. This ensured that all companies had an equal chance of being selected.

In developing the scorecard, the researcher adopted methods used by prior researchers, Standard & Poor's (2002) and Coy and Dixon (2004) so as to get a balanced measurement criterion and the scorecard was modified in order to capture the objectives of this study. To ensure that the scorecard measures what it is supposed to measure (validity), the development of the scorecard was informed by the elements of strategic information identified in the literature and the scores were determined by the existence or non-existence of those elements.

The interview guide was also developed with reference to factors that influence voluntary disclosures and was in the form of open-ended questions so as to allow the information rich respondents to air their views without limit. The researcher considered the fact that some respondents may choose to generalise their responses and not provide anything specifically related to their organisations. To minimise this risk, the researcher reviewed the respective company's annual report prior to the interview taking note of some information that would require further interrogation.

1.3.4 Data Analysis

The researcher applied content analysis and descriptive statistics techniques to analyse company reports. The findings were summarised by calculating total scores and mean/averages. The data was graphically presented, and the findings from the interviews were interpreted in light of the research objectives identifying patterns and inconsistencies with existing theory.

1.3.5 Ethical considerations

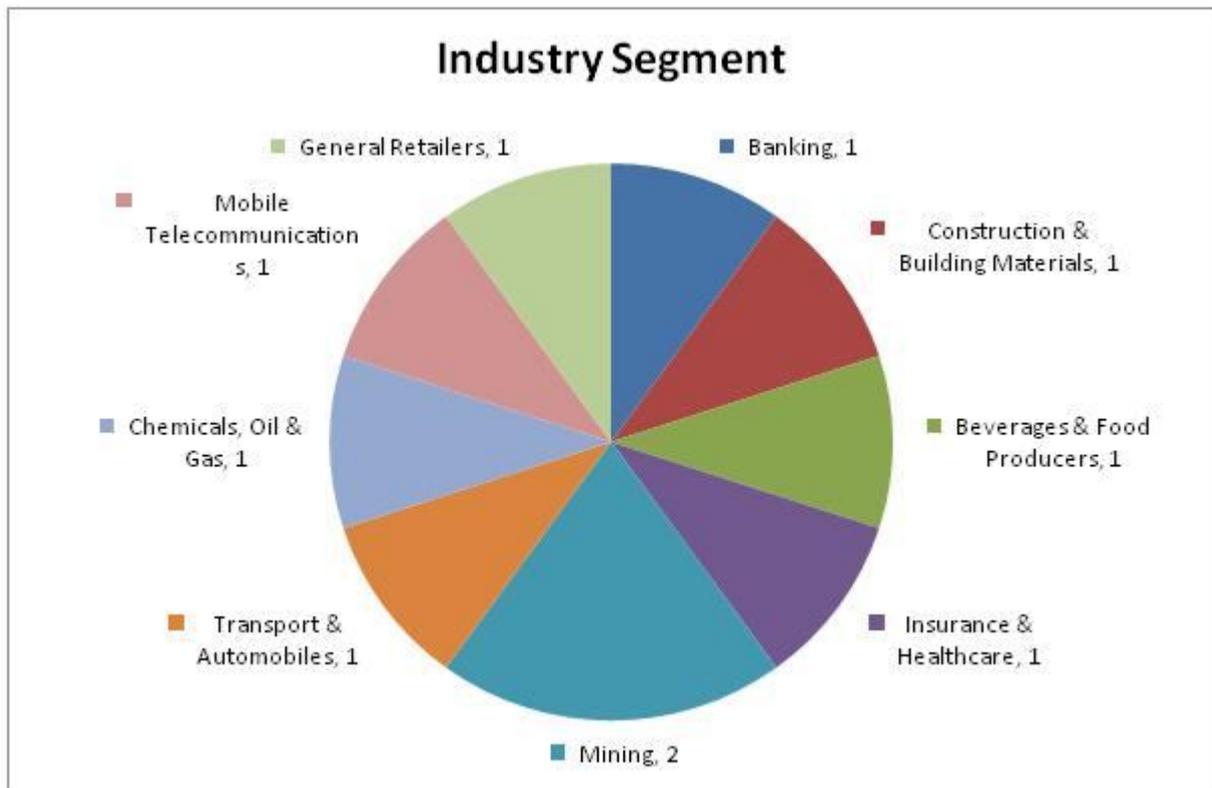
The research was guided by ethical issues which include, 'protection of participants from harm, informed consent, right to privacy and honesty'. Hence, the nature of the study was explained to the selected executives and they were given the choice to either participate or not to participate. Assurance was given to participants that their identities would be kept anonymous and the information obtained would be kept confidential and only be used for the purpose of this study. Names of listed companies were given, as annual reports are public documents. Consideration was taken of the fact that due to listing status of the targeted companies, certain information may be considered to be privileged and may be subject to insider trading rules. Besides, throughout this study, the researchers have reported the findings in a complete and honest fashion.

1.4 RESULTS

1.4.1 Company profiles

Ten companies were randomly selected from the JSE top 100 companies list representing nine industry segments of which two companies were from the Mining sector and one company each from: Transport and automobiles; Chemicals, oil and gas; Construction and building materials; Banking; Beverages and food producers; Mobile telecommunications; Insurance and healthcare and General retailers. All companies have operations outside South Africa, either in form of subsidiaries, associates, joint ventures, alliances or representative offices.

Figure 1



1.4.2 Profile of the respondents

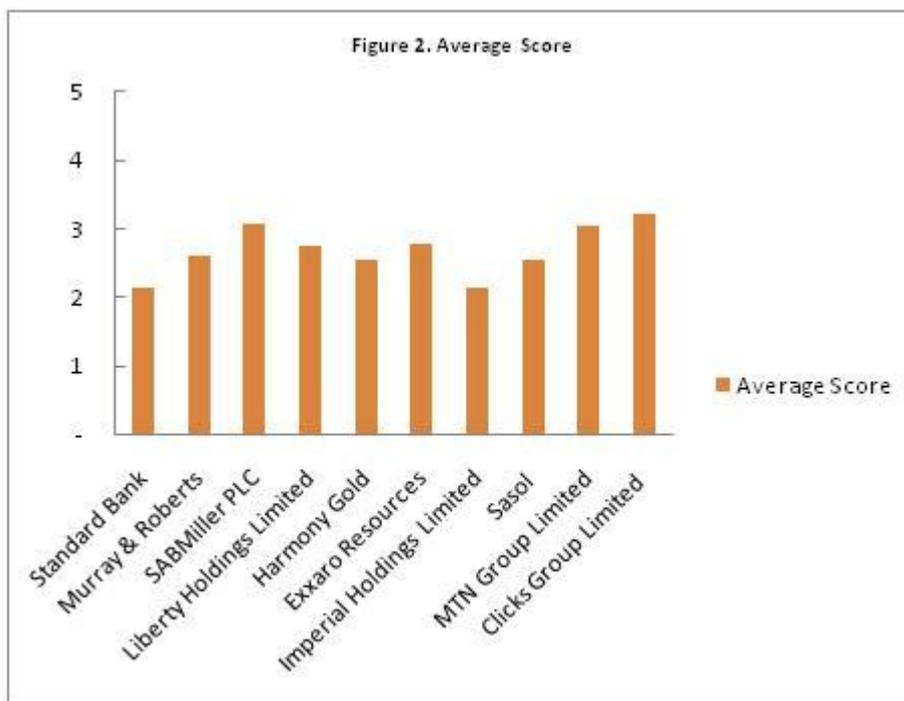
Table 1 below provides summary information about the five selected executives working for companies listed on the JSE and who were interviewed. Their identities and positions in the companies were kept anonymous and were coded as executive 1 to 5

Table 1

Executive No.	Company name	Industry Segment
1	Vodacom (PTY) Limited	Mobile Telecommunications
2	Nedbank	Banking
3	Imperial Holdings	Transport and Automobiles
4	Murray & Roberts	Construction and Building materials
5	Alexander Forbes	Insurance and financial Services

1.4.3 Company disclosure Scores

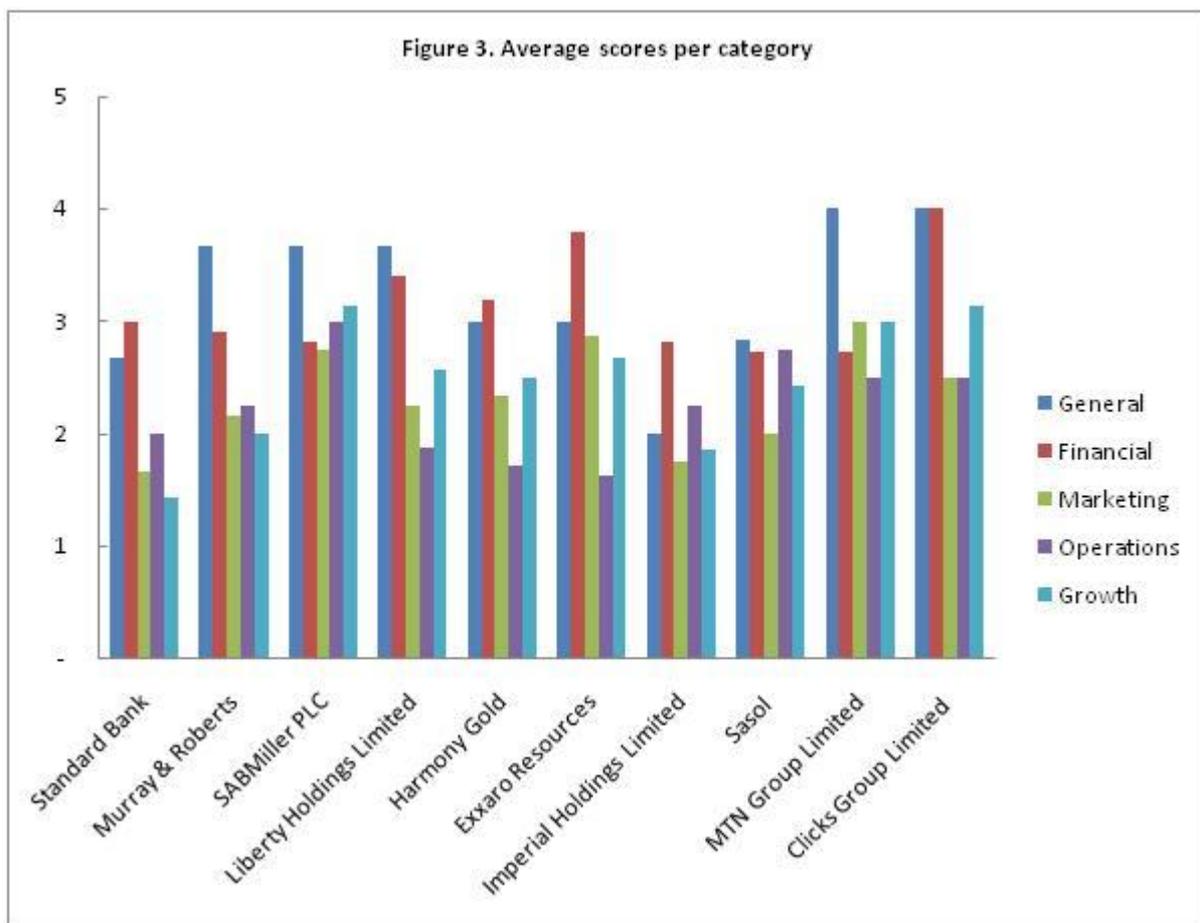
The scores are presented in figure 2 below. 70% of the companies in the sample scored below the average score of 3. Despite being number 50 on the JSE top 100 companies, Clicks Group (Clicks) emerged with the highest average score of 3.35 representing disclosures slightly above the average score of 3.



SABMiller plc came second with an average score of 3.08 and MTN Group (MTN) emerged third with an average score of 3.05. Imperial Holdings recorded the lowest overall average score of 2.14. This company scored below average in four of the five broad categories of strategic information.

1.4.4 Disclosure scores on the five broad categories of strategic information

Figure 3 below is a graphical presentation of average scores as measured against the five broad categories of strategic information, that is, General corporate strategic information; Financial performance information; Market performance and efforts to please customers; Conducting operations and competing successfully and Future prospects and business growth. The highest average score per category or 3.25 was recorded on general information, followed by financial performance information with a score of 3.14 and the lowest score of 2.25 was recorded on disclosure of operational information. Clicks scored above average in two categories, general strategic information and financial performance. Exxaro scored well above average on financial performance disclosures.



	General	Financial	Marketing	Operations	Growth	Average
Standard Bank	2.67	3.00	1.67	2.00	1.43	2.15
Murray & Roberts	3.67	2.91	2.17	2.25	2.00	2.60
SABMiller PLC	3.67	2.82	2.75	3.00	3.14	3.08
Liberty Holdings Limited	3.67	3.40	2.25	1.88	2.57	2.75
Harmony Gold	3.00	3.18	2.33	1.71	2.50	2.55
Exxaro Resources	3.00	3.80	2.88	1.63	2.67	2.79
Imperial Holdings Limited	2.00	2.82	1.75	2.25	1.86	2.14
Sasol	2.83	2.73	2.00	2.75	2.43	2.55
MTN Group Limited	4.00	2.73	3.00	2.50	3.00	3.05
Clicks Group Limited	4.00	4.00	2.50	2.50	3.14	3.23
Average	3.25	3.14	2.33	2.25	2.47	

MTN, Liberty, SABMiller and Murray and Roberts scored highly on general information. The lowest average score of the analysis (1.43) was recorded by Standard bank against information on future prospects and business growth. The company did not disclose much information on current and future investment plans, roll out of new products and next year targets. Results per each category are analysed below.

1.5 DISCUSSION

1.5.1 General corporate strategic information

A slightly above average overall score of 3.25 was achieved on General *corporate strategic information*. Companies sufficiently disclose the nature of operations, geographical / business segments and nature of products / services provided. Relevant elements of strategic information as indicated by the FASB (2001) and elements identified by Meek, Roberts and Gray (1995) and Thompson, Strickland and Gamble (2007, p.8), were visible.

The vision and mission statements though generally disclosed did not sufficiently provide the strategic direction and rationale for the business model and therefore were not effectively worded as asserted by Thompson, Strickland and Gamble (2007, p.20). General strategic goals and objectives were, however visible in all annual reports. That notwithstanding, in most cases there was no clear strategic positioning, that is whether the company competes on cost or differentiation. According to Hill (2007, p.411), Companies either compete on low cost or differentiation. Only 20% of the companies clearly stated their positioning, while 50% attained average scores and 30% had no evidence of disclosure.

The executives interviewed alluded to the fact that companies do not disclose all available strategic information in their annual reports. They highlighted the fact that companies disclose vision and mission statements values and broad objectives and achievement of prior year objectives and focus areas for the ensuing year without being specific on how the objectives were or will be achieved. The reason given by executives was that companies do not compete on strategic objectives, but on the execution of the strategy, as a result the 'how' does not get disclosed.

1.5.2 Financial performance

An overall average score of 3.14 was recorded. It was noted however that disclosures on financial performance were visible on information that is subject to mandatory financial reporting, such as achievements on revenue and earnings and ratios for performance, efficiency, liquidity and solvency. Information relevant to corporate strategy, for instance targets, was not visible and with the exception of Clicks and Exxaro, 80% of annual reports did not disclose targets. Measurable targets and time frames assist users in making comparisons and can be measured consistently. Non-disclosure of targets and timeframes reduces the comparability as identified in the FASB (2006) accounting framework. According to Thompson, Strickland and Gamble (2007, p. 29), objectives must translate the company vision into performance targets, which function as yardsticks for measuring performance.

Disclosure of industry ratios was generally poor and in most cases not visible. Industry performance metrics could be used by investors to assess the company's performance against its peers. Non-disclosure of industry information reduces the qualitative characteristic of comparability, as outlined in the FASB (2006) accounting framework.

Sensitivity analysis was another area where disclosure was falling short, with the Standard Bank and Liberty which are subject to financial services regulation such as Financial Advisory and Intermediary Services Act (FAIS) act, National Credit Act and Basel II, which require additional disclosures around risk management. The only company outside financial services that had some sensitivity analysis disclosures was Murray & Roberts, which scored a below average of 2 on this element. The rest of the companies did not have evidence of disclosure.

The findings on financial performance information are in line with the results from Standard & Poor's (2002), who in their report on 'Transparency and Disclosure Practices' by companies around the globe found that across the board, extensive disclosures were made on financial information which is regulated than on non-financial information, which is not regulated. One executive asserted that the extent of multi-national operations had more influence on disclosure of financial than strategic information. What emerges is the fact that such companies make additional segment disclosures, which are usually voluminous, but information disclosed is more of a financial than strategic nature. This view was evident in some of the annual reports that were analysed, for instance a company like Clicks, with a lesser number of multinational operations had clear and straight forward disclosures, while companies like Imperial and Murray & Roberts had detailed review of operations reports which covered mostly financial rather than strategic information.

1.5.3 Market performance and customer focus

Disclosure on marketing information was below average with an overall score of 2.33. Disclosure of information on products and markets served scored between average and above average, with about 60% of companies having sufficient disclosures. 80% of the executives interviewed were of the opinion that these two elements can be used as advertising and marketing tools by disclosing for instance more information on product range, designs and other differentiating features. As a result high disclosure scores were recorded.

Disclosure was however generally poor on some key marketing elements such as pricing strategies, sales and marketing teams and customer concerns where 50% of companies did not have evidence of disclosure. Pricing strategies did not apply to the mining companies Harmony and Exxaro and the chemical and oil company Sasol, where prices are determined by global commodity and oil prices. Only one company, MTN had above average disclosures on pricing. 60% of executives indicated that pricing was a sensitive area and such information may be strictly for internal use only. This finding concurs with the view held by Meek, Roberts and Gray (1995) who asserted that managers vary their disclosures depending on the type of information and strategic information may not be fully disclosed due to its confidentiality nature.

Another observable pattern on this category was the disclosures of market share information by industry leaders. Companies like SABMiller, MTN and Standard Bank had excellent disclosures of their market share in countries where they have operations and in all instances, the companies are either the market leaders or rank second. The same trend is also visible in terms of disclosures around brand performance, where market leaders made the most disclosures. This could support the view by Merkl-Davies and Brennan (2007), who in their signalling theory assert that well-performing companies signal their superiority by greater transparency in their disclosure and presentation of information. The overall results, however did not confirm that the size of the firm has a positive influence on the extent of disclosures made. Clicks is ranked number 50 on the JSE, however, emerged with the highest overall score, ahead of JSE's number two SABMiller which came second.

1.5.4 Conducting operations and competing successfully

This section recorded the lowest overall average score of 2.25. Disclosure of information on approaches taken to improve value chain and support activities were very poor and in most cases was largely generalised. According to Thompson, Strickland and Gamble (2007, p.3), strategy is all about 'how' - how management intend to grow the business, build loyal clients and improve operations. Thompson, Strickland and Gamble (2007, p.16) assert that excellent execution of a strategy is the best test of management excellence. Sharing the same view, one of the executives interviewed, highlighted that broad and colourful objectives that are not eventually met do not serve any purpose to users, if the execution is not visible. According to one executive, operational activities provide a solution to the 'How' and that in strategy formulation and implementation companies do not compete on objectives, but on the 'How'. All the sensitive and confidential information rest with the way operations are conducted and so are the company's strengths and key competencies. It would not be unusual to see companies reporting on detailed objectives without disclosing the 'how'. These sentiments are in line with Gigler (1994) and Meek, Roberts and Gray (1995) s' whose views are that sensitive information may not be completely disclosed.

In all cases there was no evidence of resources allocated to achieve objectives. Allocation of resources indicates management's commitment to pursue a particular set of actions in taking the business to a higher level. Non-disclosure reduces relevance quality of information.

Approaches taken on human resources practices scored highly due to compliance with South African legislation. Average scores were achieved by 90% of the companies. Most companies had detailed discussions on efforts to meet transformational objectives and targets on employment equity, skills development targets and Broad Based Black

Economic Empowerment (BBBEE). Although compliance with legislation was sighted as a factor driving certain voluntary disclosures, the executives could not confirm whether costs of litigation have an influence on the amount of strategic information disclosed, as they could not make reference to any cases in South Africa.

More than adequate disclosures were however visible on sustainability reporting, covering economic, social and environmental issues, foundations and donations spent. Extensive disclosures on environmental and safety issues were noted on mining companies and also Sasol. Even companies that scored the lowest in every other category did very well on this section. In most cases clear objectives, targets and achievements were adequately reported. All executives indicated that companies want to be seen as responsible citizens and therefore sustainability issues are disclosed in detail. One executive highlighted that companies do not compete on sustainability strategies and would therefore call for co-operation from rivals and other players through extensive reporting. As a strategy to scare away competitors, one executive highlighted that the negative impact of economic, social and environmental factors on the business is often emphasized than the positive impact on the business, for instance disclosing cost of the investment, without stating the benefits accruing to the company.

1.5.6 Future prospects and business growth

A below average overall score of 2.47 was recorded for this category. Historical achievements particularly on emerging market opportunities, strategic alliances and partners, rather than future prospects dominated the disclosures. 70% of the companies scored between average and above average disclosures on achievement of prior year targets. According to one executive, reporting is after the fact, for example a company may only announce the deal once it is signed but not on its intention to tender for a prospective project. The finding is in line with the work by Ferreira and Rezende (2007) who state that information about managerial intentions is 'soft' and cannot be directly verified before the plan is implemented. Reporting after the fact however reduces the relevance of information to investors who according to FASB (2001) need to make better investment decisions on the allocation of capital.

The researcher did not find evidence of disclosure of sales and earnings forecasts in all ten annual reports. The FASB (2006), states that information is relevant when it is useful for formulation of predictions by users and assessment of past predictions by users. Without sales and earnings forecasts, investors' are not able to make such predictions and consequently their major need is not adequately met.

In addition to empirical variables as identified by Meek, Roberts and Gray (1995), which include type of industry, degree of financial leverage, profitability, international listing, confidentiality nature of information and proprietary costs, the executives also identified other factors that influence the disclosure of strategic information as follows:

The adoption and implementation of King III report in South Africa, with effect from 1 March 2010 was expected to make some voluntary disclosures mandatory that compliance should result in increased disclosures around sustainability and material issues affecting the business.

80% of the executives indicated that disclosures are influenced by the company's assessment of what managers think stakeholders want to hear.

The volume of mandatory disclosures was considered to be extensive but due to lack of resources, companies focus on compliance with mandatory rather than making additional voluntary disclosures.

Additional disclosures may be made to inform stakeholders about the company's position in response to situations in the market or to clear its position when false information is being circulated in the market.

Companies may refer to practices by companies in the same industry or consult to improve their own reporting.

Management's own assessment was considered to be the overriding factor the choice to voluntarily disclose.

1.6 IMPLICATIONS OF THE STUDY FOR CURRENT THEORY

- Companies do not disclose strategic information in its entirety and no company completely discloses its private information. This is in line with the work of previous scholars such as, Verrecchia (1990), Gigler (1994), Meek, Roberts and Gray (1995), Ferreira and Rezende (2007) and Merkl-Davies and Brennan (2007).
- Voluntary disclosures are meant to close the gaps in areas where mandatory reporting is falling short. Challenges however lie in the sufficiency, quality and credibility of such information disclosures, as the choice of what gets reported ultimately rests with management's discretion.
- Practical insights into factors that influence voluntary disclosures show that the majority of factors are in line with empirical variables identified in the literature review and inconsistencies were noted on some variables.
- The emergence of a number of additional factors indicates that financial reporting is dynamic in nature. Certain voluntary disclosures may become mandatory, new factors emerge and there is need to constantly review and improve on existing literature in order to keep abreast with changes in reporting patterns and legislation.

1.6.1 Implications for the professional practice

Companies appear to provide minimum disclosures so as to comply with mandatory requirements. The amount of voluntary disclosures particularly around the disclosure of strategic information can be enhanced by making elements that are less sensitive mandatory. According to Hemus, Wingard and Becker (2000, p. 22), financial reporting is an evolving discipline that needs to be responsive to the ever-increasing user demands.

1.7 CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

Results of the study revealed that South African listed companies are making efforts to respond to investors' calls by voluntarily disclosing strategic information in their annual reports. The challenge however is that, the amount of disclosure is not sufficient as scores recorded range from average to below average. Investors and other stakeholders cannot be kept wanting. South African companies are therefore encouraged to continue raising the level of reporting particularly around the disclosure of strategic information. The study identified a number of weaknesses and the following recommendations are proposed in efforts to improve the quality of reporting on strategic information.

Vision and mission statements: Vision / mission statements should provide a general direction of the company's strategy and the rationale for the business model.

Measurable targets and time frames: Strategic objectives disclosed must be accompanied by measurable targets and timeframes. Measurable targets and time frames assist users in making comparisons and enhance consistence in performance measurement.

Actions to improve operations 'How': Without the 'how', the action plans cannot be reliably determined. The approach used in sustainability reporting, where objectives, action plans, targets and timeframes are set out in tabular format for users to clearly see management's intentions can also be applied on actions to improve the chain activities.

Allocation of resources: Disclosures of strategic objectives, action plans and targets must be accompanied by resources allocated to support the strategic initiatives. Resource allocation assists users in establishing management's commitment towards achieving the stated objectives.

Sensitivity analysis: Efforts should be made to analyse the impact of changes in market conditions to the company performance. Sensitivity analysis benefits the company in identifying the potential impacts of market changes and thereby come up with strategies that help mitigate the risk exposures and investor can assess the impact on their return on investment.

South African listed companies are encouraged to implement these recommendations so as to provide information that is sufficient and useful to users.

Furthermore, it should be noted that financial reporting is a very dynamic discipline and trends in corporate reporting are subject to change in line with the ever-changing reporting environment. Investors and other stakeholders keep on making new demands, the regulatory framework is also ever-changing and so are management's attitudes towards reporting. Studies of a similar nature should be repeated periodically in order to determine new levels of disclosures and the emergence of new factors that influence such disclosures.

This study can be extended to cover specific industry sectors, for instance, looking at disclosures made by companies in the mining or banking industry only. Fair comparisons can be made against companies in the same industry. The study can also be extended to other African countries and comparisons of results made against findings in this study.

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“A Methodology to Evaluate Initial Public Offering Firms' Financial Performance as a Function of Research and Development Investment in Korean Case”

Weon Jae Kim (University of Incheon, Korea)

This paper deals with the evaluation of financial performance of the randomly selected 100 Korean IPO firms, including 15 energy-saving ones, for the coming 3 years through some statistical tests as a function of R & D investment made for the previous 3 years before their IPOs.

The followings are main hypotheses:

- 1) The statistical tests for change in annual sales volume and total stock value over that in R & D investment made previous 3-year before IPO are hypothesized to result in positive relationship. Specifically, the R & D investment is hypothesized to show a prolonged effect in the firms' accounting performance for many years after IPO. If the statistical tests result in positive, the firms with R&D investment are recommended to evaluate their financial performance based not on single-term but on multi-term.
- 2) The expenditures, including advertizing, promotion, and employee training, are hypothesized to positively affect the sales volume and operating profit. We use them as control variables.
- 3) In addition, the factors of firm size and specific industry relating to environmental protection are hypothesized to show statistically significant effects in their financial performance as a result of R & D investment. So we regard them as dummy variables in figuring out any abnormal earnings effect in conjunction with the R&D investment.

The detailed implication and results of statistical analyses, associated with the IPO firms' financial performance to R&D expenditures will be provided in the full paper.

“Counterparty Risk in Credit Default Swaps Markets, Multiple Questions to Be Checked”

Jamal Mattar (Belgium)

In the vast literature, a significant increase in correlation coefficients of returns across countries is regarded as an evidence for contagion of financial crisis. We check this hypothesis in Credit Default Swaps (CDSs) market. We construct a sample of 43 CDSs on major US and European financial institutions. Then, we study the effect of big and active American financial institutions players on CDS market entering into either chapter 7 bankruptcies (Lehman Brothers, Landsbanki Bank and Washington Mutual) or passing a trouble period (Merril Lynch and Bear Stearns) during 2008 on the whole CDSs market. We remark a contagion effect for the failure of Lehman Brothers and Landsbanki, a competition effect is seen for Washington bank, a small decrease in correlation coefficient for Merrill Lynch and a small increase in the coefficient for Bear Stearns.

Introduction

Since its first standardized contract version in 1998, the CDS market was experiencing a boom expansion. According to [International Swaps and Derivatives Association](#) “ISDA” survey (April, 2010), it went from \$918 billion in 2001 to an outstanding gross notional amount of \$62.2 trillion by the end of 2007, falling to \$38.6 trillion by the end of 2008. The period 2004-2007, in which the Credit Default Swaps as the main credit derivative instrument was evolved, was relatively characterized by a low financial market volatility, financial and insurance sector growth, and stable interest rate. However, the recent financial turmoil in 2008 has showed clearly the influence of unregulated over-the-counter “OTC” instruments on financial stability.

We draw your attention on two points. First, this market is concentrated around a few major players. According to last statistics (June 2009) taken from Depository Trust and Clearing Corporation “DTCC”, five large financial institutions (JP Morgan, the Goldman Sachs Group, Morgan Stanley, Deutsche Bank and the Barclays Group) were counterparties to almost 50% of the total notional amounts of contracts. Besides, the market forces are focused in the hands of financial institutions and are interconnected to each other through chain of OTC derivative contracts (**insert table 1**).

As banks and all Financial Institutions “FI” have massively committed themselves in the CDS market, they are now highly dependent on market continuity and its smooth functioning. The failure of a major participant, or worse a whole set of participants, can put at stake all the others players. In other words, due to the high degree of concentration and interconnectedness, the risk of counterparty presents a remarkable level. Due to the OTC nature of CDSs market, each buyer negotiates with a seller directly, without a global clearing. The buyer think he escapes from the default risk of reference entity (let’s say X) but he is still exposed to the counterparty risk of CDS seller. What aggravates more the counterparty risk is also the technique of offsetting risk (**figure 1**) which creates a chain interaction.

According to this figure, we can identify at least three different channels of counterparty risk. The first source is through Jump risk or jump to default risk when the reference firm underlying the CDS contract defaults, especially if the financial problem is unanticipated. The second channel is through mark-to-model changes in CDSs’ prices. The third counterparty risk in CDSs market is through the collateral channel (mainly through collateral rehypothecation).

Since the start of the crisis last summer, the CDS market has been especially affected. Premia have been driven upward (**figure 2**), and reached all-time peaks.

Accordingly, our main aim in the article is to concentrate empirically on the first and the second channel of counterparty risk. In other words, the effects of this risk either the reference entity credit event or one of the players in CDS chain (figure 1) on the price of CDS in two different markets. Put it into a question, how counterparty risks especially a financial institution default affect the whole CDSs markets? To our knowledge, this is the first paper that explores a direct and identifiable business type to assess counterparty risk through the question of contagion in two different markets.

In order to answer the question, we will analyze the effect of bankruptcy announcements on credit default swaps spreads of creditors. More concretely, we check the effect of USA financial institutions credit event during 2008 and the effect of their bankruptcy on CDS European Market. The year 2008 is ideally suited for studying and analyzing the effects of counterparty credit risk on financial markets as the fear of counterparty risk reached their peak.

The remainder of the paper is organized as follows. Section 2 briefly discusses the relevant literature. Data selection, research methodology, and empirical models are described in section 3. Section 4 provides analysis and interpretations of the empirical findings and the last section concludes the paper with some future avenue aspect.

Literature review

The paper is related to the literature on financial contagion by focusing especially on the effect of counterparty credit risk on derivative products prices. There are an extensive literature addressing the definition, causes and effects of contagion. Among us (Corsetti et al. 2005) defined it as a simultaneous fall in asset prices, followed by an initial drop in one specific market.

CDSs markets constitute a fertile field to go deep inside into the question of counterparty risk and its effect on CDSs prices as this market are seen as one of the most interconnected and concentrated market all over the world. The major market forces are concentrated in the hands of financial institutions and are tied to each other through chains of OTC derivative contracts (Bank of International Settlement "BIS" statistics, DTCC statistics).

While the existing research focus on the impact of counterparty risk on systemic risk either in one market such as the work of (Jorion & Zhang 2007 and 2009; Arora, Gandhi, & Longstaff 2010) or on different market by taking a sample of 2 companies in automobile sector going into difficulty and their impact on the whole CDS market (Coudert and Gex, 2010), this paper adds a contribution to the literature by presenting an additional empirical evidence of the effect of counterparty risk to the CDS market by checking the contagion effect worldwide on two major market .

Our work is related to Coudert and Gex, 2010 work. We will follow their methodology. Albeit, our paper constitute an extension to their achievement considering that we will take different period of time (March 2007 to September 2009). Besides, we will focus on different sector type. Our principal concentration will be on American Financial Institutions going through either default or experiencing difficult period in 2008 and their impact on CDS financial market. The crisis period is long enough to include a sufficient number of observations. This was not the case in (Coudert and Gex 2010) work where the CDS market's response to the GM and Ford crisis was very prompt.

Data and Methodology

Data

The data relating to financial institution credit event (bankruptcy and stressed period) in USA and the effect of their events on European Market provide useful background information in terms of analyzing systemic risk.

The necessary information concerning credit events including chapter 11 “reorganization”, chapter 7 “liquidation” and jump events has been collected from the website www.bankruptcydata.com (Jorion and Zhang 2009). It provides instant access to information on thousands of business bankruptcy filings from federal bankruptcy districts. When we start to collect CDSs’ data using Bloomberg as a database, we found the necessary data for three big FI going into default in 2008: *Lehman Brothers*, *Landsbanki* and *Washington Mutual, Inc.* We add to our credit event sample two big FI which has crossed a difficult period in 2008 and getting acquired by other institutions: *Merril Lynch*¹ and *Bear Stearns*².

Regarding the effect of the credit events on CDS prices, we will measure the effect on CDS indices. In June 2004, a harmonized global family of CDS indices was launched by Markit Group, precisely iTraxx in Europe and Asia and CDX in North America. The release of this credit index family has provided a commonly accepted benchmark for credit markets where investors express their bullish or bearish expectations for an asset class. The difference between the indices and single name CDS is that the indices represent the CDS premium on an equally weighted basket of the currently most actively traded firms (125 for iTraxx Europe main and CDS NA IG) from different sectors: energy firms, industrial entities, consumer cyclical and non-cyclical firms, insurance companies, banks, telecoms as well as automobile firms.

We took the Main 5-year CDSs spread, as the 5-year maturity is the most widely traded and liquid index. The spreads are denominated in basis points (100 basis points equal to 1 percentage point). We are concerned on financial entities included in the indices plus the five originator reference entity (Lehman Brothers Holdings Inc., Landsbanki Islands hf., Washington Mutual Inc., Bear Stearns, and Merrill Lynch). The underlying reference entities are senior single name contracts.

For the period time (March 2007-September 2009) we used the iTraxx series 7, 8, 9, 10, and 11. For CDX NA IG, we used the series 8, 9, 10, 11, 12.

We used Bloomberg source database to obtain the daily last price CDSs premium of the reference entity and for entities included in the series³.

In order that our sample entities will not be biased, we include the CDSs entities present in all series during the entire period under review. Using this criterion we end up by a sample distributed as shown in **table 2**.

Methodology

By using Augmented Dickey-Fuller t-statistics (ADF), we remark that almost all CDS premium in our sample have a unit root (see **table 3**). Therefore, before calculating volatility and correlations, we should make our data stationary (**Formula 1**) by using their log first differences x_t^i (Acharya and Johnson 2007):

¹ In September-15-2008, Bank of America announces purchases of Merrill Lynch.

² In March- 24- 2008, JP Morgan acquired Bear Stearns in rescue partially financed by Federal Reserve Bank of New York.

³ Bloomberg aggregates the prices of several contributors.

Where, c_t^i = the CDS premium of firm i , i (in our case) = 1, 2, ..., 43 for period t . The resulting x_t^i series are then stationary and comparable to financial asset returns. When CDSs premia fluctuate in line with each other, it means a positive correlation and vice-versa.

As usually crisis period are generally characterized by a high volatility, the next step is to calculate the daily volatility (Coudert and Gex 2010) for the reference entities taken into account in order to split our period into three sub-periods (pre-crisis, crisis and post crisis period).

We set out to test the hypothesis of an increase in correlations between the CDSs during the financial turmoil period. Thus, we move to calculate the correlation to check the relationship between the two main variables: the credit financial institution event and the CDSs premium taken from the indices, and compare them between the pre-crisis and crisis period. If they rise significantly during the crisis, we can deduce a contagion effect. Otherwise, it will be a competitive effect (Jorion and Zhang 2007). For this purpose, we will use first the Pearson correlation coefficient ρ or r (see formula 2): Then, we can analyze and interpret the result:

+1 in the case of a perfect positive (increasing) linear relationship (correlation),

-1 in the case of a perfect decreasing (negative) linear relationship (anticorrelation),

Some value between -1 and 1 in all other cases, indicate the degree of linear dependence between the variables. As it approaches to zero there is less of a relationship (closer to uncorrelated). The closer the coefficient is to either -1 or +1, the stronger the correlation between the variables.

Notice: if the variables are independent, Pearson's correlation coefficient is 0, but the converse is not true because the correlation coefficient detects only linear dependencies between two variables.

Identification of the crisis period

In order to identify the crisis period, we shall calculate volatility as usually financial crises are distinguished by a rise in volatility. For this aim we have used the Exponential Weighted Moving Average "EWMA" method to calculate volatility for many reasons:

- It is clear using the daily CDSs prices for the reference entity that the models should be used to calculate the volatility will be models with non-constant volatility (**figure 3**). We remark from the graphic below the huge deviation between the minimum and maximum CDS value. Thus, we cannot use models which assume that volatility is constant over time and assign an equal weight to each day's return. An important point to bear in mind that among the five financial institutions there are three companies which cease to exist: Lehman Brothers Holding Inc. and Washington Mutual, Inc. left the market on September 2008. Landsbanki Islands hf. ceases to exist on December 9th 2008. For these companies, there will be no post-crisis periods. Thereby, we will compare the correlation coefficient between them and the other financial institutions in our sample just before and during the crisis;
- Concerning the models with non-constant volatility, there are the EWMA and (G) ARCH models. By comparing the equations for EWMA and GARCH (**formula 3 and 4**):

Where:

λ = decay factor, $0 < \lambda < 1$. We will put a fix value of 0.94 on our sample of daily CDS premia following the one found by Morgan (1996) on a sample of several financial markets;

$1 - \lambda$ = parameter defining a relative weight which is applied to the last return;

σ = a dispersion estimate for the day calculated at the end of the (n-1) day;

σ_{t-1}^2 = a dispersion estimate for the day n-1;

X_{n-1} = CDS premium for the day (n-1).

Notice that: β in GARCH is equivalent to λ in EWMA; λ in GARCH is equivalent to $(1 - \lambda)$ in EWMA. Therefore, EWMA is a special case of GARCH with a zero constant and where the persistence is equal to 1.

- In addition to that, several studies (Beltratti and Morana 1999; Berkowitz and O'Brien 2002; Ferreira and Lopez 2005) have concluded that EWMA model perform better than other ways to estimate volatility (such as historical volatility, Parkinson Historical Volatility, Implied Volatility) especially for time series data.

The EWMA formula can be rearranged like in **formula 5**:

Thus, the older returns have the lower weights.

The results show (**Figure 4**) a sudden jump in volatility for almost all companies in March 2008: CDS volatility went from 50 to 170 (almost 3.4%). Volatility remained high till the end-December 2008.

If we consider that the crisis period corresponds to high volatility. It begins by the Jump in Volatility on the end of August 2007, the date where Lehman announces its decision to close one of its home lending units "BNC Mortgage" and cease 1,200 employees.

Consequently, we can divide the sample into three sub-periods:

- Pre-crisis period: this period corresponds when premia and volatility were particularly low from March 2007 (20 March 2007) to the end of July 2007 (31 July 2007): this relatively short reference period (4 months and 11 days) meets the work of (Dungey 2001): he found in his work that correlations tests might be biased if the reference period "pre-crisis" is too large;
- The crisis period running from first August 2007 (Aug 9, 2007: the date where BNP Paribas suspends redemptions in \$2.2 billion of assets-backed funds) till the end of September 2008 (14 months) where in mid of September 2008 Bank of America announces the purchase of Merrill Lynch and Lehman Brothers files Chapter 11 bankruptcy ;
- Post-crisis period: it corresponds to the stage were relatively the CDS premium (figure 4) and volatility calm down. It matches the period of beginning of October 2008 to the end of our duration period (20th September 2009): 1 year;

Empirical results

Summary statistics

Our variables summary statistics are summarized in **table 4**.

We can get two main notices from the result above for all the FI CDSs:

- The huge deviation between the minimum and maximum CDS value;
- The big standard deviation for all the variables.

Correlations between firms' CDS and those of the five reference entities

Instead of calculate the correlation coefficient for each CDSs institutions with the reference entities, we have calculate an average value for iTraxx European and CDX NA IG Financial Institutions taken in the sample and then calculate the correlation coefficient during period 1 (pre-crisis), period 2 (crisis), period 3 (post-crisis) and for the whole period.

We have obtained the following result which we have put them into three tables (**Table 5, 6, 7**).

Looking on the results we can draw the following interpretation:

I. For the period before the crisis

We remark a significant correlation coefficient between the reference financial institutions entities and both European (iTraxx financial) and North-American (CDX NA IG FI) market. We can also add some additional points:

- The coefficient correlation is slightly bigger for iTraxx Europe FI (32.62%) than for local market (CDX, 31,64%). That implies the effect of these kind of institutions not only on their local market but also on other world market;
- For the relation between the second originator company (Landsbanki) and the CDS indices, the coefficient correlation is not as significant as other company effect (6, 44% for iTraxx and 6,03% for CDX). This may come to the reason that Landsbanki is not a major and active CDS player as the other institutions;
- What is impressive the impact of Washington Mutual on European FI indices (55.76%), much smaller than the correlation coefficient on its home market (39.63%) "16.13% difference". One interpretation of these significant numbers is that this FI is a big player on CDS market either buyer or seller or even as reference entity (we mean the market players betting on its performance);
- For Merrill Lynch and Bear Stearns, we remark that the coefficient correlation is significant but not so strong (below 50%). The relation between Merrill Lynch and European FI CDS indices is bigger (42%) than its local market (36%). We notice that the correlation coefficient between both Merrill Lynch and Bear Stearns and CDS indices is bigger than that of Lehman Brothers. It is slightly bigger for Merrill Lynch ($\rho=36\%$ for Merrill Lynch on CDX NA IG FI, however for Lehman Brothers ρ is equal to 31%, see table 5 above second row). The coefficient correlation of Bear Stearns on its home market is bigger (45, 24%) than that of Lehman (31, 64%). The difference is equal to 13.6% (significant);
- We can also get the remark from our result on table 1 above that the effect of originator FI except Bear Stearns companies' effect on European Market (iTraxx) is bigger than of North-American Market (CDX). One interpretation of that is the international and big effect feature of these FI sample taken into account on the whole financial market;
- Overall, if we see the global correlation coefficient (for both iTraxx and CDX) we notice a significant impact for Lehman Brothers and Merrill Lynch (39,63% and 49.997% respectively) a bigger ρ (51.02%) for Bear Stearns and a strong coefficient for Washington Mutual (61.44%) on iTraxx Europe FI and CDX NA IG FI indices.

II. For the crisis episode

If we take a look on our calculation for the impact of credit event on European and North-American CDS market, we can get the following main remarks:

- For Lehman Bankruptcy' impact on the CDS impact, we can easily input signal that the effect on its local market is much bigger than that of European FI CDS market (almost the double). We got this result from the second row from table 5. The coefficient correlation is 63, 24% for CDX NA IG and 34, 24% for iTraxx Europe. If we compare this coefficient of Lehman on its local market before and on crisis period, we notice that it has increased twofold which mean a sign of contagion on the other FI in North American market. However, the ρ before and on crisis period for Lehman on the European market increase but not as significant as we have expected (it goes from 32, 62% to 34.24%): a variation for just 5%. An interpretation for the big impact of Lehman Bankruptcy on its local market is that the failing of this FI was totally unanticipated by the market players which has created a contagion effect. This confirms the result for (Jorion and Zhang, 2007) who said that when the event is unanticipated by the market it creates a contagion impact. The bankruptcy of Lehman Brothers has also affected the European Market but not as much as its home market. That is may be due to on period of Lehman Failure (September 2008), the market was already in trouble and the market participant cannot well predicted the solvability and the performance of all sectors including financial one;
- We notice a remarkable increase in correlation coefficient for Landsbanki bank on both European and North American market. It goes from 6.44% to 16,51% (an increase almost 10%) on iTraxx indices and from 6.03% to 17,45% on CDX NA IG (an increase up to 11.42%). We can drop from these result the main conclusion that even if a FI is not a major player in CDS market, its unanticipated failure affect the local and foreign market;
- We remark a big and significant decrease in ρ for the effect of Washington mutual bankruptcy on CDS market. It dropped from 61.44% to 9.5% (last row, third column in table 4 and table 5). On iTraxx Europe, ρ went from 55.76% to 7.27% (a decrease almost 50%). On its local market, the ρ decrease almost 46.15%. These results confirm also the work of (Jorion and Zhang 2007). By making a correlation test between counterparty credit risk event and CDS premium around the period of credit event, they showed a net competition effect (anticorrelation "narrower CDS spreads") for industry filling chapter 7 bankruptcies. In that when the failure of an entity is anticipated by the market;
- In opposite to what we expected, we found a decrease in coefficient correlation for Merrill Lynch. It went from 42, 83% to 33.03% on iTraxx Europe and from 36, 80% to 26, and 57% on CDX NA HY. It decreases on both market almost 10%. This may be relying on the fact that the failure of Merrill Lynch and its purchase by Bank of America was not a big shock to the market players. Say it differently, the market was reassured that this FI will not be left to liquidation. Thus , it received the failure positively;
- The same interpretation can fit Bear Stearns credit event. The coefficient correlation around the crisis episode has increase but not so much. On European market, it pass from

39, 52% to 41.04% (just an increase to 2%). On CDX indices, it goes from 45, 24% to 51,93% (increase of 6%). The relative small increase in correlation coefficient may be due to the fact that market players were also assured because the acquisition of Bear Stearns by JP Morgan on March 2008 was partially financed by Federal Reserve Bank of New York;

- Overall, on a global scale we remark a significant increase in coefficient correlation for Lehman Brothers and Landsbanki bank failure. A decrease relationship (anticorrelation) between the failure of Washington Mutual Bank and the CDS FI indices. A decrease also in coefficient correlation for chapter 11 Merrill Lynch bankruptcies and a small increase in ρ (7%) for Bear Stearns credit event.

III. For the period after the crisis

We notice from table 6, that the coefficient correlation decreases for the left two FI in our sample either on local CDS market or other CDS market. This can be interpreted that the market calmed down again. In other words, the measure of dependencies between the variables returns to normal. This could be a sign of a non-turbulence period. What is remarkable is that the coefficient of Merrill Lynch on iTraxx indices dropped so significantly. It decreased from 33% to 1.51%. This result is important in order to understand the big impact of counterparty risk on CDS markets.

We put a graphic taken from Bloomberg (**figure 5**) which showed that the CDS market has exhibited a stunning rise in its correlations since the start of the crisis in August 2007.

Conclusion

In this article, we analyze the question of counterparty risk effect on the whole CDS market in the light of 2008 financial turmoil. We checked the possible contagion of the crisis experienced by big American financial institutions getting into either liquidation or acquired by other institutions to the whole CDS market. As long as the financial system was sound, there was no fear that counterparty risk could be a problem. Nowadays, counterparty risk is a major worry and raises widespread concern of market collapse. This we have shown in this work, by checking the question of contagion in the CDS market. The issue stems from the OTC nature of this market. Each buyer negotiates with a seller directly, without global clearing. The buyer thinks he escapes from the default risk of a company X, but it is still exposed to the counterparty risk of the CDS seller.

Our results confirm the hypothesis of contagion in the CDS market, although the coefficient did not move as we think it should increase due to many reasons we have explained in the results and discussion section.

However, according to Forbes and Rigobon (2002), if the volatility of one asset increases noticeably, its correlation with other assets will mechanically increment too even if the underlying linkages between these two assets stay constant. This bias should be taken into account when calculating the adjusted correlation coefficient.

Biography

- Jamal Mattar is a Ph.D. Student at HEC Management School, University of Liege (ULg) – Belgium; Email: Jamal.Mattar@doct.ulg.ac.be
- Danielle SOUGNE is a Ph.D., full professor of Finance at HEC Management School, University of Liege (ULg) and holder of the KBL chair in Fund Industry; research area: asset, risk management and performance measure of funds. Email: Danielle.Sougne@ulg.ac.be

Tables, figures and Formula

Tables, figures and Formula

Tables

Table 1

Single-Name Reference Entity Types of CDS Market as for April 2009

Single-Name Reference Entity Type	Gross Notional (USD billions)	Contracts
Corporate: Financials	3,501	436,71
Corporate: Consumer Services	2,360	363,529
Sovereign: State Bodies	1,773	137,961
Corporate: Consumer Goods	1,762	260,838
Corporate: Technology/Telecom	1,442	260,286
Corporate: Industrials	1,349	211,809
Corporate: Basic Materials	980	151,849
Corporate: Utilities	765	111,013
Corporate: Oil & Gas	491	79,148
Corporate: Health Care	340	54,943
Corporate: Others	171	19,572
Residential Mortgage backed securities	139	26,769
CDS on Loans	66	17,310
Other	35	6,116
Commercial Mortgage Backed Securities	22	1702
Total	15,196	2,085,696

Source: DTCC Trade Information Warehouse.

This table shows by Gross notional amount and number of contracts the most popular single-name reference entity by type of activity. We notice that the biggest type of single-name reference entity in CDS market is financial institutions, consumer service companies and sovereign debt.

Table 2*Number of CDS with the corresponding entities name in the indices*

	Index	Sample
CDX NA IG Financials	25	18
ACE LIMITED		
Aetna Inc		
The Allstate Corporation		
American Express Company		
American International Group, Inc		
Capital One Bank		
The Chubb Corporation		
CIGNA Corporation		
CIT Group Inc		
General Electric Capital Corporation		
The Hartford Financial Services Group, Inc.		
International Lease Finance Corporation		
Loews Corporation		
MARSH &McLENNAN COMPANIES, INC.		
MetLife, Inc.		
Simon Property Group, L.P.		
Wells Fargo & Company		
XL CAPITAL LTD		
Reference Entities		5
Lehman Brothers Holdings, Inc.		
Landsbanki Islands hf.		
Washington Mutual Inc.		
Merril Lynch		
Bear Stearns		
iTraxx Europe Main Financial		20
Aegon NV		
Allianz SE		
Assicurazioni Generali SPA		
Axixa PLC		
AXA		
Banca Monte dei Paschi de Siena SPA		
Banco Bilbao Vizcaya Argentaria SA		
Banco Espirito Santo Sa		
Banco Santander Central Hispano Sa		
Barclays Bank PLS		
BNP paribas		
Commerzbank AG		
Deutsche bank AG		
Hannover Rueckversicherung AG		
Intesa Sanpaolo		
Muenchener Rueck AG		
Swiss Reinsurance Company		
The Royal Bank of Scotland PLC		
Unicredito Itliano SPA		
Zurich Insurance Company		
Total	43	

Table 3

Unit root test using ADF test

	t-Stat	Europe	20	t-Stat
United States	23	Financials		20
<u>Originators</u>	5	Aegon NV		-1.362
Lehman Brothers Holdings Inc.		-0.96Allianz SE		-2.025
Landsbanki Islands hf.		-3.64Assicurazioni Generali SPA		-1.461
Washington Mutual Inc.		3.07Aviva PLC		-1.488
Merril Lynch		-1.98AXA		-0.951
Bear Stearns		-3.48Banca Monte dei Paschi de Siena SPA		-2.063
		Banco Bilbao Vizcaya Argentaria SA		-2.413
		Banco Espirito Santo SA		-2.247
<u>Financials</u>	18	-2.10Banco Santander Central Hispano SA		-2.322
ACE LIMITED		-1.18Barclays Bank PLS		-1.869
Aetna Inc		-0.92BNP Paribas		-2.538
The Allstate Corporation		-0.48Commerzbank AG		-2.719
American Express Comp.		-2.44Deutsche bank AG		-2.953
American International Group, Inc		-3.18Hannover Rueckversicherung AG		-1.898
Capital One Bank		-2.22Intesa Sanpaolo		-1.695
The Chubb Corporation		-1.08Muenchener Rueck AG		-2.047
CIGNA Corporation		-2.85swiss Reinsurance		-0.324
CIT Group Inc		-0.54The Royal Bank of Scotland PLC		-3.06
General Electric Capital Corporation		-1.11Unicredito Italiano SPA		-2.11
The Hartford Financial Services Group, Inc.		-1.24Zurich Insurance Company		-1.306
International Lease Finance Corporation				
Loews Corporation				
MARSH &McLENNAN COMPANIES, INC.				
MetLife, Inc.				
Simon Property Group, L.P.				
Wells Fargo & Company				
XL CAPITAL LTD				
		Total		43

Table 4

Summary statistics of our sample

Variable	Obs	Mean	Std. Dev.	Min	Max
Reference Entities Financial Companies					
Lehman Brothers	388	152.4366	111.9987	29.418	641.911
Landsbanki	446	425.0641	480.0157	18.533	3006.693
Washington	387	316.1952	360.1252	28.431	3350
Merril	653	192.6019	120.5928	24.548	561.907
BearStearns	653	122.6502	73.56415	30.313	727.143
CDX NA IG Financial Institutions					
Ace Limit.	653	75.13761	38.95393	22.149	197.4
Aetna Inc	653	73.4896	40.56169	12.587	194.125
The allstate corp	653	115.5483	101.3172	11.158	410.051
American Express	653	204.313	170.5431	10.827	685.747
AIG	653	664.0123	792.4872	10.525	3758.987
Capitalone Bank	653	297.4296	111.2386	72.767	562.764

The Chubbcorp	653	61.08909	32.4896	11.267	180.511
CIGNA Corp.	653	111.1651	85.98804	15.209	382.111
CIT Gr.	653	1002.168	1095.432	36.7	6054.679
General Elec.	653	264.6817	234.1034	12.851	1000.263
Hartford Financial	653	316.0017	307.2867	11.233	1122.27
International Lease	653	512.8602	488.1274	16.2	1785.535
Loews	653	50.03602	25.47468	11.264	111.114
Marsh & McL	653	67.72838	19.6051	35.264	135.561
Metlife	653	285.9012	267.1025	10.998	961.692
Simon	653	246.417	227.993	16	876.434
Wells Fargo & CO.	653	98.67953	68.69943	8.15	304.125
Xl Cap Ltd	653	373.437	322.7608	26.25	1163.65

iTraxx Europe Financial Institutions

Aegon	653	175.4613	140.9265	9.05	608.25
Allianz SE	653	68.40126	38.41804	8.233	190.809
Assicurazioni Gen.	653	68.61537	42.02684	5.818	198.325
Aviva PLC	653	129.8951	100.3657	6.86	494.15
AXA	653	101.5555	65.13498	9.1	270.485
Banca Monte dei	653	68.49795	37.57013	6.125	168.995
Banco bilbao	653	71.50035	39.72083	7.722	181.066
Banco Espirito	653	88.628	49.03127	8.6	228.325
Banco Santander	653	72.71382	40.33031	7.622	179.851
Barclays Bank	653	98.15929	63.19666	6.15	261.122
BNP Paribas	653	52.25914	28.35143	5.7	139.358
Commerzbank	653	72.82646	36.44798	8.16	164.497
Deutsche Bank	653	79.50057	42.12874	9.82	171.996
Hannover Rueck AG	653	58.5788	29.77614	10.36	146.795
Intesa Sanp.	653	60.81729	40.11079	5.761	200
Muenchener	653	47.85994	23.39198	7.354	128.238
Swiss reinsurance	653	206.4463	203.389	9.688	841.625
Royal Bank of Scotl	653	100.0222	64.21892	5.477	304.893
Unicredito Italian	653	80.46538	51.45806	7.478	276.234
Zurich Insurance	653	84.37474	47.3549	10.69	207.835

Source: Bloomberg. Author's calculations. We remark that all the entities, apart the reference entities, have the same number of observations (653). When we find a missing day value, we usually put the value of the day before.

Table 5

Correlations coefficient between the five reference entities and the sample of European and North American Financial Institutions during period 1 (pre-crisis period): 20 March 2007 to 31 July 2007 (number of observation=95)

	Lehman Brothers	Landsbanki	Washington Mutual	Merril Lynch	Bear Stearns
iTraxx Europe FI ⁴	0.3262	0.0644	0.5576	0.4283	0.3952
CDX NA IG FI ⁵	0.3164	0.0603	0.3963	0.3680	0.4524
Global index ⁶	0.3963	0.0773	0.6144	0.4997	0.5102

Data taken from Bloomberg database. Authors' arrangement of the data* (to make each entity observation equal, number of observation are equal for all entities "95") and correlation calculation.

*All CDS entities have equal number of observation, number of observation equal to period 1 to 262. When we find a missing value we usually put the same value as the day before.

Table 6

Correlations coefficient between the five reference entities and the sample of European and North American Financial Institutions during period 2 (crisis period): 1th August 2007 to End Septmeber 2008 except Landsbanki till its last CDS value on the third of December 2008

	Lehman Brothers*	Landsbanki Bank*	Washington Mutual*	Merril Lynch*	Bear Stearns*
iTraxx Europe	0.3424	0.1651	0.0727	0.3303	0.4104
CDX NA IG FI	0.6324	0.1745	-0.0652	0.2657	0.5193
Global index	0.5518	0.3185	0.0954	0.3453	0.5842

- Lehman Brothers number of Observations is 292;
- Landsbanki Bank number of observations in this period is 350;
- Washington Mutual, Inc. number of observations is 294;
- Merrill Lynch and Bear Stearn number of observations is equal to 304 observations

⁴ It is the daily average of the sample of 20 Financial institutions

⁵ It is the daily average of our sample of 18 American Financial Institutions. There are a lot of missing values for Capital One Bank Financial Institutions.

⁶ Index composed by all the CDS in the sample except the five reference entities (LehmanBrothers, Landsbanki, WashingtonMutual, Merrill Lynch, Bear Stearns)

Table 7

Correlations coefficient between the two left financial which survived the crisis by getting acquired by other entities (JP morgan acquires Bear Stearns on March 24th 2008. The operation was partially financed by Federal Reserve Bank of New York; on September 15th 2008 Bank of America announces the purchase of Merrill Lynch)

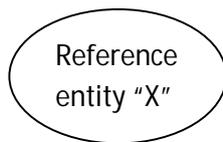
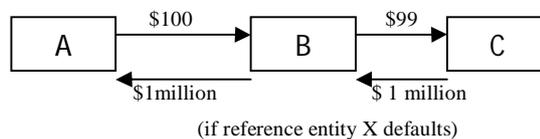
	Merril Lynch	Bear Stearns
iTraxx Europe	0.0151	0.3789
CDX NA IG FI	0.2794	0.4663
Global Index	0.1568	0.5042

Number of Observations is equal to 253 numbers.

Figure

Figure 1

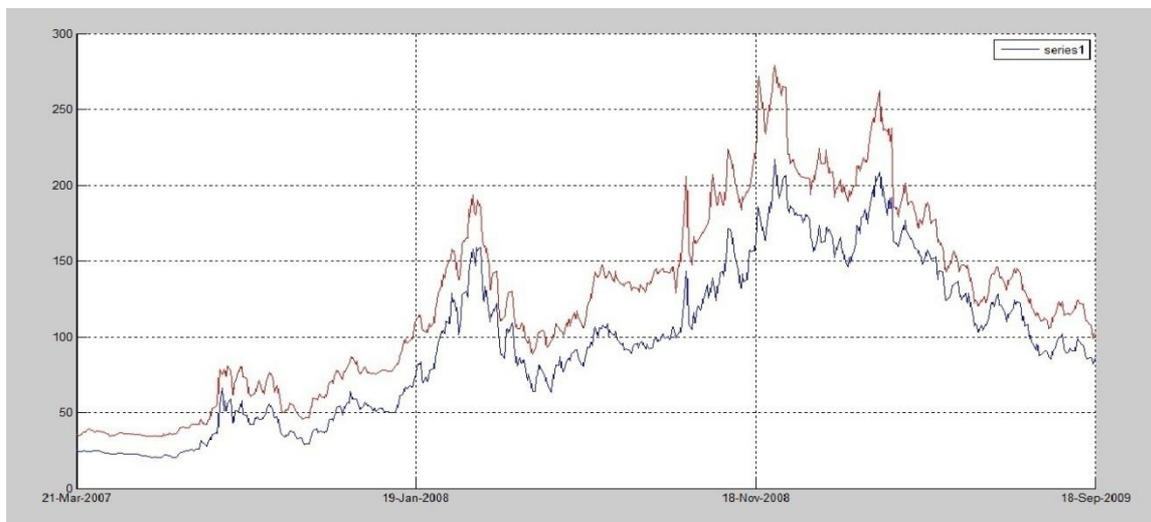
How an entity offset its counterparty CDSs' premium volatility risk



This chart describes the techniques of offsetting CDSs' premium risk. Entity "B" offsets its risk by purchasing a CDS from "C". There is no limit for this technique. In its turn "C" may undertake an additional hedging transaction by concluding an offsetting position contract with another party "D", the latter could also offset its positions etc. Thus, a chain of linked exposures will originate in which the market participants know their immediate direct counterparties, but not the other market players.

Figure 2

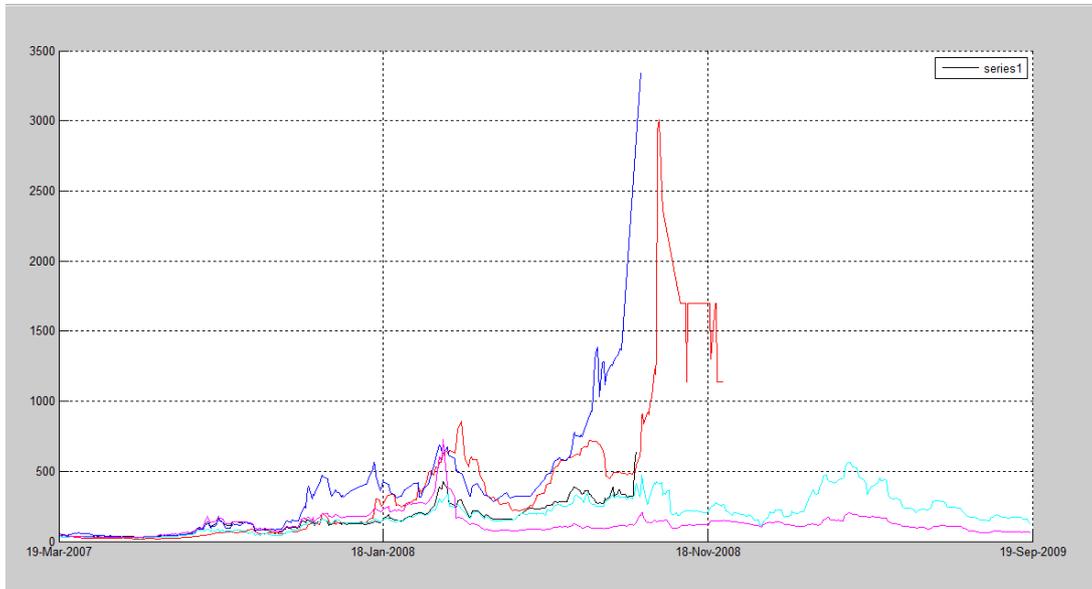
The evolution of CDSs iTraxx Europe premium and CDX North American Investment grade during the period March 2007 to September 2009



Source: Bloomberg. Authors' Calculations.

Figure 3

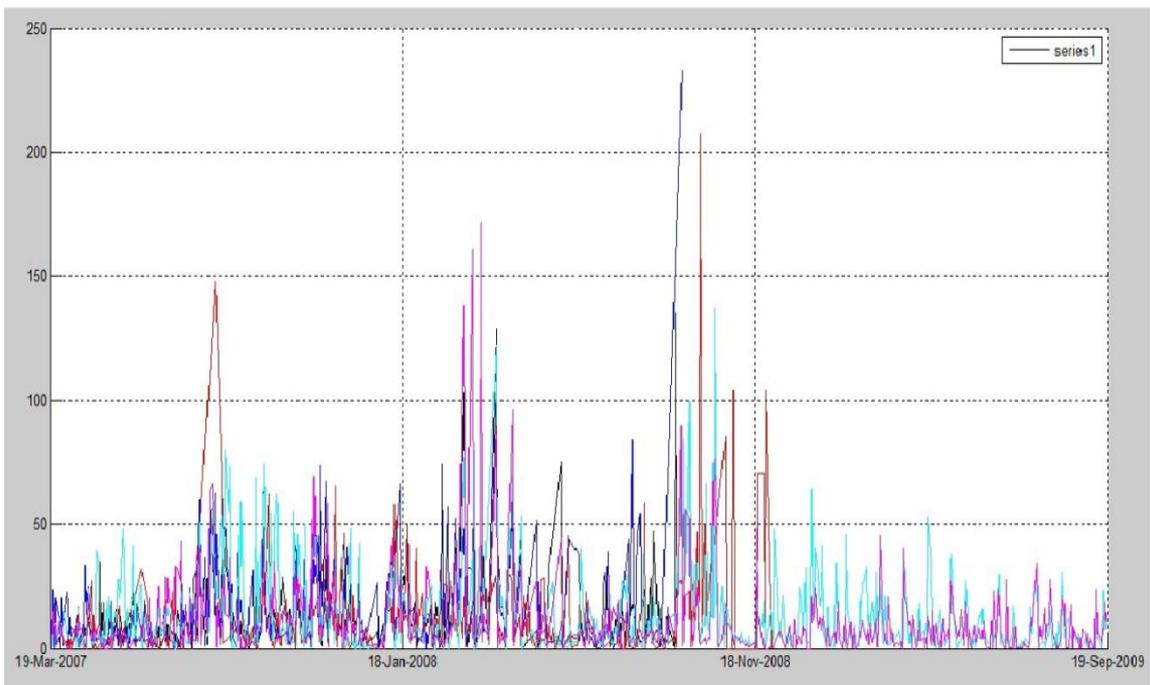
CDS premia for Lehman, Landsbanki, Merrill Lynch, Bear Stearns and Washington. Source: Bloomberg. Authors' calculations



— : Lehman Brothers; — : Landsbanki; — : Merril Lynch; — : Bear stearns; — : Washington

Figure 4

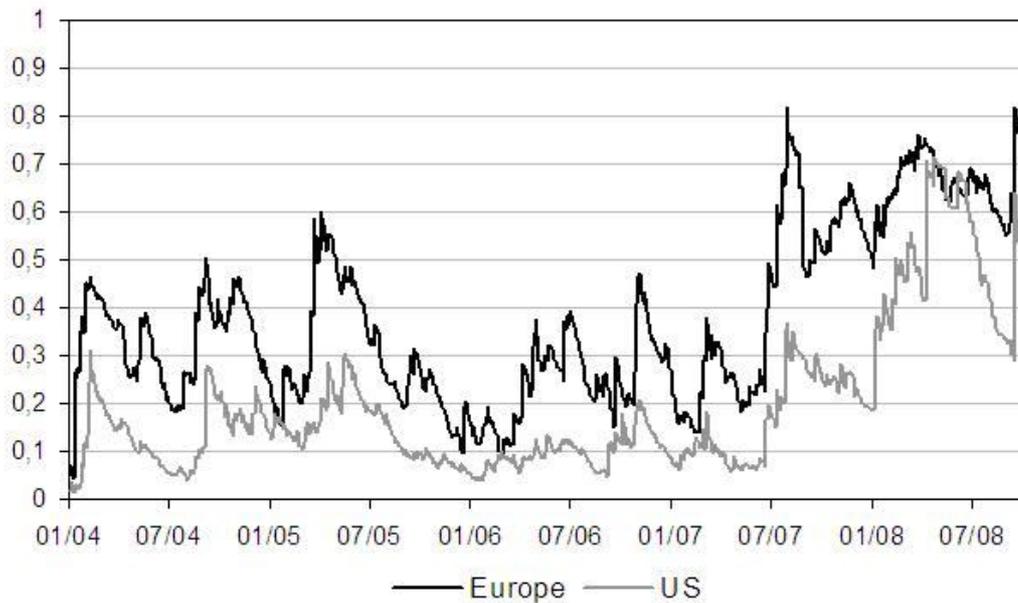
Volatility of the five originator American Financial Institution (in %). Dotted lines stand for especially the year 2008 ((20 January 2008 to December 2008). Source: Bloomberg. Authors' calculations.



— : Lehman Brothers; — : Landsbanki; — : Merril Lynch; — : Bear stearns; — : Washington

Figure 5

Average correlations between CDS premia



Source: Bloomberg. *Europe* : 66 European CDS (in the iTraxx Main since 2004), *US* : 73 North American CDS (in the CDX NA IG since 2004). Correlations are calculated by EWMA and averaged across all pairs of CDS

Formulas

Formula 1

$$x_t^i = \log(c_t^i) - \log(c_{t-1}^i)$$

Formula 2

$$\rho_{x,y} = \text{corr}(X,Y) = \text{corr}(Y,X) = \frac{\text{Cov}(X,Y)}{\sigma_x \sigma_y} = \frac{E[(X-\mu_x)(Y-\mu_y)]}{\sigma_x \sigma_y}$$

Formula 3

$$\sigma = \sqrt{\lambda \sigma_{t-1}^2 + (1-\lambda) X_t^2} \quad (\text{EWMA})$$

Formula 4

$$\sigma = \sqrt{\omega + \beta \sigma_{t-1}^2 + \alpha X_{t-1}^2} \quad (\text{GARCH})$$

Formula 5

$$\sigma_n^2 = (1-\lambda) \sum_{t=1}^n \lambda^{t-1} * r_{n-1}^2$$

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Session B

“Assessing Geo-Sectorial Extremal Dependence in Equity Markets”

Jose Faias (Catholic University of Portugal, Portugal)

In recent years there has been an increasing interest in modelling dependence in heavy tail phenomena such as the latest turbulence episodes in financial markets. The evidence of asymptotic independence in the financial data has led to the need of rethinking risk modelling and inference tools for multivariate extremes. In this paper we propose an inference scheme for assessing extremal dependence of several pairs of variables, in the context of asymptotic independence. Our approach is based on the fact that the problem of interest can be rewritten as an empirical likelihood problem for comparing the means of different populations, where such means represent the Hill's estimate of the coefficient of tail dependence. A triangular array representation allows us to obtain a nonparametric Wilks' theorem, and we apply the method to assess geo-sectorial extremal dependence in equity markets.

“Long-horizon Stock Returns Predictability: Parameter Instability Tests in Cointegration Relationship”

Suthawan Prukumpai (NIDA Business School, National Institute of Development Administration, Thailand)

A concurrent line of research indicates that stock returns are predictable by several valuation ratios such as dividend-price ratio, especially at longer horizons. The Campbell and Shiller's identity (1988) provides the theoretical support for validity of predictive regression. Even though there are positive evidences of return predictability, the statistical power is marginal and subjected to several critiques. Moreover, it is suggested that these findings are even poor out-of-sample performance (See Welch and Goyal, 2008). Several explanations are then mentioned as the reason for this phenomenon. Among others, Lettau and Nieuwerburgh (2008) discuss the presence of structural shift in financial ratio in U.S. and mention its importance in explain source of parameter instability and poor out-of-sample performance in predictive regression.

The stability of the predictive regression models of stock returns has received limited attention in the extant literature. Instead of the formal tests, the structural change is typically addressed by estimating predictive regression for various sub-samples. Therefore, the formal structural break test, Bai and Perron (1998, 2003) in particular, is applied to test the possible shift in mean of the dividend-price ratio. The objective of this paper is to provide a critical examination of empirical evidence on the ability of the dividend-price ratio to predict the Thailand stock markets. This paper would extend the literatures relating the long-horizon returns predictive regression and the structural change in the mean of variable.

The result from Bai and Perron test indicates the one breakpoint in August, 1986. Therefore, the dividend-price ratio series are adjusted by the mean of each regime as suggested by Lettau and Nieuwerburgh (2008). Consequently, the adjusted series become stationary and are more proper to be used in predictive regression. Overall, the estimated coefficients from regression using adjusted dividend-price ratio are bigger as well as R-squared. Contrary to Lettau and Nieuwerburgh (2008), this paper finds that using the adjusted dividend-price ratio, the dividend growth regression is more predictable than returns regression.

1. Introduction

Stock return predictability usually attracts a substantial attention of academia as well as practitioners. Fama and French (1988) and Lo and McKinlay (1988) provide supporting evidence that stock price do not follow random walk process especially in long horizon. Subsequently, predictive power of stock returns is one of the richest branches of literature in empirical asset pricing.

Theoretically, stock returns could be predicted using either their own past information or others predictive variables. Recently, the predictability of returns from variables rather than past returns is mainly focused, During 1980s, tons of papers studied predictability using valuation ratios such as the dividend-price ratio, earnings-price ratio, or smoothed earnings-price ratio. Fama and French (1988) and Campbell and Shiller (1988) find that valuation ratios are positively related with returns. Around the same time, several papers point out that yields spread on treasury and corporate bond are correlated with returns (Fama and Schwert, 1977; Campbell, 1987; Fama and French, 1989). The underlying fundamental model of the predictive regression is suggested by Campbell and Shiller (1988). The so-called Campbell and Shiller's identity is written as follows.

$$d_t - p_t \approx -c + E_t \sum_{j=1}^{\infty} \rho^{j-1} (r_{t+j} - \Delta d_{t+j})$$

This equation suggests that there is a long - run relationship among the price and dividend and dividend-price ratio could be used as predictive variables for either stock returns or dividend growth (See Cochrane (2005) for discussion on the predictive regression)

Even though, stock returns predictability is possible under Campbell-Shiller's identity, Cochrane (2005) suggests that due to the persistence of financial ratio, predictability will be observed only in long-horizon data. However, to test the long-horizon time series, researchers may face the risk of structural changes that invalidate the inference based on full sample estimators. Several researches provide evidence on the structural break in financial ratios (the dividend-price ratio in particular). For example, McMillan (2007) shows that the dividend yield and price/earnings ratio do not exhibit mean reversion to a single mean value. They indeed fluctuate around a level subject to periodic shifts.

In this study, we focused on the effects of structural break in long-run mean of dividend-price ratio and its impact on predictive regression. The case of Stock Exchange of Thailand (SET) is investigated. In next section, the data and econometric methodology are presented. Next, the empirical results on stock return predictability in the case of SET are discussed in Section 3. Finally, Section 4 concludes the paper and provides some implication of the results.

2. Data and Econometrics Methodology

2.1 Data

The data comprises of aggregate monthly closing stock prices (P) and aggregate monthly dividend-price ratio (DP) on the Stock Exchange of Thailand index (SET index). The data is obtained from Datastream for the period of April 1975 to December 2010, 429 observations in total. The sample period is based on data availability due to the first time set up of the Stock exchange of Thailand in the year 1975.

2.2 Econometrics Methodology

A. Structural breaks in variable (Bai and Perron 1998, 2003)

In order to examine the potential breaks in dividend yield, the methodology of Bai and Perron (1998, 2003) is applied. The Bai and Perron tests for multiple breaks of unknown breakpoints allow the data to speak for itself without imposing any prior beliefs. The aim is to identify the number of breakpoint. That is, consider the model with m breaks ($m+1$ regimes);

$$x_t = \beta_j + \varepsilon_t; \quad t = T_{j-1} + 1, \dots, T_j$$

For $j = 1, \dots, m+1$, where x_t is the variable of interest and β_j ($j = 1, \dots, m+1$) is the mean level in the j^{th} regime. The m -partition represents the breakpoints for the different regimes and is treated as unknown. Each regime is estimated by OLS with the estimate of β_j ($j = 1, \dots, m+1$) generated by the minimization of the sum of squared residuals.

B. Long-horizon predictive regression

The standard predictive regression is performed where returns series are regressed on dividend-price ratio series as follows;

$$r_t = \alpha + \beta x_{t-1} + \varepsilon_t$$

where x_t represents the dividend-price ratio. The beautiful of this equation is to provide a straightforward way to exploit the long-horizon properties of data with flexibility to adjust the horizon of return prediction and predictive variables. In particular, the long-horizon predictability of stock returns using the traditional predictive regression equation can be expressed as follow;

$$r_{t+1} + \dots + r_{t+K} \equiv r_{t \rightarrow K} = \beta_K X_t + \varepsilon_{t+K}$$

The predictability is observed from testing for significance of slope parameter in predictive variable under the null hypothesis:

$$H_0: \beta_K = 0$$

Predictive regressions are estimated by Ordinary least square method (OLS) with robust standard errors based on Newey and West (1987)'s method to control for possibility of serial correlation.

3. Empirical Results

3.1. Descriptive statistics

Table 1 provides descriptive statistics for the variables used in this paper. The stock price has a mean of 0.005 or 0.5% which is 9 times lower than the mean of dividend-price ratio and adjusted dividend-price ratio, 0.045 or 4.5%. However, the standard deviation of returns is 0.085 which is 3.4 times greater than that of dividend-price ratio. In other word, returns are much more volatile than dividend-price ratio. Moreover, returns are negative skew while dividend-price ratios are positive skew.

When looking at the autocorrelation, as is well known, the dividend-price ratio series are very persistent. The first- and second-order autocorrelations are 0.984 and 0.783, respectively. Returns series are less persistent with the first- and second-order autocorrelations of 0.109 and 0.054, respectively.

Table 1. Descriptive Statistics

Variable	Mean	SD.	Skewness	ρ_1	ρ_{12}	ρ_{24}
Returns (r)	0.005	0.085	-0.403	0.109	0.054	-0.069
Dividend-price ratio (dp)	0.045	0.025	0.680	0.984	0.783	0.602
Adjusted dividend-price ratio (\widetilde{dp})	0.045	0.013	-0.372	0.945	0.403	-0.040

Sample period: Apr 1975 - Dec 2010, 429 monthly observations.

Next, the unit root tests are conducted to investigate stationary property of the series. We perform the Augmented Dicker Fuller (ADF test), Phillips Perron (PP test) and the Kwiatkowski, Phillips, Schmidt and Shin (KPSS test) for this purpose. Moreover, Zivot and Andrew unit root test with structural break (ZA test) is also estimated. The results of unit root tests are shown in Table 2.

Table 2. Unit Root Tests Analysis using Level data

Variable	ADF test	PP test	KPSS test	ZA test
Returns (r)	-12.476***	-18.516***	0.092	-
Dividend-price ratio (dp)	-2.301	-2.173	0.306*	-4.732*
Adjusted dividend-price ratio (\widetilde{dp})	-3.694***	-3.602***	0.114	-4.602*

***** denotes 10%, 5%, and 1% significant level, respectively.

As can be seen from Table 2, price and dividend are non-stationary series while returns are stationary series. Interestingly, the dividend-price ratio series are non-stationary and are very persistent. The ADF test statistic with intercept is -2.301, whereas the critical value under 10% is -2.570. We hence fail to reject the null hypothesis of unit root in the dividend-price ratio. The PP test statistics of -2.173 also greater than -2.570, the critical value under 10%. Therefore, we fail to reject the null hypothesis of a unit root.

Unlike the unit root test performed by ADF test and PP test, KPSS test is conducted to test the null hypothesis of stationary property. However, the KPSS test statistics of 0.306 is less than the critical value at 10%, 0.347. In other word, we reject the null hypothesis of stationary properties of dividend-price ratio series. Up to this point, all test statistics lead to the same conclusion that dividend-price ratio series have unit root process and are non-stationary series.

When the regressor is nonstationary or highly persistent, the statistical inference is distorted or even no meaning. Lattua and Nieuwerburgh (2008) find that the nonstationary properties of financial ratios maybe resulted from the structural change in their mean over time. They also show that the source of model instability is due to the structural break in regressor and hence leads to the poor predictive power. The ZA test of dividend-price ration series also indicates the possible existing of structural break in such series. In the other word, the result shows that once structural break is controlled, we reject the null hypothesis of non-stationary in the dividend-price ratio series.

3.2. Structural break test

In this section, we perform the formal structural break test as suggested by Bai and Perron (1998, 2003). Often, we do not want to pre-specify a particular number of breaks to make inference. To allow this, Bai and Perron (1998) introduce two tests of the null of no break against an unknown number of breaks. These two tests are called *double maximum tests*. Table 3 Panel A reports both double maximum statistics (UDmax and WDmax) are significant at conventional levels. Moreover, the $\text{SupF}_T(m)$ tests of null of no break against the alternative of m break(s) are strongly rejected at the 10% level. In sum, the data seem to strongly favor structural break(s) in the mean of dividend-price ratio rather than zero.

In order to select number of break, a common procedure is to consider an information criterion. However, the BIC and LWZ always choose a much higher value than the true one in the presence of serial correlation case as documented by Bai and Perron (2003). They suggest the method based on the sequential application of the $\text{SupF}_T(\ell + 1|\ell)$ test which is superior to information criterion. Table 3 Panel B reports that both $\text{SupF}_T(2|1)$ and $\text{SupF}_T(3|2)$ are insignificant which indicates the one break case rather than two- or three-break case. Therefore, we will mainly consider the one break case according to sequential test selection.

Table 3. Tests for change in mean of log dividend-price ratio

Panel A: Test of structural breaks				
SupF _T (1)	SupF _T (2)	SupF _T (3)	UDmax	WDmax
32.523***	23.670***	16.765***	32.523***	32.523***
Panel B: Number of breaks selection				
SupF _T (2 1)	SupF _T (3 2)	Sequential	BIC	LWZ
2.519	1.704	1	3	2

***, **, * denotes 10%, 5%, and 1% significant level, respectively.

Table 4 reports the estimated mean of the dividend-price ratio in each regime. In the one break case, the mean of regime 1 is 0.077 or 7.7% which is higher than the full sample mean (0.045 or 4.5%) while the mean of regime 2 falls to 0.030 or 3.0%. The means of other regimes corresponding to the case of two- and three-break are also reported in Table 4. An obvious conclusion can be drawn that the mean in regime 1, dated between 1975 and 1986, is relatively higher than that of other regime. The plots of dividend-price ratio with full-sample mean and each regime mean are shown in figure 1.

In addition, the estimated break date is also reported with 95% confidence interval. In the one break case, the break date is August 1986 and the 95% confidence interval is between July 1986 and October 1986. Since the interval and the standard error of estimated break, 0.001 are small; we can rely on such estimated break.

Table 4. Dividend-price ratio and breakpoint(s) properties

regime 1	regime 2	regime 3	regime 4
0.077 (0.001) 1986:08 [1986:07 - 1986:10]	0.030 (0.001)		
0.077 (0.001) 1986:12 [1985:01 - 1987:01]	0.027 (0.001) 2003:11 [2002:03 -]	0.039 (0.001)	
0.077 (0.001) 1986:10 [1986:04 - 1987:02]	0.032 (0.001) 1993:11 [1987:09 - 1995:06]	0.023 (0.001) 2002:08 [2000:03 - 2005:10]	0.039 (0.001)

Notes: The first number in each cell is the estimated mean for such regime; standard error is reported in parenthesis. The break date (end date of the regime) is on the second line with 95% confidence intervals reported in bracket. The first regime begins in 1975:04 and the last regime ends in 2010:12.

3.3. Adjusted dividend-price ratio

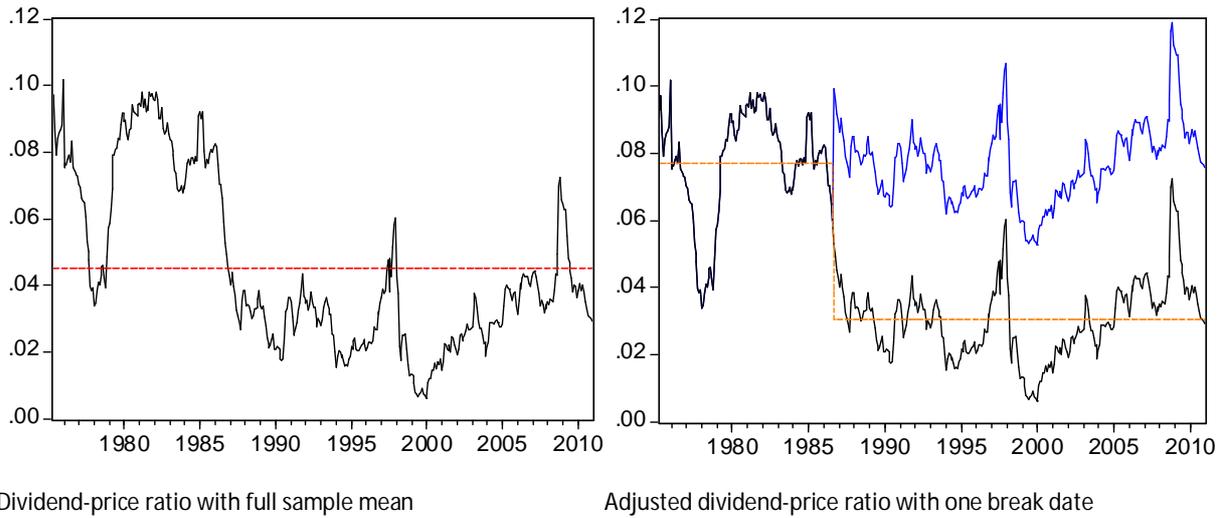
The results from previous section motivate us to construct adjusted dividend-price ratio series similarly to Lattua and Nieuwerburgh (2008)'s as follow, for one-break case;

$$\tilde{d}p_t = \begin{cases} dp_t - \bar{d}p_1 & \text{for } t = 1, \dots, \tau \\ dp_t - \bar{d}p_2 & \text{for } t = \tau + 1, \dots, T \end{cases}$$

where \overline{dp}_1 is the sample mean for 1975:04 – 1986:08 and \overline{dp}_2 is the sample mean for 1986:09 – 2010:12. The adjusted dividend-price ratio in two-break case could be defined analogously.

Figure 1 shows the dividend-price ratio series and the adjusted dividend-price ratio series from April 1975 to December 2010. The left panel plots the dividend-price ratios (Black solid line) with the full-sample mean (Red dotted-line) while the right panel plots the adjusted dividend-price ratios (Blue solid line) with the sub-sample mean, \overline{dp}_1 and \overline{dp}_2 (Yellow dotted-line). Moreover, the adjusted series is rescaled so that it coincides with the adjusted series for the first sub-sample.

Figure 1. Change in the mean of the dividend-price ratio



From Table 2, the adjusted dividend-price ratio series does not have unit root process and is no longer non-stationary. The ADF and PP test statistics are rejected at 10% significant level with the value of -3.694 and -3.602, respectively. In addition, the KPSS test statistics of 0.114 is failed to reject the null hypothesis of stationary properties. Together with the lower first- and second-order autocorrelations, 0.945 and 0.403, respectively, the adjusted dividend-price ratio series is significantly less persistent than prior. Note that, moreover, the standard deviation of adjusted dividend-price ratio is dropped by half of the dividend-price ratio which consistent to the results reported in Lattua and Nieuwerburgh (2008).

3.4. Predictive regression

Turning to our main objectives of this paper, we are now ready to compare the results from predictive regressions. Specifically, we compare the predictive regression between the returns equation and dividend growth equation using the dividend-price ratio in no break case as regressor as follows:

$$r_{t \rightarrow k} = \alpha + \beta dp_{t-1} + \varepsilon_t \quad \text{eq. 1}$$

$$\Delta d_{t \rightarrow k} = \alpha + \beta dp_{t-1} + \varepsilon_t \quad \text{eq. 2}$$

where r_t is returns on SET index; Δd_t is dividend growth and dp_{t-1} is dividend-price ratio.

The results of predictive regression using both adjusted dividend-price ratio (\widetilde{dp}) and dividend-price ratio without any adjustment (no-break case) are reported in Table 5.

We first consider the predictive power of regression over horizon for the case of no break. The results show that the size of estimated coefficients and R-squared are grown over the horizons for both equations. According to Campbell (2001) and Cochrane (2005), the “long run” coefficient is more powerful statistic than short run coefficient because of the high persistent level of dividend-price ratio. In this paper, the first-order autocorrelation is 0.984 for dividend-price ratio. In sum, the results from no break case support the long horizon predictability of returns by using dividend-price ratio but the dividend-price ratio can predict future returns better than the dividend growth.

Next, we consider the results of regression with one structural break in dividend price ratio. The evidence that the size of predictive coefficient increases over forecast horizon is still found. Note that the estimated coefficients of dividend growth regression are double whereas those of returns regression are marginally increased for the first three years but decreased in four and five forecast horizons. Moreover, in the one-break case, only estimated coefficients and R-squared from the dividend growth regression follow the expectation. Unfortunately, the R-squared from returns regression do not increase as expected. The possible explanation is that the adjusted log dividend-price ratio series are less persistent; the first-order autocorrelation drops to 0.945.

Table 5. Predictive regression of returns and dividend growth with the log dividend-price ratio

Horizon (years)	Returns		Dividend growth	
	No break	One break	No break	One break
1	0.103 (0.056) [.027]	0.146 (0.084) [0.022]	-0.082 (0.024) [0.118]	-0.180 (0.042) [0.227]
2	0.283 (0.087) [0.090]	0.373 (0.108) [0.060]	-0.141 (0.039) [0.139]	-0.340 (0.057) [0.305]
3	0.363 (0.112) [0.091]	0.439 (0.172) [0.048]	-0.171 (0.066) [0.117]	-0.429 (0.084) [0.262]
4	0.466 (0.174) [0.091]	0.293 (0.190) [0.013]	-0.199 (0.093) [0.110]	-0.493 (0.132) [0.234]
5	0.582 (0.206) [0.119]	0.383 (0.224) [0.017]	-0.232 (0.110) [0.116]	-0.590 (0.162) [0.248]

Notes: This table reports estimation results from the equation (1) and (2). The first two columns report the equation for returns while the next two columns report the predictability equation for dividend growth. The point estimation is on the

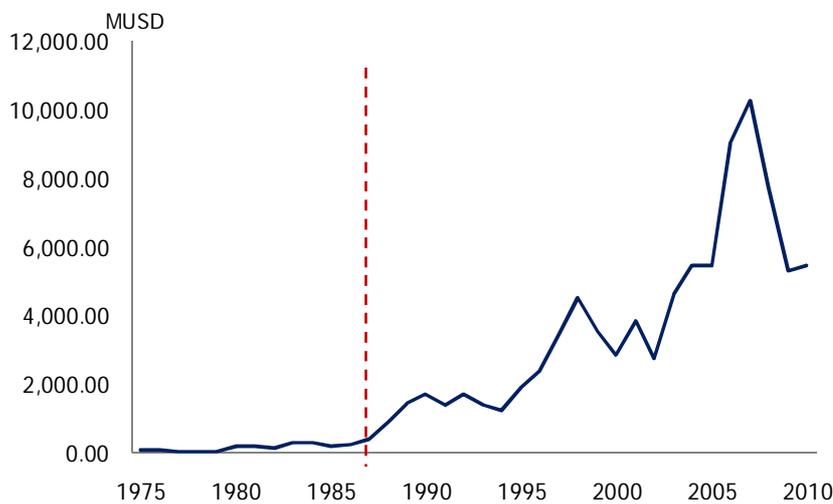
first line, the standard error is in the parenthesis, and the R-square is reported in bracket. In the one break case, the dividend-price ratio is adjusted by each regime mean as shown in Table 3.

4. Conclusion

In this paper, the predictability of stock return using dividend price ratio is investigated using the monthly data from Stock Exchange of Thailand. Neglecting the possibility of structural breaks in the dividend-price ratio series, the data exhibits non-stationary property and hence cannot be used as regressor in predictive regression.

Therefore, the possibility of structural break is investigated by using Bai - Perron (1998, 2003)'s test. The results provide evidence of one structural break in August, 1986. The economic explanation of such structural change is the liberalization in Thailand Stock Market, which allow greater participant of foreign investors as shown in Figure 2. At that time, the trading volume also increased 4 - 5 times and the SET index doubled over the year.

Figure 2. Foreign portfolio investment in Thailand (1975 - 2010), unit: MUSD



Source: Bank of Thailand

Once the dividend-price ratio series are adjusted as suggested by Lattua and Nieuwerburgh (2008), the adjusted series become stationary and are more proper to be used in predictive regression. Overall, the estimated coefficients from regression using adjusted dividend-price ratio are bigger as well as R-squared. However, unlike the no break case, the adjusted dividend-price ratio seems to better predict dividend growth than returns especially in long horizons.

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“Regime-Switching Modelling of Globalization Analysis in International Stock Markets”

Nuno Ferreira (ISCTE, Portugal)

Rui Menezes (ISCTE, Portugal)

The internationalization of financial markets is one of the topics in the discussion about recent globalization trends. Other events such as the stock market crashes and financial crises also make the study of the globalization within international stock markets an important topic for financial policy makers.

Several experimental research showed that stock markets display periods of marked turbulence and exhibit extreme values more often than one would expect if the series were normally distributed (fat tail property). In this context, in order to better understand this phenomenon, it was developed, between others, the Markov Switching Model (MSM).

Nowadays, this kind of models has attached much attention in financial and economic modeling, since, ample empirical evidence has been gathered for both nonlinearity and structural changes in the dynamic properties of many observed time series.

In particular, the dynamic behaviour of macroeconomic time series depends nonlinearly on the phase of the business cycle. This regime-switching behaviour related to expansion and contraction periods has been the focus of much research [see [1], [2], [3], [4]].

We focus our analysis to study mainly the effect of globalization on five international stock markets: (SP&500; FTSE100; NIKKEI100; IBEX35 and PSI20) based on daily closing stock market prices, from 1993 until 2010, employing a smooth transition regression (STAR) model.

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"Hedge Fund Selection for Family Offices: A Trading Strategy Based on Risk-adjusted Performance Measures"

Andreas Gruener (University of St. Gallen, Switzerland)

Martin Raasch (University of St. Gallen, Switzerland)

In recent years portfolio management within a large universe of hedge funds has become a key area of research. In this paper, the authors propose a strictly quantitative hedge fund investment approach that is of straightforward practical relevance for family office practitioners. It can be shown that portfolios constructed under the new approach are able to considerably outperform an equally-weighted index of hedge funds in an out-of-sample analysis. Thus, there seems to be evidence that the proposed approach represents a valuable tool for investors.

1. Introduction

In line with the long-term growth of the hedge fund industry, portfolio management within a large universe of hedge funds has become a central interest of academic research and a variety of investment approaches have been proposed. This paper aims to add to this stream of research through the development of a fully transparent and strictly quantitative portfolio management approach based on risk-adjusted performance measures. This approach is targeted at investors seeking direct exposure to a diversified portfolio of hedge funds such as family offices which traditionally constitute one of the main groups of hedge fund investors.

Family offices are private companies that manage the capital of a single wealthy individual or family. Family offices usually offer a one stop-solution including oversight of family-owned companies as well as investment, insurance, and tax services, wealth transfer planning, financial record keeping, and family foundation management. Family offices strive to preserve and grow family wealth in the long term. Therefore, they usually allocate their funds across a broad range of asset classes. Amit et al. (2008) found in a survey of American and European single family offices that 12-14% of managed family wealth was invested in hedge funds. When seeking hedge fund investments, family office practitioners take different routes: They pursue a direct investment in one or more hedge funds and/or invest in a fund of hedge funds. These funds of hedge funds offer their investors risk diversification across several hedge funds, as well as professional management and ongoing portfolio overseeing. On the negative side, such funds cost their investors an additional layer of fees.

This paper proposes a fully-transparent, strictly quantitative portfolio management approach that is specifically targeted at family offices seeking direct investment in a broadly diversified portfolio of hedge funds. While there are several academic studies in the field, they do not take the major practical limitations and restrictions into account that family offices face. Against this background and considering the large amount of family wealth allocated to hedge funds, it has become a necessity to develop an effective hedge fund investment approach that is of straightforward practical relevance for family offices.

The paper will be structured as follows: Firstly, the authors will review the relevant academic literature in the field. In this context, the scope of this paper and its contribution to current academic research will be addressed. Secondly, the research methodology will be outlined. This includes a review of the investment approach, the assumptions made, and the

applied evaluation methodology. Thirdly, the results of the study will be revealed. Fourthly, the authors will discuss these results and point out the limitations of this study. The last section contains a conclusion.

2. Theoretical Background

In this paper the authors strive to make a contribution to the academic literature in the field of portfolio management within a broad universe of hedge funds, a subject that has been recurrently discussed in academic literature. Several papers have examined the problem of how to identify the best hedge funds, the 'future winners', by using strictly quantitative means. Such studies are usually based on a comprehensive hedge fund database. These databases typically provide information on a broad range of individual hedge funds, such as their investment strategy, assets under management, past performance, etc. During the last couple of years, several different approaches have been discussed. Gregoriou and Rouah (2001), for instance, examined a rudimentary hedge fund selection approach. Their strategy involved yearly investment in that particular hedge fund that had delivered the highest returns in the previous year. They discovered that this simple trading strategy was not able to outperform the market.

De Souza and Gokcan (2004) took a different approach. They constructed several portfolios of hedge fund indices based on conditional value at risk (CVaR) and compared them to reference portfolios that were established by a mean-variance optimization. They found that the return distributions of most hedge fund strategy indices did not follow a standard normal distribution. Instead, they displayed significantly negative skewness and unstable correlation patterns. De Souza and Gokcan concluded that portfolio construction based on CVaR was superior to a mean-variance approach as it considered the special statistical characteristics of hedge fund return distributions.

A further interesting approach was made by Alexander & Dimitriu (2005). In their study, hedge funds were selected according to their abnormal returns, Alpha. In a second step, the portfolio weights were determined based on a constrained minimum variance optimizer. Alexander & Dimitriu showed that these portfolios performed much better than equally weighted portfolios of all hedge funds in their database or minimum variance portfolios of randomly selected hedge funds.

Joehri and Leippold (2006) proposed a strictly quantitative approach based on a broad range of risk-adjusted performance measures. In their model, capital was only invested those hedge funds that had shown superior risk adjusted performance in the past. They found that basing fund allocation on risk-adjusted performance measures, instead of purely return based measures, led to more favourable results in terms of portfolio statistics and decreased portfolio turnover. In a next step, they proposed an equally-weighted Combined Indicator of different risk-adjusted performance measures. They found that portfolios constructed on the basis of such an indicator exhibited very attractive risk-return profiles such as a high Sharpe Ratio and low downside risk measures.

In a further study Gregoriou et al. (2007) investigated a similar hedge fund investment approach. They constructed equal-weights hedge fund portfolios by selecting the hedge funds with the highest Alphas, Information Ratios, and Sharpe Ratios. The performance of the constructed portfolios was compared to that of real-life funds of hedge funds. Gregoriou et al. found that their portfolios greatly outperformed the best funds of hedge funds on the basis of Alpha, the Sharpe Ratio, and the Information Ratio. They ascribed this result to the second layer of fees charged by funds of hedge funds. They concluded that the extra fees paid to fund of hedge funds managers was largely unmerited as it was possible to create superior portfolios of hedge funds using simple portfolio construction techniques and readily available information.

Fang et al. (2008) developed a heuristic approach to hedge fund investment based on semivariance, a measure for downside risk. They discovered that unlike traditional investment vehicles, hedge funds seemed to follow return

distributions with significant non-normal skewness and kurtosis. Therefore, they judged that mean-variance optimization was not appropriate in the hedge fund space. A further observation was that the utilization of portfolio optimizers in the hedge fund space caused a 'butterfly effect': Small changes in inputs, especially mean returns, caused large changes in the optimal asset weights. They judged that this phenomenon, coupled with the illiquidity of hedge funds made optimizers a poor tool in the hedge fund space. Accordingly, they showed that their newly developed heuristic approach was able to construct portfolios with higher returns, lower risk, and more diversification compared to portfolios constructed on the basis of mean-variance and mean-semivariance optimizers.

The studies above illustrate that it is possible to construct excellent portfolios of hedge funds using simple construction techniques and readily available information. In order to identify the most promising hedge funds, most studies employ risk-adjusted performance measures, a popular tool among researchers and practitioners. These measures describe the risk / return profiles of individual hedge funds and enable investors to judge whether a particular hedge fund has shown a good risk / return relationship compared to its peers in the past.⁷ As the investment approach presented in this study is fundamentally based on risk-adjusted performance measures, it seems worthwhile to briefly revisit the benchmark research in the field.

In the academic discussion of risk-adjusted performance measures, a study by Eling and Schuhmacher (2007) attracted a high level of attention. Eling and Schuhmacher offered an excellent overview of the most prominent risk-adjusted performance measures in the field. They clustered these measures into lower partial moment, drawdown, and value at risk-based measures.⁸ In their study Eling and Schuhmacher used these measures to rank hedge funds based on their historical risk-adjusted performance. They found that the hedge fund rankings established by these risk-adjusted performance measures were highly correlated. They concluded that the choice of risk-adjusted performance measure was not critical to the evaluation of hedge funds.

⁷ The best known and most common risk-adjusted performance measure is probably the Sharpe Ratio. Despite its popularity among practitioners, the usage of the Sharpe Ratio in the hedge fund space has been vividly criticized in academic literature. This is mainly due to the fact that the Sharpe Ratio is based on classical portfolio theory and thus theoretically dependent on the assumption of normally-distributed returns (Pedersen & Rudholm-Alfvén, 2003). Hedge funds, however, classically have investment mandates that allow for the use of leverage, short selling, derivatives, and investment in highly illiquid securities (Dor, Dynkin, & Gould, 2006). As a consequence of such techniques, hedge fund returns typically display performance characteristics that are very different from traditional asset classes. It has been shown that most hedge funds' returns do in fact not follow a normal distribution, but show a negative skewness and positive kurtosis as well as positive serial correlation (Brooks & Kat, 2002; Ding & Shawky, 2007; Lo, 2002; Lucas & Siegmann, 2008; Mahdavi, 2004; Sharma, 2004). Thus, the Sharpe Ratio seems inadequate to analyze hedge funds as it is based on the assumption of standard normally distributed returns. These considerations have triggered the development of a variety of alternative risk-adjusted performance measures in the hedge fund space that account for asymmetrical returns.

⁸ Lower partial moment-based measures include Omega, the Sortino Ratio, Kappa 3, and the Upside Potential Ratio. Drawdown-based measures comprise of the Calmar, Sterling, and Burke Ratios. Value at Risk-based measures include Excess Return on Value at Risk, the Conditional Sharpe Ratio, and the Modified Sharpe Ratio.

This conclusion was criticized in a study by Nguyen-Thi-Thanh (2009). Like Eling and Schuhmacher, Nguyen-Thi-Thanh applied different risk-adjusted performance measures to a sample of hedge funds and compared the resulting rankings. Despite strong positive correlations between the hedge fund rankings established by these measures, she observed significant modifications in the rankings in absolute terms. She concluded that the choice of risk-adjusted performance measure was crucial for the evaluation and thus the selection of hedge funds.

Joeiri and Leippold (2006) circumnavigated the problem of risk-adjusted performance measure selection by proposing an equally-weighted Combined Indicator of different measures. They found that portfolios constructed on the basis of such an indicator exhibited very attractive risk-return profiles such as a high Sharpe Ratio and low downside risk measures.

This paper follows Joeiri and Leippold's research line further and is targeted at the development of a quantitative investment approach for family offices. Thereby and in contrast to previous research, the authors will take lock-up periods and minimum investment requirements on an individual hedge fund level into account in order to develop an effective hedge fund investment approach that is of straightforward practical relevance for family offices.

3. Research Methodology

This paper proposes a fully-transparent, strictly quantitative portfolio management approach that is specifically targeted at family offices seeking direct investment in a broadly diversified portfolio of hedge funds. This approach comprises of three steps: data preparation, investment selection, and fund allocation. Each of these steps will be briefly described below. In addition, the evaluation methodology will be outlined.

3.1. Data Preparation

Studies that are concerned with quantitative investment strategies in hedge funds are typically based on a comprehensive hedge fund database. The data used in this paper are sourced from Eurekahedge.⁹ The Eurekahedge Hedge Fund database contains information on individual hedge funds such as their investment strategies, historical returns, assets under management, etc. In order to guarantee for a sufficiently large sample size and to prevent the instant-history bias from eroding the data sample, the authors limit the observation period from January 2003 to June 2009.¹⁰

In contrast to most previous works, however, this study will narrow down the dataset considerably in order to mirror the relevant hedge fund universe that practitioners face. To this end all non-reporting, non-flagship¹¹, and all closed hedge

⁹ Eurekahedge, based in Singapore, is a private data vendor in the alternative investments space.

¹⁰ When hedge funds register with a database, they are given the opportunity to backfill their previous returns. While successful hedge funds will seize this opportunity, bad hedge funds' track records are most likely not backfilled (Géhin, 2006). This phenomenon is usually referred to as 'instant history bias'. Fung and Hsieh (2000) estimate the instant history bias to be around 1.4% per year. This finding is supported by Ibbotson and Chen (2006), who find that hedge funds that report their AuM have a backfill bias of 1.3%.

¹¹ The database includes different versions of several hedge funds. These are for most part on-shore/off-shore, accumulating/distributing and different currency versions of essentially the same

funds are removed from the sample.¹² After this process there are 4,816 hedge funds left. These hedge funds constitute the 'relevant hedge fund universe' from a practitioner's point of view as they represent an enumeration of all hedge funds that are theoretically investable. A corresponding procedure is applied to the EurekaHedge Fund of Hedge Funds database in order to define a 'relevant funds of hedge funds universe' of 1,710 funds.¹³

In a next step, the authors narrow down the 'relevant hedge fund universe' even further. Research in the field clearly indicates a negative relationship between hedge fund size and performance.¹⁴ To account for this finding, the proposed investment approach only considers comparatively small hedge funds with US\$1 million to US\$100 million in AuM.¹⁵ These hedge funds constitute the 'attractive hedge fund universe'.

3.2. Investment Selection

This paper proposes an entirely quantitative investment selection approach that relies heavily on risk-adjusted performance measures. These indicators are used to identify the hedge funds with the best risk / return profiles within the 'attractive hedge fund universe'. Since no single risk-adjusted performance measure has been shown to dominate the others in academic literature (Eling & Schuhmacher, 2007), this study draws on a broad range of risk-adjusted performance measures. Figure 1 provides an overview. On the whole, 15 different risk-adjusted performance measures are calculated for each individual hedge fund of the 'attractive hedge fund universe'.¹⁶

The computation of these risk-adjusted performance measures is essentially based on the historical post-fee returns reported by the individual hedge funds in the 'attractive hedge fund universe'. Furthermore, several risk-adjusted performance measures depend on a number of parameters which have to be fixed. These include the length of the in-sample period, the risk free rate (r_f), the minimum acceptable return (τ), the number of considered largest drawdowns for the Sterling and Burke Ratios, the significance level for VaR-based risk-adjusted performance measures (α), and the risk factor of the MPPM (ρ).

hedge fund. The authors remove such duplicate funds by concentrating on the fund with the highest AuM, the so-called flagship fund.

¹² Unfortunately, the EurekaHedge databases only include the current open/closed status of a specific fund. As historic information is not available, the authors assume that open funds have been open and closed funds have always been closed to new investment during the whole observation period. This is certainly an unfounded simplification that is only applied for the lack of more accurate information.

¹³ Funds of hedge funds are investment vehicles that invest in hedge funds.

¹⁴ See for instance Hedges (2003), Herzberg and Mozes (2003), Harri and Brorsen (2004), Ammann and Moerth (2005), and Boyson (2008).

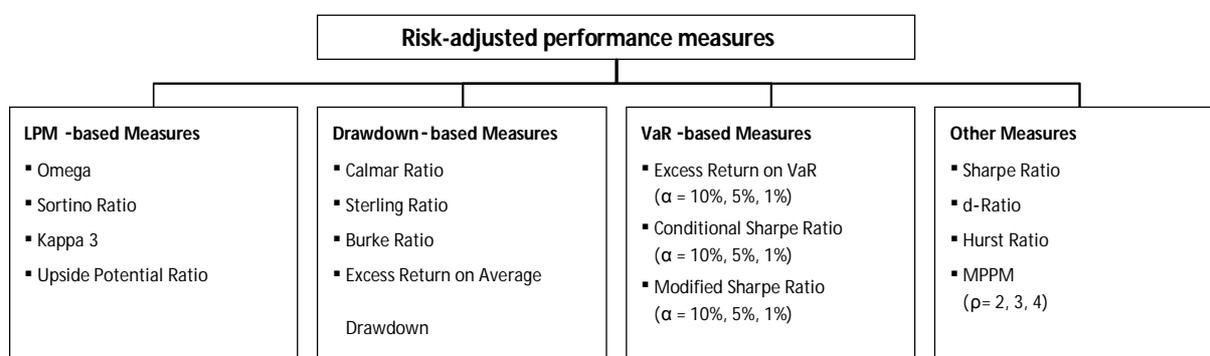
¹⁵ Amman and Moerth (2005) indicate that performance drops considerably if hedge fund AuM fall short of or exceed these values.

¹⁶ For a detailed description and discussion of these risk-adjusted performance measures please see Eling and Schuhmacher (2007), Joehri and Leippold (2006), Koh et al. (2002), and Ingersoll et al. (2007).

The authors set the length of the in-sample period to 24 months.¹⁷ The risk free rate is defined as the interest on a US T-Bill. Further, the minimum acceptable return is set equal to the risk-free rate.¹⁸ For the Sterling and Burke Ratios, the authors consider the three largest drawdowns during any in-sample period. In the case of VAR-based measures, three different significance levels, namely $\alpha = 1\%$, 5% , and 10% are tested. Similarly, the MPPM is calculated under three different risk measures $\rho = 2, 3, 4$. Finally, this paper employs a buy and sell lag of three months.¹⁹

On the whole, 15 different risk-adjusted performance measures are calculated for each individual hedge fund in the 'attractive hedge fund universe'. All hedge funds are ranked from best to worst according to their absolute values under each risk-adjusted performance measure. Then, these different rankings are merged into one single equally weighted ranking, the so-called Combined Indicator ranking²⁰. Only the top-scoring hedge funds are considered for investment.

Figure 1: Risk-adjusted Performance Measures



Source: Eling and Schuhmacher (2007), authors' own illustration

3.3. Fund Allocation

This paper is based on a sequence of out-of-sample tests. As discussed in the previous paragraph, the risk-adjusted performance measures for all hedge funds within the 'attractive hedge fund universe' are calculated based on a 24-months in-sample period.²¹ Then, the hedge funds are ranked by their risk-adjusted performance measure values with the top hedge funds qualifying for investment. Figure 2 illustrates this process: The constructed portfolio reallocates its

¹⁷ In the HF space, there is no single generally-used in-sample period. In the light of previous studies, such as Joehri and Leippold's (2006), an in-sample period of 24 months appears reasonable.

¹⁸ τ is usually zero, the risk-free rate or average return; previous research has shown that these different choices of τ by and large deliver equivalent results (Eling & Schuhmacher, 2007).

¹⁹ While the choice of a buy and sell lag is certainly arbitrary, this choice is based on a study by Joehri and Leippold (2006).

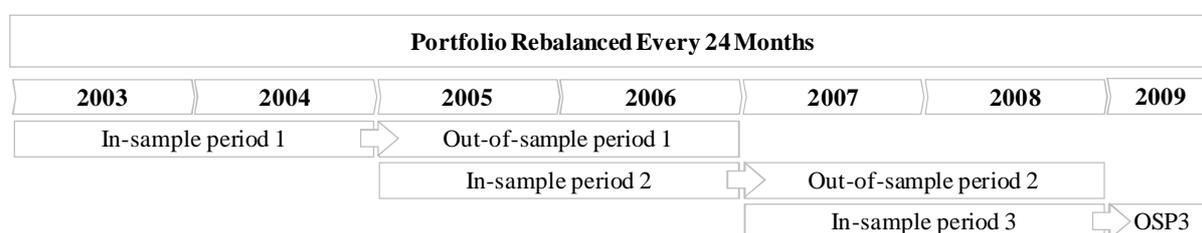
²⁰ This procedure is based on a study by Joehri and Leippold (2006).

²¹ In the HF space, there is no single generally-used sample period. In the light of previous studies, such as Joehri and Leippold's (2006), an in-sample period of 24 months appears reasonable.

investments regularly and buys in a new set of hedge funds with the best risk-adjusted performance measure values.²² The authors assume transaction costs of 2.5% of assets under management for each reallocation.²³

The initial portfolio size is US\$10 million.²⁴ The authors take a straight-forward approach to fund allocation within this portfolio. Considering the high minimum investment sizes that many hedge funds require, it seems appropriate from a family office practitioner’s point of view to strictly limit the number of individual investments. Previous research indicates that the majority of diversification benefits are captured with a naively-diversified portfolio of just 10 hedge funds.²⁵ Thus, the simulated portfolio is invested in no more than 10 hedge funds at any time during the observation period. At the beginning of each period, an equal share of disposable capital is allocated to each selected hedge fund. These weights are not adjusted throughout the respective out-of-sample period.

Figure 2: Illustrative Overview of Portfolio Reallocation



Source: Authors' own illustration

3.4. Summary of Investment Approach

As shown above, the investment approach developed in this paper involves three major steps: data preparation, investment selection, and fund allocation.

The first step, data preparation, starts from a comprehensive and up-to-date hedge fund database, namely the EurekaHedge Hedge Fund database. In order to mirror the relevant hedge fund universe that practitioners face, all non-reporting, non-flagship²⁶, and all closed hedge funds are removed from the sample. Out of the remaining hedge funds, only those that have AuM between US\$1 million and US\$100 million are considered for investment.

²² The authors assume portfolio reallocations to occur on 31st December 2004, 2006, and 2008.

²³ Transaction costs include operating expenses and pre-sale charges, as well as other costs incurred. An estimate of 2.5% appears reasonable.

²⁴ While the choice of the initial size of the hedge fund portfolio is certainly arbitrary, an amount of US\$10 million appears reasonable.

²⁵ See for instance Park and Staum (1998), Henker (1998), Amin and Kat (2003), Lhabitant and Learned (2004), and Lhabitant and Laporte (2006).

²⁶ The database includes different versions of several hedge funds. These are for most part on-shore/off-shore, accumulating/distributing and different currency versions of essentially the same hedge fund. The authors remove such duplicate funds by concentrating on the fund with the highest AuM, the so-called flagship fund.

In the second step, investment selection, the authors calculate a Combined Indicator of 15 different risk-adjusted performance measures for each of these hedge funds. All hedge funds are ranked from best to worst according to their Combined Indicator Values.

The third step, portfolio reallocation, is straightforward: 10% of the disposable capital is allocated to each of the top ten hedge funds with the highest Combined Indicator Values. This process is repeated every two years.

3.5 Performance Assessment

The performance of the constructed Combined Indicator portfolio is tracked on a monthly basis. This portfolio is measured against two different benchmarks: an equally weighted index of hedge funds in the 'relevant hedge funds universe' and an equally weighted index of funds of hedge funds in the 'relevant funds of hedge funds universe'.²⁷

The comparison with both benchmarks addresses different questions. The comparison of the portfolio against the 'relevant hedge fund universe' is to answer the question whether the proposed methodology is capable of selecting superior funds from the 'relevant hedge fund universe'. If that is the case, the constructed Combined Indicator portfolio should beat this benchmark. The comparison of the portfolio against the 'relevant funds of hedge funds universe' is to answer the question whether the proposed methodology produces portfolios superior to real-life funds of hedge funds. If that is the case, the constructed portfolios should beat this benchmark.

In this context, it must be mentioned that funds of hedge funds offer valuable benefits over a direct investment in hedge funds. These are accessibility, liquidity, and professional management. These advantages come at a certain cost and funds of hedge funds charge their investors with a second layer of fees which negatively impacts their performance. As the proposed portfolio management approach offers none of the aforementioned benefits that funds of hedge funds provide, benchmarking against funds of hedge funds is not a like-with-like comparison and thus included for reference only.

In this context, the special situation of family offices must be pointed out. Family offices are usually potent investors with significant assets under management and a long-term planning horizon. Furthermore, they employ several investment professionals who can provide oversight of potential direct hedge fund investments. Thus, the benefits that funds of hedge funds provide compared to a direct investment in hedge funds, namely accessibility, liquidity, and professional management, are likely to be less advantageous for many family offices than for other investors with lesser financial and human resources. In other words, a direct investment in hedge funds as discussed in this study is not per se advisable for all investor groups in all situations; instead, it is exclusively targeted at and appropriate for family offices in the described situation.

The evaluation process itself is straightforward: The authors will calculate the first four statistical moments of the Combined Indicator portfolio and its two benchmarks in order to facilitate a straightforward comparability.

4. Results

The Combined Indicator portfolio is benchmarked against the hedge fund index and the fund of funds index in order to assess its performance. The comparison of the Combined Indicator portfolio against the hedge fund index is to answer the

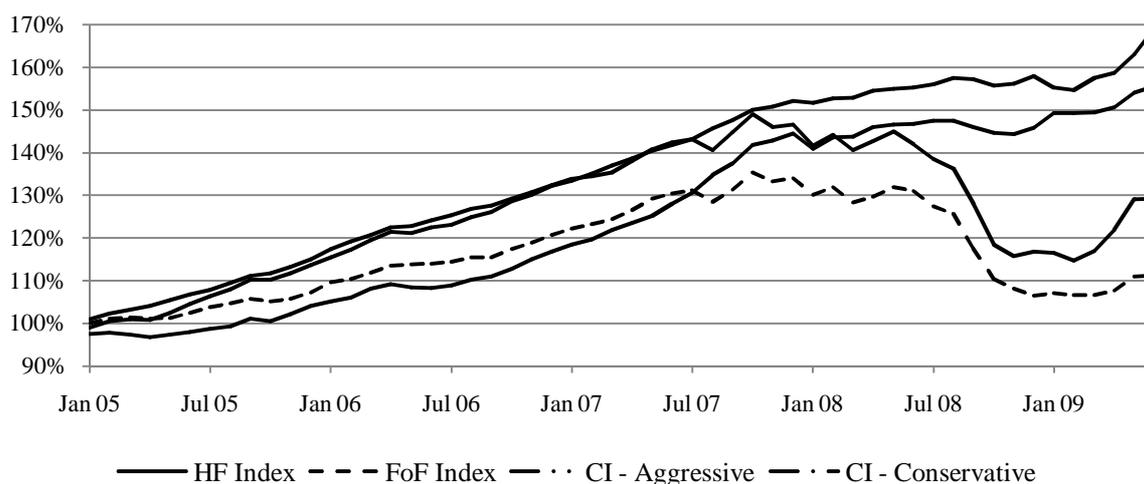
²⁷ Just like the constructed portfolio, these benchmarks are rebalanced after 24 months.

question whether the proposed methodology is capable of selecting superior funds; the comparison against the fund of hedge fund index is to answer the question whether the proposed methodology is superior to real-life funds of hedge funds.

Figure 3 highlights the portfolio performance of both indices and the portfolio constructed under the new approach from January 2005 to June 2009. The figure displays two different variants of the constructed portfolio which are named 'Combined Indicator - Aggressive' and 'Combined Indicator - Conservative'. The aggressive portfolio variant draws on all hedge funds in the 'attractive hedge fund universe'.²⁸ In contrast to that, the conservative portfolio variant exclusively contains hedge funds that describe their trading strategy as 'market neutral'.²⁹ It can be seen that both of these Combined Indicator portfolio variants clearly outperform the hedge fund index and the fund of funds index at the end of the observation period. A further result is that the 'Combined Indicator - Aggressive' portfolio and the hedge fund index seem to be somewhat correlated in the bull market from 2005 - 2007. During this period, the 'Combined Indicator - Conservative' portfolio shows a clearly noticeable relative underperformance. On the other hand, the performance of both Combined Indicator portfolio variants in the bear market of 2007 - 2009 is clearly superior to that of the hedge fund index. These results may imply that the Combined Indicator in itself tends to favour hedge funds with a lower market risk over their peers which leads to an outperformance of both Combined Indicator portfolio variants over the benchmarks.

Figure 3: Performance Benchmarking

Portfolio Net Performance



Source: Authors' own illustration

Table 1 shows the fundamental statistics of the two Combined Indicator portfolio variants and the indices. It is evident, that both constructed portfolios are characterized by higher monthly average returns than the two indices. At the same time they display lower standard deviations than their benchmarks. Moreover, they show a higher skewness, and a lower

²⁸ The 'attractive hedge fund universe' comprises all hedge fund of the 'relevant hedge fund universe' that have assets under management between US\$1 million and US\$100 million.

²⁹ The EurekaHedge Hedge Fund database gives hedge funds the opportunity to provide a synopsis of their strategy. Based on these descriptions, the authors were able to identify allegedly 'market neutral' hedge funds.

kurtosis than the two indices.³⁰ Thus, the two Combined Indicator portfolio variants clearly dominate their benchmarks on a risk / return basis.³¹ These results visibly imply that the proposed methodology is capable of successfully selecting superior hedge funds from the 'relevant hedge fund universe'.

Table 1: Fundamental Return Statistics (January 2005 – June 2009)

	Average Monthly Net Returns	Standard Deviation	Skewness	Kurtosis
Hedge fund Index	0.58%	2.20%	(1.30)	3.79
Fund of Fund Index	0.20%	1.86%	(1.72)	3.94
Combined Indicator (Aggressive)	0.98%	1.07%	(0.23)	1.52
Combined Indicator (Conservative)	0.82%	0.92%	(0.37)	0.79

Source: Authors' own illustration

A comparison of the fundamental return statistics between both Combined Indicator portfolio variants is further revealing. The 'Combined Indicator - Aggressive' portfolio is characterized by considerably higher average returns and dominates throughout the observation period. The 'Combined Indicator - Conservative' portfolio on the other hand shows a lower standard deviation of returns, a similar skewness and a lower kurtosis. In other words, it displays an inferior return but a superior risk profile.

Drawing on these findings, there seems to be evidence that the proposed methodology is indeed capable of selecting superior hedge funds from a broad universe of investment choices.

³⁰ Skewness is a measure of the asymmetry of the return distribution around the mean. Positive (negative) skewness indicates a distribution with a fat right (left) tail. Kurtosis is a measure of the 'peakness' of the return distribution. A positive (negative) kurtosis indicates a relatively peaked (flat) distribution compared to the standard normal distribution.

³¹ These results, however, do not hold true for shorter holding periods; this can be ascribed to a high level of transaction costs.

5. Synopsis and Discussion

In this paper the authors develop a purely quantitative hedge fund investment approach based on a Combined Indicator of several risk-adjusted performance measures. This simple investment approach has proven superior to an equally weighted hedge fund index in a sequence of out-of-sample tests. Against this background, it seems worthwhile to discuss the limitations of this study plainly.

First of all, the proposed investment approach has only been tested during a relatively short observation period from January 2003 to June 2009. Although this has been a deliberate choice – in order to safeguard data quality – one has to be aware of this shortcoming. At the same time it must be pointed out that this period covers the larger part of a full economic cycle and one of the most severe financial crises in recent history. Still, it would be advantageous to observe the performance over a longer period.

Moreover, the proposed investment approach is not scalable. It relies essentially on the availability of investment opportunity in small hedge funds. A significant inflow of capital into this approach would erode performance levels due to diminishing returns to scale. Therefore, the strategy is only apt for few and small investors.

Furthermore, it must be mentioned that the proposed investment approach is a heuristic and does, as such, not produce optimal allocations. Still, it represents a fully transparent, easy-to-implement, and inexpensive-to-operate decision-making guideline for investors seeking exposure to a diversified hedge fund portfolio. While the heuristic is tailored to the needs of family offices, it is also appropriate for other investor groups such as pension funds and corporations.

Finally, it has to be pointed out, that the proposed methodology is a niche solution that is only apt for special types of investors such as family offices. Family offices usually have significant assets under management combined with a long-term planning horizon and a qualified body of investment professionals. Thus, they are less dependent on the benefits that funds of hedge funds provide, namely accessibility, liquidity, and professional portfolio oversight. In other words, a direct investment in hedge funds as discussed in this study is not per se advisable for all investor groups in all situations. Still, certain kinds of investors, such as family offices might use this new approach to generate equal or even higher returns than funds of hedge funds.

Considering all these factors, the limitations of the proposed heuristic become evident: It represents a valuable decision-making guideline for investors; however, it cannot be considered as a silver bullet to hedge fund investment.

6. Conclusion

In this paper the authors strive to make a contribution to the academic literature in the field of hedge fund selection and portfolio management within a broad universe of hedge funds. While there are several academic studies in the field, they do not take the major practical limitations and restrictions into account that family offices face. Against this background and considering the importance of hedge funds for family offices, it has become a necessity to develop an effective hedge fund investment approach that is of straightforward practical relevance for family office practitioners. Some studies, such as Joehari and Leippold's (2006), have tried to bridge this gap. The study at hand follows their research line further by incorporating a larger number of practically relevant restrictions: Unlike Joehari and Leippold's work (2006) this paper considers lock-up periods and minimum investment requirements on individual fund level. Furthermore, the Combined Indicator put forward in this study comprises of a significantly larger number of risk-adjusted performance measures.

The study shows clearly that an equally weighted index of hedge funds can be outperformed using a relatively simple methodology that relies entirely on historical data. A portfolio of hedge funds constructed under the proposed heuristic proved able to outperform a hedge fund index and a fund of fund index in a sequence of out-of-sample tests. Thus, there seems to be evidence that the proposed heuristic represents - in all probability - a capable and viable option in a real-life hedge fund investment setting.

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“The Location of Undisplayed Liquidity: Evidences from Visible Order-Level Messages”

Ruihong Huang (Humboldt University of Berlin, Germany)

Nikolaus Hautsch (Humboldt University of Berlin, Germany)

Undisclosed limit orders (ULO), which violate the principle of pre-trade transparency, have been widely introduced to electronic limit order book (LOB) platforms in financial markets in the last decade. Despite of the increasing importance of understanding traders' decisions of using ULOs for regulators, exchanges and investors (see, e.g SEC 2010), the empirical studies are few, especially on markets with non-display orders. In this paper, we investigate how traders decide the aggressiveness of their ULOs in an LOB market when they are open to options of disclosed limit order, reserve orders and non-display orders, by studying the aggressiveness of undisplayed liquidity in NASDAQ. Particularly, we extract reliable information of locations of undisplayed liquidity by analyzing market reactions on visible orders contained in the ITCH order-level message data. Then we model the aggressiveness of undisplayed liquidity against selected market condition variables by means of ordered probit models.

Our paper is distinguished from the exist literature in part because opaque markets with non-display orders have barely been studied, but also because it brings the new important insights: 1) we find that there is significant more undisplayed liquidity inside of spreads in market opening hour. This indicates that informed traders may take the average of non-display order's ability on hiding aggressive price to reduce information leakage when pursuing their desired position. 2) Our model predicts that undisplayed liquidity inside of spreads has a “U” shape distribution and the hidden spreads is positively correlated to visible spreads. This implies that using visible spreads as metric for costs of immediacy is still practically reasonable to some extent, despite of theoretical “wrong”. 3) We observe that high number of fleeting orders, a term referring to disclosed limit orders that are cancelled shortly after submission, significantly decreases the aggressiveness of undisplayed liquidity on the opposite side but does not increase that on its own side. This implies that high-frequency traders (HFT) are more likely to be undisplayed liquidity takers than makers. Besides, our results also confirm empirical findings and theoretical predictions in literature that LOB states, previous transaction process and short-term limit order flow have significant impacts on ULO submission strategies.

“Financial System, External Shocks and Economic Growth in Mexico, 1970-2009”

Miguel A. Tinoco (Universidad de Colima, Mexico)

In the last decades the Mexican economy has gone through deep changes from the import substitution model to the neo-liberal model and liberalization of the 1980s and 1990s. The financial system experienced deep changes as well. It began to open internationally in the late 1970s and liberalize and deregulate in the 1980s and early 1990s. However, macroeconomic performance has been poor. Economic growth averaged 3.5 % during 1970-2009, worsening 2 % in 2000-2009. Private credit from money deposits in banks as a proportion of GDP averaged 19.1 % in 1970-2009 and decreased to 15.8 % in the last decade. There is also evidence that Mexican growth has been constrained by the US economy (Beckler, 2009), especially since the beginning of the North American Free Trade Agreement in 1994.

Very few studies have tried to gauge the effects of financial development on the Mexican economic growth in the long run. For instance, Rodriguez and Lopez (2009) found that financial development had a positive impact on output during 1990-2004 by using a dynamic production function and co-integration analysis. Venegas, Tinoco, and Torres (2009) studied the relationship between financial liberalization, development and economic growth for the period 1961-2007. With a co-integration model, they show that financial development caused a small effect on the real rate of output, and that financial repression inhibits economic growth and it is inversely proportional to financial development.

No previous studies have assessed the impact of external shocks coming from the US economy on the Mexican growth and the financial sector in the long run. We improve some results from Venegas, Tinoco, and Torres (2009) to test with co-integration analysis the hypothesis that both the Mexican economic growth and the financial sector development have been constrained by the performance of the US economy. We develop our analysis in two phases. First, we focus on the effects of the domestic effects of financial development by adding stock market indicators to the model proposed by Venegas, Tinoco and Torres (2009). Secondly, we analyze the influence of the US economy on the Mexican financial development and growth by adding the US growth rate and other control variables such as the real exchange rate and oil prices. Given that our variables may have different orders of integration, we employ a dynamic OLS proposed by Stock and Watson (1993) in which right-hand side variables enter in both level and first-differences.

Session C

“Equity Prices, Monetary Policy and Economic Activities in South Africa”

Lumengo Bonga-Bonga (University of Johannesburg, South Africa)

Given the recent worldwide stock market volatility and the financial and economic instability that followed, this paper investigates the possible influence equity price shocks have on economic activities and inflation in South Africa. Moreover, the paper discusses the role monetary policy action should play in preventing or reducing the disruptive effects of equity market volatility in South Africa. The paper uses the structural vector error correction (SVEC) model to identify the different shocks and obtain the impulse response functions. The paper finds that monetary policy shocks can influence equity prices through their effects on exchange rate, and that positive equity price shocks reduce inflation in South Africa. The results show that equity price shocks have the characteristics of supply shocks in South Africa. This raises questions as to whether ‘leaning against the wind’ strategies in the stock market can be supported in South Africa. The paper suggests that monetary policy should not respond to positive equity prices in South Africa.

“Measuring the Effects of SCHIP, Welfare Reform, Rising Obesity Rates and an Aging Population on Medicaid Costs”

Anusua Datta (Philadelphia University, United States)

Donald Vandegrift (The College of New Jersey, United States)

Medicaid expenditures account for a sizeable proportion of U.S. GDP - \$360.3 billion in 2009 or 2.55 percent of GDP. Moreover, this percentage is projected to rise as the Affordable Care Act of 2010 further expands eligibility criteria for the Medicaid program. Unfortunately, there is little literature on the effect on healthcare spending of earlier expansions to Medicaid from programs such as the SCHIP. Similarly, the welfare reform act of 1996 (i.e. Personal Responsibility and Work Opportunity Reconciliation Act) which had a significant impact on Medicaid expenditures has received little attention in the literature. In this study we examine the impact of these major policy initiatives and other factors driving Medicaid expenditures in the U.S., using panel data from 50 states for the years 1990 through 2003. We find that a one percentage-point increase in the percentage of the total population that is enrolled in SCHIP through Medicaid raises per-capita spending on Medicaid about \$52 and that a one percentage-point increase in the percentage of the total population that is enrolled in SCHIP through a Medicaid combined program raises per-capita spending on Medicaid \$29.50. According to our estimates, PRWORA cut per-capita Medicaid spending by about \$65.

1. Introduction

The cost of the Medicaid program is clearly one of the most vexing contemporary budget issues. In 2009, total Medicaid spending was \$360.3 billion (2.55 percent of GDP) or \$7,107 per enrollee (Centers for Medicare and Medicaid Services, 2010). Truffer et al. (2010) project that these costs will rise to \$794 billion by 2019. Because the federal government shares the cost of Medicaid with the states, Medicaid costs affect both state and federal budgets.³² For 2009, Medicaid expenditures accounted for 21.1 percent of all state government spending (National Association of State Budget Officers, 2010). Worse yet, Medicaid expenditures as a percentage of state spending more than doubled from 1992 to 2007 (Marton and Wildasin, 2007).

Beginning in 2014, the Affordable Care Act of 2010 (i.e. the new Obama health care law) further expands eligibility for the Medicaid program to include all people under age 65 with incomes less than 138 percent of the Federal Poverty Level. As a consequence of this expansion and added Children’s Health Insurance Program (CHIP) funding, the Centers for Medicare and Medicaid Services project that Medicaid and CHIP enrollment will

³²For 2007, about 43 percent of Medicaid spending was paid for by state governments, the remainder (57 percent) was funded by the federal government (Truffer et al., 2008). Medicaid comprises about 7 percent of the federal budget.

increase 34 percent in 2014 and total spending will rise 17.4 percent (Centers for Medicare and Medicaid Services, 2010).³³

Given the high and rising costs associated with the program, state governments are concerned about the fiscal stress induced by rising Medicaid expenditures. According to a recent Kaiser Foundation study, states have responded by adopting various cost containment methods such as: benefits reduction (13 states), raising the bar on eligibility (1 state), pharmacy utilization controls (30 states), provider payment cuts or freezes (36 states).³⁴

However, for every dollar a state reduces in Medicaid expenditures, the state loses one to three dollars in federal matching funds. Such reductions can have adverse repercussions on the health and well-being of state residents as well as the state economies (Ku and Broaddus, 2003). A better understanding of the causes for the increase in Medicaid spending can suggest methods to cut expenditures while holding health outcomes constant.

Understanding the likely fiscal effects of prospective changes to Medicaid requires that we understand the fiscal effect of past changes to the program. Consequently, this paper will examine the impact of two key pieces of legislation on Medicaid expenditures: the Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) of 1996 and the expansions of Medicaid that occurred primarily under the Balanced Budget Act (BBA) of 1997, to extend health coverage to more low-income children and their parents under the State Children's Health Insurance Program (SCHIP).

PRWORA replaced Aid for Families with Dependent Children (AFDC) with a block grant program known as Temporary Assistance for Needy Families (TANF). One of the main goals of TANF was to move recipients of cash assistance off public assistance (welfare) and into the workforce. Policy makers feared that the tighter welfare eligibility criteria required by TANF might unintentionally cause many people to lose health insurance coverage. To prevent this, the new law effectively decoupled Medicaid from cash assistance for low-income families. Families meeting the requirements for assistance under the old AFDC eligibility criteria could continue to receive Medicaid benefits. However, there is evidence that many such families did not retain their Medicaid benefits (Garrett and Holahan, 2000). Despite a clear link between welfare and Medicaid and evidence that suggests PRWORA cut the welfare rolls, the effect of PRWORA on Medicaid spending has received little attention in the literature.

Likewise, there is little economic literature on the impact of BBA on Medicaid spending. The most significant provision of the BBA from Medicaid's perspective is that it established the State Children's Health Insurance Program (SCHIP) to provide health coverage to low income children who did not qualify for Medicaid. States could use SCHIP funds to cover children through expansions of their Medicaid programs or through separate State programs. At present, about 40 percent of SCHIP funds are being spent under Medicaid. The earliest changes to Medicaid extended coverage to all children under 6 years in families with income below 133 percent of the federal poverty line (FPL) and to all children in families with incomes below 100 percent of the FPL.

³³The federal government is expected to finance much of the costs of these added beneficiaries through a 100 percent Federal Medical Assistance Percentage (FMAP). However, this FMAP will be reduced to 90 percent in 2020 and thereafter.

³⁴ Report of the Kaiser Commission on Medicaid and the Uninsured, 2010.³⁴

Later, the BBA provided states with grants to expand coverage further and create SCHIP. Additional policy changes expanded coverage to low income adults.³⁵ For both Medicaid and SCHIP, states have some autonomy to determine income eligibility standards and the scope of coverage. However, flexibility is greater for states that chose to establish separate SCHIP programs. The federal government permitted these states to design new procedures and benefit packages. But the literature that assesses the impact of SCHIP focuses mainly on initial enrollment or “take up rates” in the program and the “crowding out” effect of SCHIP.

Of course, factors other than changes in legislation also impact Medicaid expenditures. On the demand side, factors such as increases in the number of elderly and disabled, and a rise in obesity rates are likely to affect Medicaid spending. On the supply side, advances in medical technology, hospital/nursing home market structure, introduction of new drugs, and HMO coverage have been shown to affect healthcare costs. Since Medicaid is a means-tested program, variations in income and unemployment rates affect Medicaid caseloads and therefore spending.

Most empirical studies on healthcare costs are based on survey data, such as the MEPS data. While this data allows us to control for a number of individual characteristics they ignore macroeconomic and state-level cost factors. Indeed, the 2008 Actuarial Report on the Financial Outlook for Medicaid notes that a key limitation of their analysis and the existing literature is the “unavailability of demographic, macroeconomic, health care, and program assumptions specific to each state. Because these state-specific assumptions are not available, it is not possible to project Medicaid spending or enrollment separately by state” (Truffer et al., 2008, p. 5). The present research addresses these gaps in the literature. In this study, we use panel data for US states for the period 1990-2003 to analyze the effects of welfare reform and SCHIP on Medicaid costs, while controlling for various public health, demographic, income and other factors.

³⁵ This expansion of coverage to low-income adults occurred as a result of three changes. First, Congress severed the link between TANF/AFDC and Medicaid and created a new family coverage category that required states to extend Medicaid eligibility to children and adults who were eligible for AFDC as of July 1996. Congress also permitted states to further expand eligibility by raising income limits and asset disregards. Second, as of August 1998, the federal government permitted states to relax the 100-h rule. The

100-h rule restricted Medicaid eligibility for two-parent households to households where the primary earner worked fewer than 100 hours a week. Third, as of July 2000, the federal government permitted states that covered children up to 200 percent of the FPL (and met other conditions) to use unspent SCHIP funds to insure low-income adults.

2. Background

In contrast to the relatively voluminous literature on Medicare spending, there are relatively few recent studies that examine Medicaid spending (Buchanan et al., 1996; Baicker, 2001; Hadley and Holahan, 2003; Holahan and Ghosh, 2005; Marton and Wildasin, 2007; RAND, 2008; Gruber, 2008). Hadley and Holahan (2003) use Medical Expenditure Panel Survey (MEPS) data to determine whether Medicaid is in fact more costly than private insurance for comparable populations. This is an important question as the percentage of Americans with private insurance is declining while the percentage of Americans with public insurance (e.g., Medicare or Medicaid) is rising. Answering the question is complicated by the fact that the adult population covered by Medicaid is less likely to report excellent or very good health and more likely to report fair or poor health than the privately insured. In addition, the Medicaid population has significantly higher rates of chronic medical conditions such as diabetes, hypertension, heart disease, and digestive disorders. In contrast to adults, the health differences between children insured through Medicaid and children with private insurance are relatively modest.

Because health care costs are higher for individuals with fair or poor health regardless of the type of insurance coverage, an accurate comparison between Medicaid and private coverage must correct for population health characteristics. To account for these differences, Hadley and Holahan predict expenditures for hypothetical people who are representative of the average individual covered by either Medicaid or private insurance. They show that if the average adult with Medicaid was given private coverage, expenditures would be higher.

Conversely, if the average adult with private coverage was given coverage under Medicaid, expenditures would fall. For children, switching from Medicaid to private coverage has no effect on expenditures. These basic results hold regardless of whether the authors allow underlying behaviors to differ.

By contrast, Holahan and Ghosh (2005) analyze Medicaid spending growth for 2000 - 2003 by disaggregating Medicaid spending by category (e.g., acute care, nursing home care) and decomposing the growth in spending into growth in enrollment and growth in spending per enrollee. They find that over the period total Medicaid spending grew at 11.4 percent per year while enrollment grew at 8.0 percent a year. They attribute much of the enrollment growth to the economic downturn. After accounting for caseloads, they find that spending per enrollee increased only 3.1 percent a year - well below the private sector rate of increase. Though growth in spending was relatively uniform across Medicaid spending categories, there were exceptions. Prescription drug spending, acute care services, and long-term care grew at 17.1, 13.4 and 8.4 percent, respectively over the period. In fact, growth in acute care spending accounted for nearly 70 percent of the total spending growth over the period.

In addition to variation in Medicaid spending across categories, there is also substantial variation in spending among the states. State Medicaid expenditures as a share of total state budgets varied anywhere from 13 percent (Utah and Wyoming) to 30 percent (New York, Tennessee, and Maine) in 2005. Welfare spending also varies widely by state. Thus while California had one of the most "generous" state welfare plans, its Medicaid spending as a share of the state's budget is relatively low. A large portion of Medicaid spending supports health care for the elderly. About one quarter of Medicaid enrollees are elderly, or disabled, but these groups account for about two thirds of spending (Marton and Wildasin, 2007).

2.1 PRWORA, SCHIP and Medicaid

Despite the significant documented effects of PRWORA, there is little literature on the effects of the subsequent decline in number of welfare recipients on Medicaid costs. While PRWORA severed the link between welfare and Medicaid eligibility, Medicaid policy was subsequently reformed to expand participation, with state determined eligibility criteria. Ku and Bruen (1999) report that, between 1995 and 1997 Medicaid enrollment of adults and children declined by 5.3 percent, implying that the loss of welfare recipients was not fully offset by the increase in participation by non-welfare families. A series of recent studies (Ellwood and Ku, 1998; Ellwood and Irvin, 2000; Garrett and Holahan, 2000 and Garret et al., 2002) find significant declines in Medicaid participation of women and children between 1995 and 1997. Ellwood and Irvin (2000) also find that Medicaid programs have lost low-cost welfare leavers while continuing to cover those with higher costs.

Baicker (2001), on the other hand, finds substitution between Medicaid and welfare expenditures. The mandated Medicaid expansions of the late 1980s caused increased Medicaid spending but the increases were almost exactly offset by decreases in other welfare expenditures. Thus, the Medicaid mandates shifted only the composition of welfare benefits not their overall level. Due to these offsetting factors, the net effect of PRWORA on state Medicaid expenditures can only be determined empirically.

While there are few studies that examine the cost implications of SCHIP on Medicaid, a recent RAND (2008) study uses *micro-simulation modeling* to assess the government cost of each newly insured adult and child. The simulations are based on a set of assumptions about Medicaid/SCHIP take up rates, rate of “crowding out”, utilization rates etc. The study estimates that a Medicaid/SCHIP expansion will increase government spending \$17.9 to \$89.0 billion, about a 6 to 28 percent increase in program spending. The government cost for each *net newly insured* person is estimated to range from \$4,420 to \$6,420, for individuals with incomes 100 to 300 percent of Federal Poverty Level (FPL). These assessments are based on simulations! The true costs of Medicaid/SCHIP expansions can only be estimated using historical data, as is done by this paper. Much of the remaining literature on SCHIP focuses on the effect of Medicaid/SCHIP expansions on the insurance coverage rates for both adults (Busch and Duchovny, 2005; Aizer and Grogger, 2003; and Kronick and Gilmer 2001) and children (Ham and Shore-Sheppard, 2005; LoSasso and Buchmueller, 2004). Two basic effects determine the impact of the SCHIP expansions on the percentage of uninsured. First, not all the newly eligible individuals enroll in the government insurance program. A series of papers show that take-up rates for means-tested public health insurance for children (Cutler and Gruber, 1996; Currie and Gruber, 1996; Dubay et al., 2001) and adults (Busch and Duchovny, 2005) are low. Second, newly eligible individuals may drop private insurance and add public insurance. This will cause enrollments in government health insurance programs to rise but there will be no change in the percentage of uninsured (i.e., a crowd-out effect). Estimates of the “crowd-out” effect of public insurance vary. In general, public insurance enrollments rise as a result of the eligibility expansions. Kronick and Gilmer (2001) show that there is almost no crowd out for expansions to adults who have income below the FPL. However, there is substantial crowd out (up to 55 percent) for expansions that cover adults with income levels between 100 percent and 200 percent of the FPL. Card and Shore-Sheppard (2003) show that raising the income eligibility standard yields diminishing additions to the ranks of the insured. LoSasso and Buchmueller (2004) find that SCHIP caused a small but significant reduction in the

percentage of uninsured children. Also, there is some evidence that take up is higher in states with a separate SCHIP program.

2.2 Public Health and Healthcare Costs

Studies on the role of public health in healthcare costs have mostly been limited to Medicare expenditures or total healthcare expenditures. Some papers have considered more direct causes of Medicare expenditures or medical care consumption (e.g., heart attack and stroke), while others have focused on key predictors of health status that have a larger behavioral component (e.g., obesity and smoking) (Skinner and Wennberg, 2000b; Sturm, 2002; Finkelstein et al. 2003; Finkelstein et al. 2004; Thorpe et al., 2004; Wee et al., 2005). Sturm (2002) employs data from the 1997-98 Healthcare for Communities national telephone survey and finds that obesity is associated with a \$395 annual increase in health care costs while smoking raised annual health care costs by \$230.

Using the 1998 Medical Expenditure Panel Survey (MEPS), Finkelstein et al. (2003) find that obesity is associated with increases in medical spending even after controlling for income, education, insurance status, sex, race, marital status, and location. In their data, obesity status is associated with a 37 percent increase in medical spending (\$732) with Medicare and Medicaid recipients showing increases of 36 percent (\$1,486) and 39 percent (\$864), respectively. Thorpe et al. (2004) finds that obesity increases over the period 1987-2001 account for 27 percent of the increase in expenditures over the period. About half of this rise was the result of higher obesity prevalence while half was the result of higher relative spending among the obese.

3. Empirical Model

To analyze Medicaid expenditures in the U.S., we employ state-level data from the National Health Expenditure Accounts (NHEA) on Medicaid expenditures and total personal health care expenditures for the period 1990-2003. The data is compiled by the U.S. Department of Health and Human Services (HHS). HHS identifies all final consumption of health care goods and services for a given year and state (by residence) that is purchased or provided by direct or third-party payments. In addition, the data include health care related investments for a given year and state. The data are not dependent on patient reports. By contrast, most empirical studies on healthcare costs are based on individual-level survey data such as the MEPS or CPS data. However, Hadley and Holahan (2003) note that the MEPS data suffers from systematic underreporting and that as a consequence MEPS data report expenditures that are about 24 percent lower than the NHEA data. Because the MEPS defines expenditures as "payments made for health care services," it does not include expenditures that cannot be linked to a particular patient (except for Medicaid payments to public hospitals and clinics). Thus, MEPS fails to include Medicaid overhead expenses associated with capitated health plans and payments from Medicaid to hospitals that serve a large number of low-income patients (i.e., disproportionate share payments). Finally, Hadley and Holahan (2003) note that MEPS respondents often fail to report Medicaid expenditures or misreport Medicaid coverage as private coverage. At the most basic level, respondents may simply fail to recall some health care utilization. The misreporting of Medicaid coverage as private coverage

occurs because Medicaid contracts with private insurance plans. Consequently, providers may mistakenly believe that the source of funds is private insurance when in fact it is Medicaid.

Aside from avoiding the underreporting problems associated with MEPS, the CMS data allow us to account for various macroeconomic factors that affect Medicaid spending. CMS 2008 Actuarial Report on the Financial Outlook for Medicaid notes that a key limitation of the existing literature is the lack of “demographic, macroeconomic, health care, and program assumptions specific to each state” which makes it impossible “to project Medicaid spending or enrollment by state” (Truffer et al., 2008). To capture these effects on Medicaid expenditures, we employ a fixed-effects panel-data model of the following form:

$$(1) \quad Medicaid_{it} = \gamma_i Policy + X_{it} \Gamma + \delta_i + u_{it}$$

$i = 1, \dots, N$ (states); $t = 1990, \dots, 2003$ (years).

In equation (1) $Medicaid_{it}$ represents real per-capita Medicaid expenditure in state i and year t ; $Policy$ measures the effects of PRWORA and SCHIP; X_{it} is a vector of variables which control for public health, demographic and income factors; δ_i accounts for state fixed effects; and u_{it} is the transitory error term that varies across states and time-periods.

Our hypothesis about the effect of welfare reform is: PRWORA reduced the number of welfare caseloads and as a result contributed to a decline in state Medicaid expenditures. One way to assess the effects of PRWORA on Medicaid costs is to estimate the relationship between welfare caseloads and state Medicaid expenditures. However, this assumes that all of the changes in welfare caseloads were due to PRWORA, which is not the case. In fact, evidence suggests that much of the change in caseload is not due to policy (Blank, 2002), but due to other factors such as unemployment rate, income etc. It is important therefore to distinguish the effects of these factors, from those due to policy.

One way to address this issue could be to remove the impact of other factors on welfare caseloads and use the residual in the Medicaid regression:

$$(2) \quad Caseload = Caseload(Policy) + Caseload(Other)$$

$$(3) \quad Caseload(Other)_{it} = \alpha_i + Z_{it} \phi_i + e_{it}$$

$$(4) \quad Caseload(Policy)_{it} = Caseload_{it} - Caseload(Other)_{it}$$

Equation (2) assumes that welfare caseload depend on welfare policies and other factors. Equation (3) estimates the effect of other factors on caseload, where Z_{it} includes factors such as - income, unemployment rate, population over 65, etc. However, obtaining the effect of welfare policy on welfare caseloads in this fashion can be controversial. If equation (3) is incorrectly specified, using estimates from it to construct the $Caseload(Policy)$ variable will result in biased estimates.

To avoid this problem, we use an alternative approach. We include a discrete dummy variable to capture the effects of policy, while welfare caseload is included to control for the effects of unemployment and other factors.

The policy dummy $TANF_{dum}$, takes the value of 1 starting in the year PRWORA went into effect in state i and zero otherwise. We define the slope dummies for welfare caseloads as:

$$(5) \quad AFDC_Caseload = AFDC_{dum} * Welfare \ caseload$$

$$(6) \quad TANF_Caseload = TANF_{dum} * Welfare \ caseload$$

Substituting the policy variables into Eqn. (1) we have:

$$(7) \quad Medicaid_{it} = \gamma_1 TANF_{dum}_{it} + \gamma_2 AFDC_Caseload_{it} + \gamma_3 TANF_Caseload_{it} \\ + \gamma_4 SCHIP_{it} + X_{it} \Gamma + \delta_i + u_{it}$$

$$i = 1, \dots, N \text{ (states)}; t = 1990, \dots, 2003 \text{ (years)}$$

In equation (7), $TANF_{dum}_{it}$ is expected to account for the discrete shifts in Medicaid expenditures caused by the new welfare reform law, while $AFDC_Caseload$ and $TANF_Caseload$ control for the effects of other factors that may affect the number of welfare recipients that request Medicaid benefits. Thus, we should expect the sign for γ_2 and γ_3 to be positive. For example, when welfare caseloads rise in a recession we would expect state Medicaid expenditures to go up. The sign for γ_1 which measures the effect of policy reform, however will be determined *empirically*.

SCHIP enrollment is used to measure the effect of the state children health insurance program on per capita state Medicaid costs. Since all states do not administer SCHIP through Medicaid, we only include SCHIP enrollment for states where it is administered through Medicaid expansions or where it is a part of combination plans, but exclude states for which SCHIP is not a part of Medicaid.³⁶

The other control variables included are: *Obese* - percentage of the population over 18 years of age that is obese, *Smoke* - percentage of the population over 18 years of age that smokes, *Alcohol* - per capita alcohol consumption, *65+ Years* - percentage of the total population over 65 years of age, *Income* - state per-capita income, *HMO* - percentage of the total population that is enrolled in HMOs, *Unemp* - state unemployment rate, *Povrate* - percentage of population below poverty, *NME* - FDA approvals of new molecular entities to measure introduction of new drugs (Cockburn, 2004). *HProf* - percentage of hospitals in a state, that are *for-profit*; and *NHProf* - percentage of *for-profit* nursing homes in a state.

³⁶ Source: HCFA – The State Children’s Health Insurance Program Annual Enrollment Report Oct. 1, 1998-Sept.30, 1999 In 42.9 percent of states in 1999 the SCHIP program was under Medicaid, about 26.4 percent were under separate SCHIP plans while 30.4 percent had combination plans (i.e., administered through Medicaid and through separate plans)

4. Endogeneity Issues

One potential concern with respect to estimating the above model relates to the endogeneity problem between the policy variables and Medicaid Expenditures. For example, while higher enrollment in SCHIP and increases in welfare caseloads are expected to increase state healthcare costs. Rising healthcare costs may also motivate states to cut back on these programs. Both PRWORA and SCHIP, give states autonomy to determine the scope of coverage. Consequently, we instrument for SCHIP in the final equation. We use the state SCHIP income eligibility criteria to create an instrument for SCHIP enrollment. The variable is constructed by multiplying the Federal Poverty Level income (FPL for a family of four) with the state income eligibility criteria for SCHIP. The state income thresholds vary from a minimum of 100 percent of FPL to a maximum of 350 percent for some states. Tests indicate the instrument is valid. An F -test of the instrument is significant ($F(1, 571) = 358.09, p < 0.0001$) and the partial R^2 of the instrument is 0.37. To prevent endogeneity in the relation between welfare caseloads and Medicaid spending, we lag the welfare caseloads variables two years. Finally, a Wooldridge test for the presence of autocorrelation in panel data suggests that first-order autocorrelation is present ($F(1, 49) = 269.5, p < 0.0001$). Therefore, we correct for autocorrelation in our final model.

5. Data

Data for the remaining variables were collected from *The Statistical Abstract of the U.S.* (per-capita income, percentage of the population over 65, poverty rate). Real per-capita income is state personal income per capita in 1996 dollars. In the results reported below, nominal values are converted using the GDP deflator. Data on the employment variables are taken from the Bureau of Labor Statistics' Local Area Unemployment Statistics (unemployment rate).

Data on obesity rates and the percentage of the population, 18 years and older, that smokes, is taken from the Centers for Disease Control and Prevention's (CDC) Behavioral Risk Factor Surveillance System (BRFSS). Obesity is based on Body Mass Index (BMI) where BMI is weight in kilograms divided by height in meters squared. An individual with a $BMI \geq 30$ is considered obese. Alcohol consumption data is from the National Institute of Alcohol Abuse (NIAA) at the National Institutes of Health. The NIAA uses sales data to calculate annual per-capita consumption of alcohol. All alcohol sales are converted to an ethanol equivalent and then divided by the state population 14 years of age and older. Missing values in the alcohol consumption data were filled using the average for the earlier and later year. If data were missing for two or more consecutive years, we did not interpolate the missing values. Instead, we simply dropped the observation from the analysis.

Inter-study Competitive Edge *HMO Industry Report* provides HMO enrollment rates and data on *New Molecular Entities* is collected from the U.S. Food and Drug Administration Center for Drug Evaluation and Research.³⁷ The data contains annual observations on each variable across the 50 U.S. states for each year during the period 1990-2003 (14 years and 50 cross sections). Data on SCHIP income eligibility criteria were obtained from various

³⁷ See also Cockburn (2004) for this data.

reports of Congressional Research Service, Washington D.C. Welfare caseloads data were drawn from the Department of Health and Human Services website.

6. Results

Table 1 reports the summary statistics for the dependent and independent variables. Real Medicaid spending per capita varies rather dramatically across states. Mean Medicaid spending across the entire data set is \$518 and the standard deviation is \$211. For 2003, New York, Maine and Rhode Island had the highest real per capita Medicaid spending at \$1,782, \$1,205, and \$1,114, respectively. The low spending states for 2003 were Nevada, Virginia, and Utah at \$369, \$409, and \$412, respectively. Real total health care spending per capita also varies rather dramatically across states.

Mean health care spending across the entire data set is \$3,462 and the standard deviation is \$1,962. For 2003, Massachusetts, New York, and Delaware had the highest real per capita health care spending at \$5,573, \$5,443, and \$5,361, respectively. The low spending states for 2003 were Utah, Arizona, and New Mexico at \$3,247, \$3,374, and \$3,676, respectively. Mean Medicaid spending per-capita is about 15 percent of mean total health care spending per capita. Averaging over the entire time series from 1990 to 2003, about 12.5 percent of the US population was insured through Medicaid.³⁸

Table 2 shows regression results for real per-capita Medicaid spending. Models I through IV report the estimates for various specifications of the model from OLS in column 1 to the instrumental variables model corrected for first-order autocorrelation in columns 3 and 4.

Policy Effects

As expected, the coefficient for *SCHIP-M* is positive and highly significant. From Table 2, we can see that on average, a one percentage-point increase in the percentage of the total population that is enrolled in SCHIP through Medicaid raises per-capita spending on Medicaid about \$52. This represents about a 10 percent increase in mean per-capita Medicaid spending. Viewed alternatively, one more individual insured through Medicaid raises total Medicaid spending by \$5,200. The coefficient for *SCHIP-C* is also positive and highly significant. From Table 2, we can see that on average, a one percentage point increase in the percentage of the total population that is enrolled in SCHIP through a Medicaid combined program raises per-capita spending on Medicaid \$29.50. This represents about a 5.7 percent increase in mean per-capita Medicaid spending. Viewed alternatively, one more individual insured through an SCHIP combined program raises total Medicaid spending by \$2,950. RAND (2008) study estimates that the cost of Medicaid to federal and state governments ranges from \$4,420 to \$6,420 for each additional SCHIP enrollee. However, as mentioned earlier, these estimates are based on micro-simulations which require assumptions about take up rates and rates of “crowding out”. Our study therefore is the first to provide estimates of the cost of SCHIP expansions on Medicaid costs, using historical data.

Next, we turn to the impact of PRWORA on per-capita Medicaid spending. The welfare reform law resulted in a significant decline in the number of welfare caseloads. At the same time, however, Medicaid eligibility was expanded under different criteria. While the former policy was expected to decrease welfare

³⁸ The percentage of the population insured through Medicaid generally rises over the period from 9.2 percent in 1990 to 14.2 percent in 2003.

caseloads and therefore the number of Medicaid enrollees, the latter was likely to increase Medicaid enrollment at the margin.

From Table 2, we can see that the coefficient for *TANFdum* is negative and significant in all specifications of the model. The negative coefficient suggests that the declines in welfare caseloads due to welfare reform resulted in lower Medicaid spending. According to our estimates, PRWORA cut per-capita Medicaid spending by about \$65. Using the mean per-capita Medicaid spending figure, this represents about a 12 percent reduction in total Medicaid spending. This is not surprising given that welfare caseloads declined by an average of 20 percent across all states between 1995 and 1997. Because welfare caseloads continued to decline after 1996, additional decreases in per capita Medicaid costs may have occurred. These results confirm what other studies (Ellwood and Ku, 1998; Ellwood and Irvin 2000) found i.e. that declines in welfare recipients after the welfare reform act significantly exceeded the increase in insurance coverage provided through Medicaid expansion programs, thereby resulting in a net decline in the number of Medicaid enrollees.

Recall that in our specification in Eqn (7), *TANFdum* captures the effects of the new welfare reform policy (PRWORA) on Medicaid costs. *AFDC_Caseload* and *TANF_Caseload* variables were included to control for the effect of other factors like income and unemployment rate on welfare caseloads, and therefore Medicaid expenditures. An increase in unemployment is expected to increase welfare caseloads which in turn should increase Medicaid costs. Therefore we expect a positive relationship between welfare caseloads and Medicaid costs. From the estimates, we can see that while the coefficient for *AFDC* caseloads is insignificant, the *TANF* caseloads coefficient is positive and significant in all specifications. From Table 2, a one percentage point increase in the total population that is enrolled in *TANF* raises per-capita spending on Medicaid about \$7. This represents about a 1.3 percent increase in mean per-capita Medicaid spending. Viewed alternatively, one more individual enrolled in *TANF* raises total Medicaid spending by about \$700.

Public Health Indicators

Of the public health indicators, obesity is positively related to state Medicaid expenditures and is highly significant in all specifications. Obesity is associated with a variety of risk factors for cardiovascular disease, such as hypertension, elevated cholesterol, and type-2 diabetes, as well as an increased risk of cancer, stroke, osteoarthritis and other diseases (Must et al., 1999). These secondary effects of obesity typically require hospital stays and additional expensive medicines to treat complications and can substantially increase expenditures. Our estimates, shown in Table 2, suggest that a one percentage point increase in the population obesity rate increases per-capita Medicaid expenditures by about \$18.

Among the other public health factors alcohol consumption had a significantly positive effect on Medicaid spending, while surprisingly the effect of smoking was not significant. The health effects of smoking are often evident after a substantial lag. Testing for such an effect would require lags of ten to fifteen years at a minimum and the data to conduct such an analysis is not available. It is also likely that lower life expectancy of smokers (due to cancer and other smoking related diseases) may lower state Medicaid expenditures on this population. The Table 2 estimates also suggest that a one gallon increase in annual per-capita consumption of alcohol increases per-capita Medicaid expenditures by about \$10.

Income and Demographic Factors

Turning to demographic factors, the results in Table 2 show that the percentage of the population over sixty-five is an important influence on Medicaid spending. A one percentage-point increase in this population leads to an increase in real per-capita Medicaid expenditures of about \$34. The relative size of the over 65 population varies a great deal among states and it accounts for much of the variation across states at any point in time. As the population ages, we should expect the relative size of this group to increase, and thereby exert a significant pressure on Medicaid costs.

Considering health is a normal good - richer states are expected to spend more on Medicaid than poorer states. The estimates for state per capita income suggest that about \$20 of every \$1000 increase in per capita income goes towards Medicaid spending. The effect of a rise in state poverty rate and unemployment rate increases state Medicaid expenditure. Thus states where the percentage of population, that is unemployed or poor, is higher are likely to incur higher costs. Finally, a one percentage-point increase in the unemployment rate raises per-capita Medicaid spending by about \$8.50 while a one percentage-point increase in the poverty rate raises per-capita Medicaid spending by about \$5.50.

HMO Penetration, NME and Provider Ownership Structure

The effect of HMO enrollment on Medicaid costs is less straight forward. On the one hand, studies on Medicare patients have shown that Medicare patients enrolled in HMOs have lower costs than those enrolled under fee-for-service. On the other, given the fact that HMO's can generally negotiate lower prices from health providers, it is also expected that a large HMO presence in a state may cause health providers to shift costs to non-HMO patients, namely Medicare, Medicaid, other privately insured patients and the uninsured. Our estimates in Table 2 suggest that an increase in the percentage of population enrolled in HMOs exerts a positive and significant impact on state Medicaid expenditures. However, the effect is quantitatively small. A one percentage-point increase in HMO enrollment raises real per-capita Medicaid spending by about \$1.50 (or only about 0.3 percent of mean per capita Medicaid spending).

FDA approval of new drugs is also likely to have an effect on Medicaid costs. Since new drugs tend to be expensive it was expected that the current values of NMEs (measured as *New Molecular Entities* approved by the FDA) would exert a positive impact on costs. On the other hand, new drugs are likely to improve the health of patients using them and lower demand for Medicaid services. Our estimates for new drug approvals when lagged by two years suggest they lower Medicaid costs³⁹. One new drug introduction lowers per capita Medicaid spending by about \$1.20. In an average year, about 30 new drugs were introduced suggesting a cut in costs of about \$21 or 4 percent of mean per-capita Medicaid spending.

As previous studies have shown, hospital and nursing home care account for the bulk of Medicare and Medicaid costs.⁴⁰ In our analysis, the ownership structure of hospital sector had significant effect on per-capita Medicaid

³⁹ Current values of NME were found to be insignificant. NME became significant when it was lagged twice. This suggests that the positive effect of new drugs occurs with a lag.

⁴⁰ See Cutler and Meara, 2001 and Geppert and McClellan, 2001.

spending while the ownership structure of the nursing home sector did not. A one percentage-point increase in the percentage of hospitals that are run for profit reduces per-capita Medicaid spending by about \$1.70 (or only about 0.3 percent of mean per capita Medicaid spending). While the cost reducing effect of for-profit hospitals could reflect greater efficiency, it is possible that for-profit hospitals, unlike non-profit or government hospitals, can pick-and-choose the types of services they render and the patients they are willing to treat, which might be biased against those that are more costly.

7. Conclusion

Medicaid expenditures account for a significant proportion of U.S. GDP (2.55 percent) – nearly as much as we spend on defense (3.7 percent of GDP). Moreover, this percentage is projected to rise, thereby exacerbating budget problems at both the federal and state levels. In this paper, we examine the effect of two key pieces of legislation on Medicaid spending: the Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) and the State Children's Health Insurance Program (SCHIP). We also examine the factors driving Medicaid expenditures in the U.S. using panel data for 50 states for the years 1990 through 2003.

To our knowledge this is the first study to estimate the cost implications of SCHIP expansions on state Medicaid expenditures, using state-level data. We find that a one percentage-point increase in the percentage of the total population that is enrolled in SCHIP through Medicaid raises per-capita spending on Medicaid about \$52 and that a one percentage-point increase in the percentage of the total population that is enrolled in SCHIP through a Medicaid combined program raises per-capita spending on Medicaid \$29.50. These estimates represent an increase in mean per-capita Medicaid spending of about 10 percent and 5.7 percent, respectively. The impact of the PRWORA, which significantly lowered state welfare caseloads, had a negative impact on Medicaid expenditures. Although Medicaid coverage was expanded after 1996 under different criteria, the effect of a decline in welfare caseloads seems to trump the latter! According to our estimates, PRWORA cut per-capita Medicaid spending by about \$65. Using the mean per-capita Medicaid spending figure, this represents about a 12 percent reduction in total Medicaid spending.

Results indicate that public health, population over the age of 65, new pharmaceutical products, and income are all important in explaining state Medicaid expenditures. Among the public health factors, obesity turns out to be very significant in explaining rising Medicaid spending. This suggests that reducing obesity rates in the U.S. could potentially lower the pressure it exerts on public health care costs. Population over 65 years is strongly significant in both regressions. Thus as the U.S. population ages we expect Medicaid costs to increase further.

States with higher levels of HMO enrollments tend to have higher Medicaid expenditures. Large HMO presence in a state may cause health providers to shift costs to non-HMO patients, as HMO negotiate lower prices for health services. Finally, for-profit hospitals appear to lower Medicaid costs in our model. However, some studies have suggested that this could be because of cost-cutting methods employed by for-profits that also compromise quality.

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Table 1. Means and Standard Deviations

Variable	Mean	Standard Deviation	Minimum	Maximum	n
RMEDICAIDPC	518.08	211.08	140.65	1782.72	700
SCHIP-M	0.80	3.07	0.00	20.52	700
SCHIP-C	1.03	3.37	0.00	27.48	700
TANFCASE	14.67	17.59	0.00	79.32	700
AFDCCASE	19.54	23.02	0.00	83.73	700
TANFDUM	0.53	0.50	0.00	1.00	700
POP65PC	12.62	1.98	3.98	18.56	700
SMOKE	23.14	2.98	11.90	32.60	687
OBESE	16.97	4.20	6.90	28.40	687
ALCOHOLI	3.88	1.46	1.20	8.70	689
URATE	5.24	1.47	2.20	11.40	700
RINCP	23.92	4.08	15.06	39.34	700
POVRATE	12.51	3.76	4.51	27.66	700
HMO	17.72	12.33	0.00	54.20	700
NMELAG2	28.64	8.61	18.00	53.00	700
HPROF	0.12	0.12	0.00	0.48	700
NHPROF	0.62	0.18	0.00	0.85	700

RMEDICAIDPC_{it}: Real per-capita Medicaid spending (in 1996 dollars) per 1,000 population for state i in year t.

SCHIP-M_{it}: SCHIP-Medicaid program enrollment per 1,000 in population for state i in year t.

SCHIP-C_{it}: SCHIP-Combined program enrollment per 1,000 in population for state i in year t.

AFDCCASE_{it}: AFDC Caseloads per 1,000 in population, pre TANF for state i in year t.

TANFCASE_{it}: TANF Caseloads per 1,000 in population, post TANF for state i in year t.

TANFDUM_{it}: Dummy variable = 1 for years in which TANF is in effect for state i.

POP65PC_{it}: Percentage of the total population 65 years and older for state i in year t.

SMOKE_{it}: Percentage of the population 18 years of age and over in state i that smokes in year t.

OBESE_{it}: Percentage of the population 18 years of age and over in state i that is obese (BMI \geq 30) in year t.

ALCOHOL_{it}: Per capita (population 14 years of age and older) annual consumption of alcohol (ethanol equivalent) in gallons for state i in year t.

RINCP_{it}: Real per-capita income (in thousands of 1996 dollars) for state i in year t.

URATE_{it}: Unemployment rate for state i in year t.

POVRATE_{it}: Percentage of the total population in poverty for state i in year t.

HMO_{it}: Percentage of the total population enrolled in an HMO for state i in year t.

NME_t: Number of new molecular entities approved by the FDA in year t.

HPROF_{it}: Percentage of hospitals that are for-profit hospitals for state i in year t.

NHPROF_{it}: Percentage of nursing homes that are for-profit nursing homes for state i in year t

Table 2. Real Per Capita Medicaid Expenditures

Variables	Model I	Model II	Model III	Model IV
	Fixed Effects	Fixed Effects & Instrumental Variables	Fixed Effects, IV, and AR1	Fixed Effects, IV, AR1, and Trend
SCHIP_Medicaid	4.598*** (1.04)	4.555*** (1.31)	5.651*** (1.28)	5.192*** (1.25)
SCHIP_Combined	5.214*** (1.01)	3.020** (1.30)	2.875** (1.30)	2.958** (1.26)
TANF_dum	-95.915*** (21.67)	-99.781*** (21.79)	-34.983* (20.87)	-65.164*** (21.13)
TANF_Caseload	1.773*** (0.43)	1.455*** (0.44)	1.864*** (0.43)	0.713* (0.42)
AFDC_Caseload	-0.143 (0.42)	-0.373 (0.42)	-0.658 (0.42)	-0.600 (0.41)
YEAR				-0.342*** (0.07)
POP65+	58.128*** (9.32)	56.640*** (9.32)	39.464*** (6.34)	34.034*** (7.79)
SMOKE	-1.248 (1.93)	-1.743 (1.94)	-1.875 (1.68)	-2.208 (1.87)
OBESE	19.755*** (1.57)	19.866*** (1.58)	18.858*** (1.61)	18.305*** (1.57)
ALCOHOL	8.574*** (3.51)	9.921** (3.54)	13.344*** (3.54)	10.274*** (3.49)
RINCOME	26.957*** (3.41)	27.581*** (3.45)	8.574*** (2.18)	20.770*** (3.18)
URATE	16.539*** (3.24)	16.466*** (3.26)	0.449 (3.08)	8.392** (3.37)
POVRATE	5.148*** (1.59)	5.377*** (1.60)	5.105*** (1.61)	5.558*** (1.56)
HMO	1.899*** (0.60)	2.139*** (0.61)	1.830*** (0.61)	1.535** (0.60)
NMELAG2	-0.551 (0.36)	-0.701** (0.36)	-1.250*** (0.36)	-1.179*** (0.35)
HPROF	-0.779 (1.06)	-1.229 (1.08)	-2.362** (1.06)	-1.723* (1.03)
NHPROF	-0.215 (1.22)	0.086 (1.24)	-0.664 (1.00)	-1.220 (0.97)
N	680	680	630	630
Adj R-Sq	0.915	0.915	0.916	0.920

Standard errors in parentheses. *** = significant at 0.01, ** = significant at 0.05, * = significant at 0.1.

All cross-section estimates are suppressed.

“Changes in the Labour Market of Latvia Under the Influence of the Economic Crisis”

Guntars Vanags (Daugavpils University, Latvia)

In the period of economic growth the labour market markers in Latvia have been improved reaching the level of the labour market markers of the EU countries. However, the economic crisis, which has affected also the national economy of Latvia, has influenced the situation in the labour market. The fast decline of demand for goods and services promoted the closing of enterprises, and also the reduction of employees' amount in other enterprises. Measures of budget consolidation influenced the reduction of employees' amount in the state establishments. In the construction sector, in which during the period of economic growth there was a comparatively high demand for qualified and non-qualified manpower, in the result of changes in the credit market, the structure of the labour force demand and supply has rapidly changed. The above mentioned factors influenced also the changes in the labour market structure in general: the labour force supply, both qualified and non-qualified, has rapidly increased; however, under the influence of the economic crisis, the demand for the manpower could not ensure the growing supply. In the result of this the unemployment level, which started to decrease only in 2010, has soared. With the growth of the unemployment level the problem, which is connected with the manpower drain to the countries of the Europe Union, became topical.

“Estimation of the total factor productivity: comparison of the two possible approaches and different inputs”

Kristyna Vltavska (University of Economics Prague, Czech Republic)

The paper focuses on improvement of a very popular part of economic research, total factor productivity. For the standard computation of total factor productivity, hours worked and stock of capital are used. After employing the National Account Standards 2008 new inputs appeared – labour services as the labour input, capital services as the capital input. For the analysis of total factor productivity, index approach or econometric approach can be used. The econometric approach depends on the quality of the data and the amount of observations. While the index number approach does not require the long time series of observations the econometric theory needs more than ten observations of one variable. These two approaches do not compete. The use of an approach depends on the type of analysis a researcher would like to perform. The paper concentrates on the comparison of the two approaches using all types of inputs in the Czech Republic in the period between 1996 and 2008.

Keywords: capital services, econometric approach, hours worked, index number approach, total factor productivity.

Introduction

Productivity measurement is a very popular part of economic research even though the results depend very much on input variables. The most commonly used input variables are capital and labour. Capital stock is used as the capital input. The National Accounts Standard 2008 recommends using capital services as the capital input. By using this approach the capital input is presented by a flow indicator instead of stock of capital. The issue of capital services has its roots in economic theory and it means that the capital brings a profit to the user. The profit splits into the return to capital and consumption of fixed capital. On a competitive market, the return to capital should equal the return to alternative assets including financial assets (Sixta, Fischer 2009). As the labour input the European System of Accounts 1995 recommends total hours worked but some authors still use total employment. Recently, the quality of workforce was brought out. While the data of hours worked capture the time dimension, they do not reflect the skill size. That can be achieved by using labour services as the labour input though.

For measuring productivity the econometric or index number approach can be used. Production approach to productivity measurement links the theory of the firm, index number theory and national accounts. The OECD uses the index number theory for all their production measures. The growth accounting technique examines how much of an observed rate of change of an industry's output can be explained by the rate of change of combined inputs. Hence, the growth accounting approach evaluates multifactor productivity growth residually (OECD 2011, p. 18). Alternatively, an econometric approach can be used. This approach finds its base only in observations of volume outputs and inputs. It requires postulating a relationship between production elasticities and income

shares which may not correspond to reality. Therefore, testing of the relationships needs to be performed. Additional possibilities occur with econometric techniques. Allowance can be made for adjustment costs and variations in capacity utilisation. Furthermore, it is possible to investigate forms of technical change other than the Hicks-neutral formulation implied by the index number based approach; and there is no a priori requirement to assume constant returns to scale of production functions (OECD 2011, p. 19). The advantage of the econometric approach is its ability to gain information about the whole representation of the specified production technology. The econometric approach much more depends on the quality of the data and the amount of observations. While the index number approach does not need the long time series of observations, the econometric theory needs more than ten observations of one variable. This requirement is one of the disadvantages of this method. Another difficulty is worse communication to the spectrum of users of productivity statistics.

The goal of this paper is to compare the results of the index number approach and econometric approach of measuring productivity in all industries in the Czech Republic in the period between the years 1996 and 2008.

Data and Methodology

Total factor productivity as one of the suitable tools used for evaluation of economic development has its roots in neoclassic economic theory where Cobb-Douglas production function is used most commonly. The total factor productivity can be estimated in many ways. This paper focuses only on the simplest production function covering labour and capital.

Index of productivity of two factors originates from the following decomposition (Jilek, Moravová 2007):

$$Y_t = A_t F(CS_t, L_t) \quad (1)$$

$$\frac{Y_1}{Y_0} = \frac{A_1}{A_0} \left(\frac{CS_1}{CS_0} \right)^{1-\alpha} \left(\frac{L_1}{L_0} \right)^\alpha \quad (2)$$

where Y_1/Y_0 is the index of value added in constant prices of 2000,

CS_1/CS_0 is the index of capital services,

L_1/L_0 is the index of hours worked,

α is the average share of compensation of employees on value added in current prices.

For the analysis, data from the Czech Statistical Office and Department of Economic Statistics (University of Economics, Prague) are used. These data include value added in constant prices and current prices, hours worked, compensation of employees and data used for estimations of capital services.

The index number approach and econometric approach vary in their estimations of returns to scale. In index number approach (using the Cobb-Douglas production function) the returns to scale are calculated as the average share of compensation of employees on value added in current prices. In the econometric approach the calculation using the least squares method or the method of generalized least squares can be used.

This analysis is based on the productivity function and the method of generalized least squares for the return to scale estimation (Hušek 2009). The arguments for using this approach were two. Firstly, using the Cobb-Douglas production function for econometric estimation of return to scale showed the whole model as statistically insignificant. Secondly, the autocorrelation is anticipated in the data and the method of generalized least squares takes this assumption into account. The productivity function originates from the following decomposition:

$$\frac{Y_i}{L_i} = a \left(\frac{CS_i}{L_i} \right)^{1-\alpha} \quad (3)$$

where Y_i is the value added in constant prices of 2000,
 CS_i are the capital services,
 L_i are the hours worked,
 a total factor productivity,
 α return to scale.

Results

Due to the national accounts indication of the variables the results which are showed in the tables indicated gross value added as *VA* (instead of the *Y* in the formulas), labour input as *L*, capital input as *CS* and total factor productivity as *TFP* (instead of the *A* in the formulas).

Table 1: Calculation of total factor productivity using the index number approach, total growth from 1996 to 2008 (%)

	VA	L	CS	TFP
Total	46.09	-0.43	23.83	18.49
A + B Agriculture, forestry, fishing	-1.35	-24.30	14.67	13.66
C Mining and quarrying	-35.96	-30.23	4.56	-12.21
D Manufacturing	111.12	-1.60	38.78	54.60
E Electricity, gas and water supply	-14.52	-9.00	14.54	-17.99
F Construction	-24.02	-2.60	53.77	-49.27
G Wholesale and retail trade; repairs	154.63	-1.00	57.06	63.77
H Hotels and restaurants	-54.49	7.82	14.69	-63.20
I Transport, storage and communication	39.73	0.89	47.08	-5.84
J Financial intermediation	66.77	-0.02	37.31	21.48
K Real estate, renting and business activities	45.47	13.01	22.66	4.94
L Public administration and defence	12.19	-0.20	-0.70	13.21
M Education	33.00	2.75	-4.18	35.09
N Health and social work	-32.84	1.27	13.94	-41.80
O Other community, social and personal service activities	6.36	10.64	51.12	-36.39

Note: VA – change in value added in %, L – contribution of change in hours worked to change in VA, CS – contribution of change in net capital services to change in VA, TFP – total factor productivity growth in %

Source: Czech Statistical Office, computations of authors

In the period between 1996 and 2008 gross value added of the whole Czech economy grew by 46.09 % (see table 1). The main proportion of this was caused by CS (23.83 %) and TFP (18.49 %). Hours worked represent a much lower influence with – 0.43 %. The largest increase of gross value added was achieved in industry G – Wholesale and retail trade with 154.63 %. This growth was reached by development among the industries during the period between 1996 and 2008. The deepest decrease of gross value added was recorded in industry H – Hotels and restaurants. The gross value added declined by 54.49 %. The main proportion of this was constituted by total factor productivity (- 63.20 %).

Besides quantification, verification is also an integral part of econometric approach. The verification is composed of three parts: economic, statistical and econometric. In case of economic verification the value of return to scale the interval between 0 and 1 is required. Statistical verification stands for the evaluation of the parameters and model. Econometric verification means testing the conditions which are necessary for application of econometric methods (e.g. autocorrelation and heteroscedasticity).

In this paper, the estimations of return to scale of all industries were carried out. Only in the whole economy and industry O – Other community, social and personal service activities, the statistical and economic verifications were successful. The rest of the industries recorded their return to scale outside the interval required or the t-statistics failed.

Table 2: Calculation of total factor productivity using the econometric approach, total growth from 1996 to 2008 (%)

	VA	L	CS	TFP
Total	46.09	-0.63	13.01	30.09
O Other community, social and personal service activities	6.36	6.30	71.00	-41.49

Note: VA – change in value added in %, L – contribution of change in hours worked to change in VA, CS – contribution of change in net capital services to change in VA, TFP – total factor productivity growth in %
 Source: Czech Statistical Office, computations of authors

Gross value added of the whole Czech economy grew by 46.09 % in the period between 1996 and 2008 (see table 2). Using the econometric approach, the main proportion of the development of the value added was constituted by *TFP* (30.09 %). The capital services and hours worked represented a much lower influence with 13.01 % and - 0.63 % respectively. Gross value added of the industry O – Other community, social and personal service activities grew by 6.36 in the period in question. The main proportion of the development was constituted by capital services (71.00 %).

Comparing the results of the index number approach and the econometric approach, the differences emerge. In case of the index number approach, the main proportion of the development of the gross value added of the whole Czech economy was represented by capital services. Using the econometric approach, the main proportion of the development of the gross value added was constituted by total factor productivity.

Conclusion

Measuring productivity from different points of views is necessary for future economic research in this field of studies. The OECD manual called *Measuring productivity* popularises research of total factor productivity measurement. However, the nature of total factor productivity measurement is not fully determined so far. Firstly, there is the problem based on the input variables used (labour services instead of hours worked, capital services instead of fixed assets). On the other hand, using two different approaches for measuring productivity leads to different results, too.

In this paper, the index approach and the econometric approach for measuring productivity were compared. There is no reason to view these two approaches as competitors. Using one of them is the choice of the researcher who knows the pros and cons of both approaches.

The results from the comparison are quite different which arises from the theoretical background. The econometric approach is sensitive to the quality of the dataset. In the time of economic recession the results based on the econometric approach were significantly different from the results based on the index approach.

Recently the discussion about constant returns to scale - which is the condition of using Cobb-Douglas production function in the index number approach - appears. There is no doubt that the requirement of constant returns to scale is indefensible. This assumption leads us to using the econometric approach more often than the index number approach, especially using translog (transcendental logarithmic) production function which is a generalization of Cobb-Douglas production function. However, this will be part of future studies.

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“To the usage of Europe 2020 indicators at international statistical comparison: composite indicator approach”

Lenka Hudrlikova (University of Economics Prague, Czech Republic)

Europe 2020 is a set of indicators used by the European Commission to monitor five headline targets of strategy for the next decade – Strategy for smart, sustainable and inclusive growth. Europe 2020 can be used for policymaking. There are eight headline indicators. How to deal with an issue of many indicators at international comparison? We use a composite indicator approach. A comprehensive indicator allows us a synthetic analysis and comparison between countries. This paper is driven by perspectives of creating one composite indicator Europe 2020. Constructing of a composite indicator is a very difficult process with several steps based on good economic framework and statistical principles. First of all, we have to select sub-indicators. There are several statistical requirement and assumptions which data should fulfil. The important features of composite indicators relate to the normalisation methodology used, and the weights used for aggregation.

The aim of the paper is to make analysis of variables included to Europe 2020 from the point of perspective of creating composite indicator. The analysis is based on multivariate statistical methods such as cluster analysis and principal components analysis. By using selected methods, there is constructed an example of composite indicators where we use Europe 2020 indicators as sub- indicators. The comparison of European countries by using this composite indicator is included.

Key words: composite indicators, weighting scheme, indicators Europe 2020, international comparison

1. Introduction

European Commission formulates Strategy for smart, sustainable and inclusive growth for EU Member States. Key parameters on which Commission would like to see the European countries by 2020 are:

„The employment rate of the population aged 20-64 should increase from the current 69% to at least 75%, including through the greater involvement of women, older workers and the better integration of migrants in the work force;

The EU currently has a target of investing 3% of GDP in R&D. The target has succeeded in focusing attention on the need for both the public and private sectors to invest in R&D but it focuses on input rather than impact. There is a clear need to improve the conditions for private R&D in the EU and many of the measures proposed in this strategy will do this. It is also clear that by looking at R&D and innovation together we would get a broader range of expenditure which would be more relevant for business operations and for productivity drivers. The Commission R&D and innovation intensity;

Reduce greenhouse gas emissions by at least 20% compared to 1990 levels or by 30%, if the conditions² are right; increase the share of renewable energy sources in our final energy consumption to 20%; and a 20% increase in energy efficiency;

A target on educational attainment which tackles the problem of early school leavers by reducing the drop out rate to 10% from the current 15%, whilst increasing the share of the population aged 30-34 having completed tertiary education from 31% to at least 40% in 2020;

The number of Europeans living below the national poverty lines should be reduced by 25%, lifting over 20 million people out of poverty."

COMMUNICATION FROM THE COMMISSION

EUROPE 2020: A strategy for smart, sustainable and inclusive growth (Brussels. 3.3.2010)

These targets must be measurable and comparable. Eurostat provides set of headline indicators monitoring the targets.

- Employment rate by gender, age group 20-64 (EMP)
- Gross domestic expenditure on R&D (GERD)
- Greenhouse gas emissions, base year 1990 (GH)
- Share of renewables in gross final energy consumption (RE)
- Energy intensity of the economy (EN)
- Early leavers from education and training (EL)
- Tertiary educational attainment by gender, age group 30-34 (TE)
- Population at risk of poverty or exclusion (POV)

They are interrelated and relevant to all Member States despite disparities in levels of development and standards of living. International comparison is desirable. Composite indicators approach is the way to avoid comparisons by means of multiple indicators. The composite indicator could represent an overall view of the all set of indicators. Composite indicators became more and more popular every year. According to (Saltelli 2011) in October 2005 there were 992 times searching "composite indicators" only on Scholar Google, 1900 times in May 2007, 4 420 times in September 2009 and 5 900 times in May 2011. It clearly shows the expansion and development of this issue.

Composite indicator (CI) by definition of OECD glossary is formed when individual indicators are compiled into a single index, on the basis of an underlying model of the multidimensional concept that is being measured. In paper individual indicators are meant eight indicators Europe 2020 and aggregated single index is used for comparison of country performance.

CIs are very discussed because of the involvement subjective judgement. There are some pros but also cons about CIs. List of them could be found in (OECD 2008). Just to mentioned some of them.

- CIs could provide complex view on multi-dimensional policy domain of interest.
- CIs facilitate the task of ranking countries on complex issues.
- CIs can help attracting public interest.

On the other hand, there are several drawbacks of CIs.

- CIs could be easily misinterpreted if they are nontransparent
- CIs may tempt to simplistic conclusions

- CIs are data demanding because data are required for all the sub-indicators and for a statistically significant analysis.

2. Data and Methodology

Data are provided by Eurostat. The set of data is not completed for 2009 and following years. More missing values generate more difficulties. Due to this fact analysis is based on data from 2008. There is only one missing value of indicator Gross domestic expenditure on R&D (GERD) in Greece. It was misplaced by value of the previous year. To choose the most suited imputation method depends on the type of analysis. The simplest method is case deletion – remove either country or indicator from the analysis. This method could not be used in comparing all EU member countries. Other methods are discussed in (OECD 2008).

The goal of data transformation could be adjusted for different ranges, different variances and outliers. There are wide scale of normalisation methods such as ranking, standardization (or Z-scores), re-scaling, distance to reference country, logarithmic transformation, categorical scales, cyclical indicators, balance of opinions. More about pros and cons of these techniques could be found in (Nardo et al. 2005). There is used min-max method because in the analysis we need data in scale 0-1. This method is the most suitable for selected methods of weighting and aggregation. Raw data contain not only different scales but also different direction. Indicators with original positive direction are normalised using (1).

$$I_c^t = \frac{x_{qc}^t - \min_c(x_q^{t_0})}{\max_c(x_{qc}^t) - \min_c(x_q^{t_0})} \quad (1)$$

Indeed, indicators with negative direction (higher values worse performance and vice versa) are normalised according to (2):

$$I_c^t = \frac{\max_c(x_q^{t_0}) - x_{qc}^t}{\max_c(x_{qc}^t) - \min_c(x_q^{t_0})} \quad (2)$$

Where x_{qc} is the value of the indicator q for country c at time t . After using min-max method, data are in range from 0 to 1 and have same positive direction (higher value better performance).

2.1. Multivariate Analysis

Multivariate analysis is be used for check the internal consistency. This part in creating is very important because of starting point for choosing weighting and aggregation method.

Cluster Analysis (CA)

Cluster analysis help discover structures in data. Detailed descriptions of cluster analysis can be found in number of sources about multivariate analysis (Everitt, et al. 2011) or (Statsoft 2011), associated to CIs (Nardo et al. 2005). The main idea of hierarchical clustering is grouping objects into respective categories by algorithm. At the first step, each object represents its own cluster, the distances between those objects are defined by the chosen distance measure (here Euclidean distance). There are numerous of linkage rules. Next there are provides results for method called single linkage or nearest neighbour. It means the distance between two clusters is determined by the distance of the two closest objects (nearest neighbours) in the different clusters. This rule will put objects together to form clusters, and the resulting clusters tend to represent chains.

Principal Component Analysis (PCA)

PCA is a multivariate exploratory analysis. The idea under PCA is to account for the highest possible proportion of the overall variation in the indicator set using the smallest possible number of factors. Original correlated set of variables (indicators) is changed into a new set of uncorrelated variables. Thus these new variables are linear combination of the original ones. After descending them according to the amount of explained overall variance, there are only few factors (principal component) accounts for the large enough portion of the variance. The indicator no longer depends upon the dimensionality of the original dataset but rather on the “statistical” dimensions of the data. More about PCA could be found in several sources e.g. (Manly 1994). Using PCA as a tool in constructing of CI is explained covered in (OECD 2008).

2.2. Weighting and aggregation

Choice of weighting and aggregation method could affect the results. These methods are the most discussed by opponents of CIs. We can divide methods of weighing to the main classes (OECD 2008): statistical approaches and participatory approaches or alternatively (Decanq and Lugo 2010) data-driven, normative and hybrid.

Paper discusses only methods based on statistical methods. Other methods are based on opinion e.g. experts, stakeholders, policymakers or public. For Europe 2020 Indicators there is no available such results for participatory methods.

Equal weighting (EW)

Equal weighting is the simplest method. The main advantage of this method is its transparency and soundness. It means all sub-indicators q ($q=1, \dots, Q$) are given the same weight w_q for all countries c ($c=1, \dots, M$).

$$w_q = 1/Q \quad (3)$$

There is risk that dimension with more indicators will have higher influence in the CI. It is case of Indicators Europe 2020 because there are 8 indicators, 5 targets and only 3 type of strategy (smart, sustainable and

inclusive growth). According to (Saisana 2011) non-equal weighting scheme may be useful when there are few indicators (3-10) and bivariate correlations are moderate to low (<.50).

Principal components analysis (PCA)

After using PCA as an explanatory analysis there is that useful using PCA as a weighting method.

The base of using PCA as weighting method is taking into account the correlation.

Benefit of Doubt approach (BOD)

BOD is a method based on Data envelope analysis (DEA) which is used mainly at production issues and evaluation macroeconomic performance. Using BOD, the composite indicator is defined as the ratio of a country's actual performance to its benchmark performance. There is not one weighting scheme for all countries. For each country, they are used its own weights which are optimal for this country. It guarantees the best position because of maximisation of the overall performance. With any other weighting profile, the relative position of that country would be worse. Optimal weights are obtained by solving the following maximisation problem for each country:

$$CI_c^* = \max \sum_{q=1}^Q I_{qc} w_q$$

(4)

Subject to

$$\sum_{q=1}^Q I_{qc} w_q \leq 1$$

$$w_q \geq 0$$

$$\forall k = 1, \dots, M; \forall q = 1, \dots, Q$$

where I_{qc} is indicator q ($q=1, Q$) for country c ($c=1, M$). And w_q weight for the country. This is problem of linear programming to choose weights that maximize the composite indicator value CIs. The only restriction is their non-negativity. As a result, we obtain value of CI between 0 and 1, the higher values the better performance in relative terms. The advantage of BOD is that normalization is redundant, as well as aggregation (see formula (4)). Nevertheless, the main disadvantage of this method is that without setup of constraints (min-max portion of each sub-indicator in CI) the weight could be given only by an indicator in which the country is the best. Setting constraints for each indicator is advantageous if there are some results from participatory approach (hybrid method). In case indicator Europe 2020 there is no additional information. More over BOD de facto DEA approach in constructing CIs could be found in (Cherchye et al. 2006, Cherchye et al. 2009).

2.3. Methods of aggregation

Linear aggregation is the most widespread method.

$$CI_c = \sum_{q=1}^Q I_{qc} \cdot w_q$$

(5)

Subject to

$$\sum_q w_q = 1 \text{ and } 0 \leq w_q \leq 1.$$

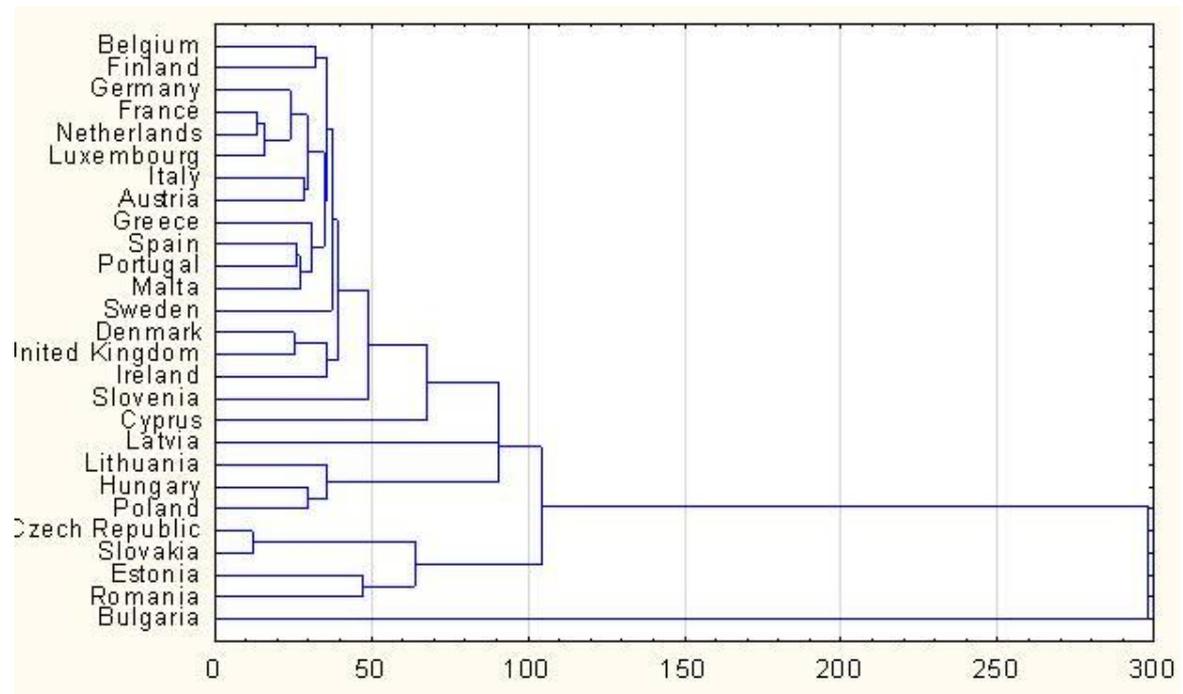
where I_{qc} is normalized indicator q ($q=1, \dots, Q$) for country c ($c=1, \dots, M$) and w_q respective weight. The drawback of this method is full compensability among indicators. The lack in one dimension (indicator) could be compensated by a plenty in another one. There could be used non-compensatory approach multicriteria approach which is based on the Condorcet theorem. But there is computational problem in using this method. In this case the number of countries is high because for comparing 27 countries, we need 27! permutations. It is unmanageable. For mentioned reason we use only linear aggregation which is the most used in practice. The problem of compensability could be weakened by weighting scheme.

3. Results

3.1. Cluster Analysis

Cluster analysis is method to classify objects, in this case EU Member States. Figure 1. shows the results for method single linkage also labelled like nearest neighbour method. This rule govern the distance between two clusters is determined by the distance between two closest elements in different clusters. This rule produces clusters chained by single objects. Results of cluster analysis are usually represented by a hierarchic tree or a dendrogram (see Figure 1.).

Figure 1. Dendrogram using Single Linkage



The primer EU members - known under the name of the EU-15 and Malta tend to clustering together. In the lower part of the dendrogram are the newest members of the EU who tend to another cluster. Hypothesis is that countries from the same cluster should be ranks alike.

3.2. Principal Component Analysis (PCA)

Principal component analysis should work on significantly correlated indicators, because the weights are set in accordance to correlation between indicators. Simply said two highly correlated indicators will be given higher weight and vice versa. We can see a correlation matrix in table 1.

Table 1. Correlation Matrix of Europe 2020 Indicators

	EMP	GERD	GH	RE	EN	LE	TE	POV
EMP	1	0.566**	-0.076	0.491**	-0.183	-0.313	0.521**	-0.380
GERD		1	-0.001	0.520**	-0.490**	-0.175	0.432*	-0.604**
GH			1	-0.242	-0.549**	0.440*	0.251	-0.308
RE				1	0.005	-0.072	0.026	0.008
EN					1	-0.215	-0.432*	0.634**
LE						1	-0.153	0.116
TE							1	-0.371
POV								1

Note: * (**) Correlation is significant at the level 0.05 (0.01), 2-tailed

Correlation coefficients between indicators are moderate or low. Correlation structure does not entirely fulfill the assumption of using PCA. Testing whether PCA could be applied is presented in table 2.

Table 2. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.608
Bartlett's Test of Sphericity	Approx. Chi-Square	85.158
	df	28
	Sig.	0.000

Value of Kaiser-Meyer-Olkin (KMO) test should be between 0.6 and 1.0 and Bartlett's test of sphericity for uncorrelated indicators should reject null hypothesis. It implies PCA could be applied in this case. Assumptions in PCA are mentioned in (Nardo et al. 2005, 24-25).

Setup of weights using PCA is based on eigenvalues and then from the optimal numbers of components. Using Kaiser Criterion that suggest select all components which are associated to an eigenvalues higher than one, it corresponds to three components (factors). Table 2 shows eigenvalues, factor loadings for 3 principal components, squared factor loadings and rescaled weights. Weights are normalized by squared factor loading, which is the portion of the variance of the factor explained by the variable.

Table 3. Eigenvalues, factor loadings based on principal components, squared factor loading; re-scaled weights

	Factor loadings			Squared factor loading (scaled to unity sum)			Weights (rescaled) %
	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2	Factor 3	
EMP	0.714	0.456	0.012	0.167	0.103	0.000	11.70
GERD	0.844	0.241	0.198	0.233	0.029	0.037	13.19
GH	0.290	-0.816	0.078	0.027	0.328	0.006	12.31
RE	0.359	0.578	0.674	0.042	0.165	0.430	14.94
EN	-0.712	0.540	-0.063	0.166	0.144	0.004	13.05
EL	-0.152	-0.647	0.635	0.008	0.206	0.382	13.77
TE	0.699	-0.063	-0.326	0.160	0.002	0.101	9.75
POV	-0.776	0.221	0.207	0.197	0.024	0.041	11.30
Eigenvalues	3.057	2.029	1.056				6.142

3.3. Weighting scheme

The methods based on opinions of researchers is do not consider at this paper, only the methods based on statistical methods are compared. Three types of weighting scheme are chosen and compared – equal weighting (EW), principal component analysis (PCA) and benefit of the doubt analysis (BOD). There is no general consensus on using one of weighting scheme. The most common is equal weighting due to simplicity and transparency. When there is no clear idea on what method used, it is possible prefer simplicity. In case of indicators Europe 2020 there are eight indicators. According to (2) weight on each single indicator for each country equals 12.5 % (to sum up 100%). Weights derived from PCA also in table 3 as well as results for several step in PCA method. Weights by EW, PCA and BOD are compared in table 4. However weights by BOD are

country specific. It is one of the advantages of BOD driven weights that they could not be seen as unfair for some country. Any other weights would have produced lower scores of CI.

Weights for the Europe 2020 indicators based on different methods

		EMP	GERD	GH	RE	EN	EL	TE	POV
EW		12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50
PCA		11.70	13.19	12.31	14.94	13.05	13.77	9.75	11.30
B O D	Belgium	11.48	12.82	11.48	12.82	18.56	1.93	24.07	21.67
	Germany	18.21	17.14	18.21	17.14	19.43	5.04	23.60	19.88
	France	13.39	12.93	13.39	12.93	16.93	6.17	23.29	19.98
	Italy	16.24	16.75	16.24	16.75	26.22	8.49	38.13	28.63
	Luxembourg	12.17	8.82	12.17	8.82	17.64	1.15	25.05	19.94
	Netherlands	20.42	8.92	20.42	8.92	14.15	1.49	20.15	17.72
	Denmark	18.96	7.81	18.96	7.81	13.13	0.86	18.65	16.51
	Ireland	16.32	8.22	16.32	8.22	12.49	2.15	26.23	21.33
	United Kingdom	16.78	8.47	16.78	8.47	12.95	2.17	26.83	21.72
	Greece	21.39	9.11	21.39	9.11	19.26	4.51	39.01	31.06
	Spain	17.74	11.57	17.74	11.57	14.17	9.75	37.40	7.69
	Portugal	29.42	14.65	29.42	14.65	18.47	23.29	40.38	3.65
	Austria	28.05	25.46	28.05	25.46	20.76	23.91	6.55	31.59
	Finland	13.74	17.52	13.74	17.52	11.04	12.01	15.09	14.98
	Sweden	14.95	14.86	14.95	14.86	10.56	14.95	14.07	11.70
	Czech Republic	18.69	9.52	18.69	9.52	24.30	4.74	14.30	29.39
	Estonia	23.82	7.47	23.82	7.47	27.35	12.12	11.63	20.63
	Cyprus	23.10	0.00	23.10	0.00	0.00	2.50	24.43	20.85
	Latvia	23.31	1.71	23.31	1.71	29.74	19.98	22.21	20.30
	Lithuania	16.83	3.20	16.83	3.20	26.95	9.49	16.97	25.77
	Hungary	6.31	8.44	6.31	8.44	38.17	6.96	29.92	38.31
	Malta	0.00	2.73	0.00	2.73	19.99	0.00	53.93	0.00
	Poland	2.41	3.21	21.33	18.55	38.92	17.58	30.54	31.36
	Slovenia	18.03	10.30	18.03	10.30	14.54	9.31	22.40	27.54
	Slovakia	13.92	2.87	21.06	18.50	38.23	17.41	29.90	30.39
	Bulgaria	18.08	3.01	31.24	0.87	50.38	11.94	0.00	40.38
	Romania	15.00	2.92	26.06	18.67	47.62	19.45	35.25	41.03

3.4 Ranks of countries

There are compared results for three scenarios. Used weighting schemes are different. Scenarios with equal weights and weights derived from PCA give same weight for each country and linear aggregation is used (5). Whereas, BOD approach assign the best weights for each country. The BOD weights based value of composite indicators for each country is maximized, so there could be several of them equal one. The aggregation method is connected to weighting method (4). As a result, it is not valid ranking when comparing country with different weights. Note that to sum up weights they don't have to be equal one. This problem could be tackle with cross efficiency approach. Cross efficiency compares every country with all other countries, applying the weights of the others (Hollingsworth and Wildman 2002). Thus the matrix of cross efficiencies is formed, dimension 27 x 27. Rows represent rating countries, columns are rated countries. Cross efficient score would be expected lower than the original scores. Because country cannot have higher score than original BOD-derived score. It is the highest score which can country obtain. Cross efficiency helps with aforementioned problem of BOD approach

without constraints. If one country is strong only in single indicator, BOD gives the most of weight on this indicator and the rest is given almost zero weights. Cross-efficiency used weights of all other countries as well. Comparison of country via cross-efficiency average (median) is made.

Table 4. EU countries ranks by different weighting and aggregation methods

	EW LIN	PCA LIN	Cross-efficiency DEA (average)	Cross-efficiency DEA (median)	Maximum difference in rank
Sweden	1	1	1	1	0
Finland	2	2	3	3	1
Denmark	3	3	2	2	1
Netherlands	4	5	4	4	1
Austria	5	4	7	6	3
France	6	7	5	5	2
Germany	7	6	6	7	1
United Kingdom	8	9	8	9	1
Slovenia	9	8	10	12	4
Estonia	10	10	14	13	4
Ireland	11	13	11	10	3
Belgium	12	12	12	11	1
Luxembourg	13	14	9	8	6
Latvia	14	11	13	14	3
Lithuania	15	15	15	15	0
Czech Republic	16	16	16	16	0
Cyprus	17	17	17	17	0
Spain	18	20	20	21	3
Poland	19	19	19	19	0
Slovakia	20	18	18	18	2
Portugal	21	21	24	24	3
Greece	22	22	21	20	2
Italy	23	23	22	23	1
Hungary	24	24	23	22	2
Romania	25	25	25	25	0
Bulgaria	26	26	26	27	1
Malta	27	27	27	26	1

Cross efficiency could be understood as a part of robustness analysis. Results could be considered stable. Last column shows there are six countries ranked on the same position according to different scenarios. Note that Sweden ranks first with all used methods. The most relevant shift is only in case of Luxembourg (see table 5). It shifted 6 positions. Supposing Luxembourg is an outlier which could influence result by some of the methods.

4. Conclusion

Composite indicator approach in international comparison brings new technique generally used for other issue. Composite cannot be fully objective. Different method is suitable for different empirical case. And there is no only one clearly correct method of creating CI. Conclusion based on composite indicator approach could be easily misinterpreted. Soundness and transparency are very important. Author of every CI should reveal which tools were used and all methodological principles. As well as construction of CI is underlying post analysis such as robustness of CI and trend analysis. De-constructing CI can also help extend the analysis.

Paper included comparison of three weighting scheme. Each of them has some assumptions, pros and cons. In the case of indicators Europe 2020, equal weighting can not face the problem that there are eight indicators but they represent less targets of EU policy. PCA has assumption which seems not completely fulfilled. BOD approach has problem with setting constraints called pie share constraints. However, setting constraints could change the character of the method from an objective to a subjective one. Strengths and drawbacks of CIs have been indicated in the first part of the paper. Nevertheless CIs can provide what set of indicators cannot - embracing large view on complex issue. In this case it is policy domain Strategy indicators Europe 2020 that should measured the goals of a strategy for smart, sustainable and inclusive growth.

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“An Evaluation of the Credibility and its Related Attributes of the Hungarian Inflation Targeting Regime (2001-2009)”

Szikszai Szabolcs (University of Pannonia, Hungary)

In this paper, we present the findings of our empirical research on the evolution of the credibility of the Hungarian IT regime from its first decision in July 2001 to April 2009. We assess the credibility of the National Bank of Hungary (MNB) using methodology already successfully implemented by other authors who evaluated the evolving credibility of other central banks. The measurement method provides a dynamic assessment of the evolving market perception of credibility of the Hungarian IT regime as perceived by market participants and as reflected in market prices of financial assets. In our specification, we regress the very short-term changes in the term spread of government bond yields – as well as changes in the exchange rate – on the surprise component of inflation announcements, where the time-varying coefficient of the surprise component of CPI announcements is interpreted as a degree of inflation-aversion, or, credibility. We use the Elliot-Müller test to check for the time persistence and the Müller-Petalas procedure to track the time path of the credibility measure. Our findings show that the perceived credibility of the Hungarian IT regime was unstable and appears to have improved in the investigated period.

Introduction

Since price stability became the primary objective of monetary policy authorities around the world, inflation targeting has been the most widely acclaimed central banking technique. No country that has ever introduced an IT regime abandoned it later. Blinder (2006) points out that countries which desire disinflation are more likely to introduce inflation targeting but its advantages for any type of economy are clear. In a wide cross-country panel study, Mishkin and Schmidt-Hebbel (2007) show that inflation targeting helps keep inflation low in the long run, improves the efficiency of monetary policy and strengthens central bank independence in various types of economies ranging from large industrial economies such as Germany, Canada or the United Kingdom to emerging economies such as Brazil, Turkey or Korea. However, their analysis also concludes that the monetary policy performance of industrial-country inflation targeters dominates that of emerging countries. That is, inflation targeting has so far been more successfully adopted by industrial economies than by emerging ones.

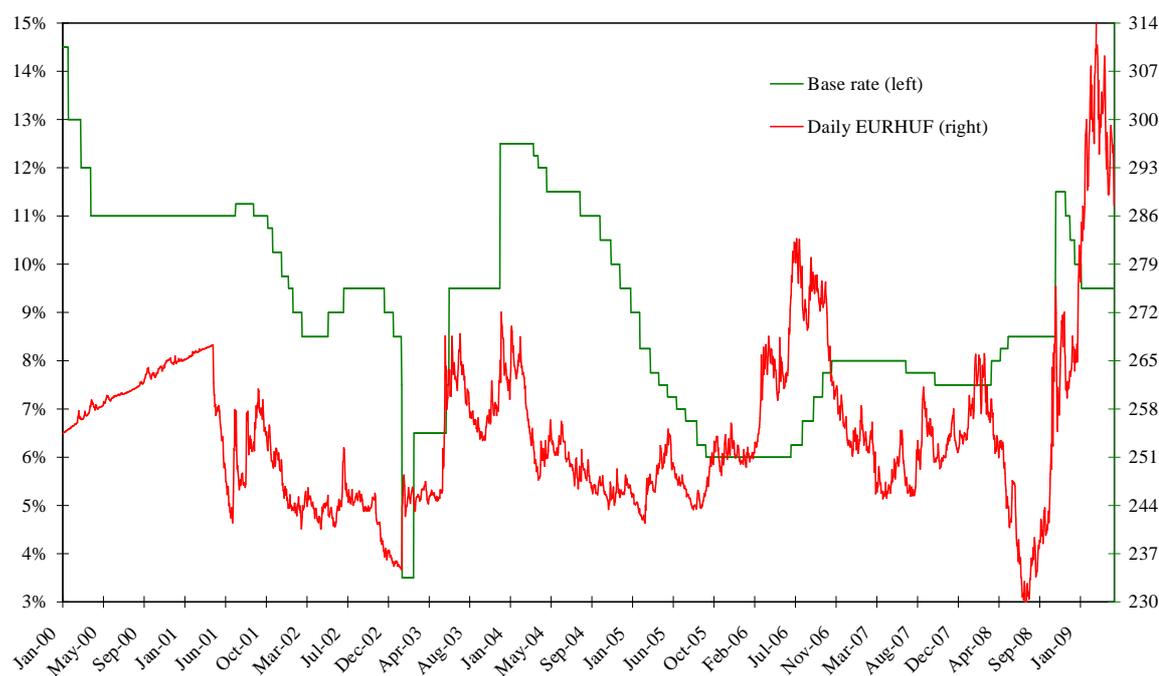
The most important, but also the most tedious and, sometimes, painful task for a central bank switching to a new regime, such as inflation targeting, is to establish a strong perception of the new regime’s credibility amongst financial investors. In the case of inflation targeting, this perceived credibility comes from the perceived anti-inflationary stance of the central bank. The more financial investors think the central bank is inflation-averse, the more they perceive the regime as a credible one. As it was demonstrated in earlier historical examples – the most recent, and peculiar, example of that time was the establishment of the European Central Bank (ECB), a brand new institution –, the need to establish and maintain a strong feeling of an inflation-averse authority

amongst financial investors is of key importance for any central bank to operate a successful inflation targeting regime (see the case of the ECB in Goldberg and Klein, 2005).

The Monetary Council (MC) of the National Bank of Hungary (MNB) decided to introduce inflation targeting in June 2001, after the government and the central bank decided to widen the floatation band of the euro-forint exchange rate to create more maneuvering room for interest rate decisions. The new nominal anchor, which replaced the nominal exchange-rate peg, was a converging target set together by the MNB and the government, but to be attained and maintained by the MNB alone. At the same time, new legislation gave the central bank independence in making monetary policy decisions. It was a brand new historical situation for monetary policymakers, who had to prove to the financial market that the new regime is up and reliably working and is one that they can base their investment decisions on. Hungarian central bankers had to establish a new relationship with market participants from the scratch, one based on trust and credibility. Thus, the credibility of monetary policy has become a vital and delicate issue in Hungary, just like in other parts of the world where an inflation targeting regime is in place.

Seemingly, the success of the new inflation targeting regime in Hungary was warranted by the new independent status of the so far politicized monetary branch of economic policymaking. But the Hungarian case was a bit more complicated than the international average as the currency exchange rate band was left intact after the introduction of the IT regime. This added to the uncertainty surrounding monetary policymaking and made MNB's task of establishing credibility even more difficult than it could otherwise have been. Given the potential contradiction of the two monetary policy objectives – the legal obligations to meet the inflation target and keep the euro-forint exchange rate within a $\pm 15\%$ floatation band around the parity rate –, the MNB had to establish the credibility of its inflation targeting regime and maintain the credibility of the floatation band of the euro-forint exchange rate at the same time. As it eventually turned out, the MNB could not successfully grapple with the dual nature of the Hungarian monetary policy framework. The inherent contradiction between the IT regime and the exchange rate band played out badly in financial markets (see *Figure 1*). Financial investors were aware that raising the policy rate to bring inflation down strengthened the forint against the euro and, thus, threatened to push the exchange rate out of the floatation band.

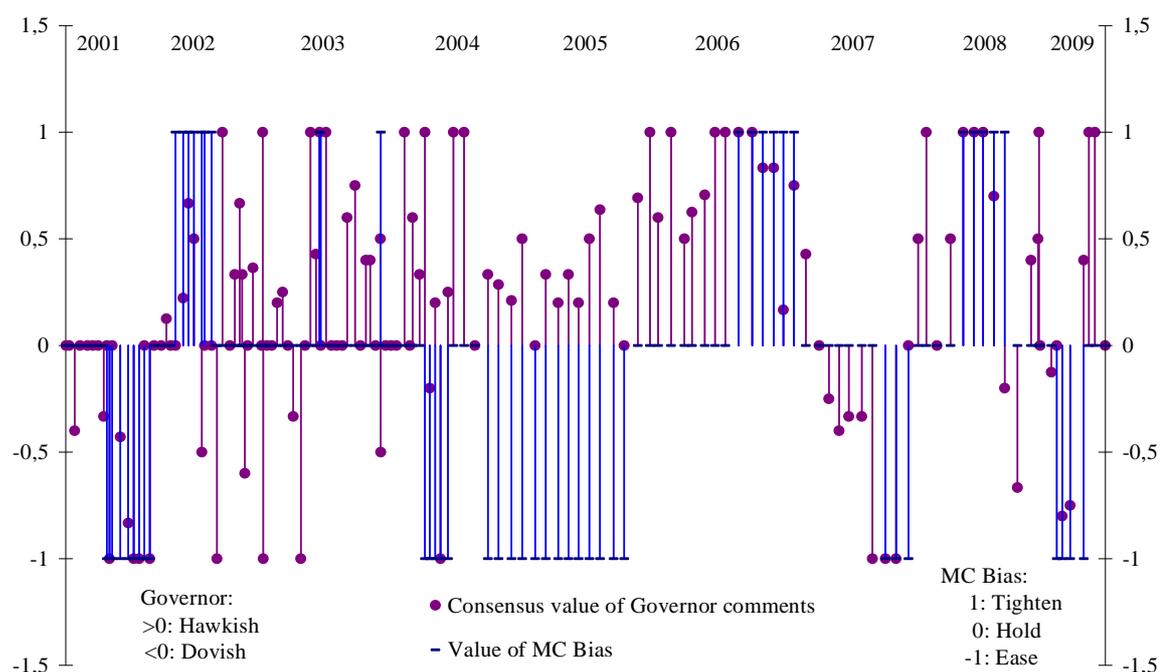
Figure 1 MNB base rate and the EURHUF exchange rate



Source: www.mnb.hu.

Eventually, the inevitable clash of these potentially contradictory monetary policy tasks jeopardized the credibility of MNB's IT regime. Press evidence (see Nyíri, 2003 or *The Economist*, 2004, amongst others) supports the view that the market perception of the credibility of MNB's IT regime suffered a decisive blow in the turbulent sub period between October 2002 and November 2003, when the central bank was continually faced with the dilemma to decide between acting in the logic of the IT regime and acting to keep the euro-forint exchange rate within the floatation band. When, due to speculative pressure, the exchange rate reached the strong limit of the band, the MNB decided that maintaining the band was more important. But, later, it decided with the government to shift the parity of the band in the weaker direction, which, then, forced it to put aside the IT logic again to defend the exchange rate of the forint. Logically, such a chain of events should go against the credibility of any IT regime. Rozkrut et al. (2007) claim that the MNB could not recover the substantial loss of credibility suffered in this turbulent sub period (Rozkrut et al., 2007, p. 194). They also show that the consistency of central bank communication was low in a large part of the period (see *Figure 2*), which might also have affected the market perception of MNB's credibility. Apart from that, the conspicuous lack of coordination between fiscal and monetary policy-makers – an example of which is presented in Madár (2003) – contributed a great deal to MNB's missing the inflation target in the majority of the cases and further questioned MNB's commitment to the inflation target in the eyes of the investors.

Figure 2 Communication on future policy by MNB MC and Governor comments



Source: own calculations based on data from www.mnb.hu and own press collection.

The purpose of the paper is to give a statistical account of the evolution of the financial market perception of the credibility of MNB's monetary policy in the period between June 2001 and April 2009. The paper applies the approximation method to assess the credibility of MNB's monetary policy. It starts from the general concept of monetary policy success and follows with a study of the measures of monetary policy credibility. The methodology relies heavily on advanced statistical and econometric methods. Finally, the conclusions are drawn based on the presented evidence.

Key components of monetary policy success

Credibility

The market perception of a central bank's credibility is a key component of success because it is the most important asset the central bank has in its mission of realizing its monetary policy strategy. As the Hungarian monetary policy authority operates an IT regime as part of its monetary policy strategy, the most relevant question in our case is how credibility can contribute to a strategy of reaching the inflation target. According to Mishkin (2004), for an inflation targeting regime to be successful in an emerging economy – i.e. to achieve its inflation target –, it needs to be more than the simple announcement of a medium-term inflation target. Mishkin (2004) says that the strategy of an inflation targeting central bank also needs to be information inclusive, transparent and supported by good communication, with policy-makers held accountable for the success of their

policy actions. All this is what, Mishkin (2004) says, it takes to make inflation targeting succeed in reducing inflation in emerging economies.

In fact, all of the points mentioned by Mishkin (2004) above have to do with the drive on the central bank's part to establish credibility of its actions among the investors in financial markets. This is because, if an IT regime is thought to be credible, expectations of the inflation rate become well-anchored to the target and fewer and more gradual policy moves are required to reach this target (Amisano and Tronzano, 2005). In this context, market perceptions of the inflation aversion of an inflation targeting central bank play a crucial role in making IT operate more effectively. As Blinder (1999) points out, a more credible central bank can engineer disinflation with a lower level of employment sacrifice as changes in the key monetary policy instrument will cause smaller GDP/employment gap volatility.

In his study based on a survey among central bankers and economists, Blinder (1999) shows that central bankers mostly identify credibility with "dedication to price stability" (Blinder, 1999, p. 5). An important, and difficult, issue is to measure this dedication. Obviously, when an inflation targeting regime is successful in keeping inflation low, it becomes credible. In other words, a central bank becomes credible when it matches its words with its deeds, i.e. if it says that it will and, indeed, does bring inflation down. But this is a simple, ex post assessment of credibility, based on the track record of the inflation-targeting central bank. A more dynamic assessment of credibility, suited to real-life circumstances, comes from the measure of perceived, ex ante credibility as seen by investors in financial markets. In this context, an inflation targeting central bank, dedicated to price stability, is said to be credible when the perception of its pre-commitment to disinflation or, in other words, its aversion to inflation as perceived by investors and implied by market prices of financial assets is high.

Even more importantly, this market perception of credibility dynamically evolves with time, as stressed by both Amisano and Tronzano (2005) and Goldberg and Klein (2005). Economic agents continually adjust their perception of credibility of the monetary policy based on matching the deeds and the communication of the central bank with their earlier expectations based on the logic of the announced monetary policy regime. When a decision of the central bank is perceived to have been in contradiction with the policy framework or with previous communication, the market perception of credibility suffers. Vice versa, when the central bank seems to have decided in consistency with the policy framework and its earlier communication, the market perception of credibility improves. This perception of credibility then becomes an important exogenous factor in monetary policy decision-making: after economic agents obtain a certain perception of the inflation aversion of a central bank, this perception of credibility then feeds back into monetary policy actions and increases (when credibility is high) or decreases (when credibility is low) their effectiveness.

Predictability

After Mishkin (2004), transparency is an important element of a credible inflation targeting regime, and this can generally be said of any kind of monetary policy regime. Eijffinger and Hoeberichts (2000) think that transparency makes it “easier to make a judgement and to hold central bank officials accountable for their behaviour” (Eijffinger and Hoeberichts, 2000, p. 2). They stipulate transparency as one of the pillars of the democratic accountability of a central bank, besides the existence of a clear monetary policy strategy and a person or a committee bearing final responsibility for monetary policy decisions. Perez-Quiros and Sicilia (2002) opine that transparency “facilitates the understanding of what the central bank does and by doing so, it helps central banks to foster their credibility” (Perez-Quiros and Sicilia, 2002, p. 7). Based on these, the meaning of central bank transparency is straightforward: it implies how clearly financial investors see why the central bank is doing what it is doing and how closely central bank decisions are aligned with the monetary policy strategy. Besides other communication devices, as Eijffinger and Hoeberichts (2000) stress, transparency may be most enhanced by regular communication explaining central bank decisions, such as the publication of the minutes of monetary council meetings.

The predictability of a central bank’s decisions is a consequence, or, manifestation of the degree of its transparency. The better the motives of a central bank’s decisions are understood and the more its decisions are perceived to be in line with its strategy, the better economic agents are able to predict future policy moves. Vice versa, the degree of predictability as implied by financial market prices, according to Perez-Quiros and Sicilia (2002), shows how transparent a central bank is in the eyes of financial market participants. In other words, predictability is a measure of how well market participants understand monetary policy strategy and how precisely they anticipate future policy actions under various market conditions. In this vein, higher predictability of policy moves helps build central bank credibility. While measuring credibility itself can prove to be a difficult task, measuring predictability of both market interest rates in general and base rate decisions in specific is more straightforward. Evaluating predictability as implied by market prices gives a good first proxy for a central bank’s credibility as seen by market participants.

Central bank communication

Communication plays an important role in making central bank decisions transparent and in establishing a good market perception of its credibility. After Mishkin (2004), a key component of building credibility and making central bank decisions more predictable lies in good communication. Clearly, improving central bank communication with financial markets has become a focal endeavor in monetary policy-making, lately (see Woodford, 2005). Central bank communication may be regular or ad hoc and may take different shapes beginning with the publication of post-meeting statements (communiqués) by the monetary council – the decision-making body – of the central bank through the publication of the minutes of meetings of the monetary council to individual comments made by the Governor or other members of the monetary council. As Woodford

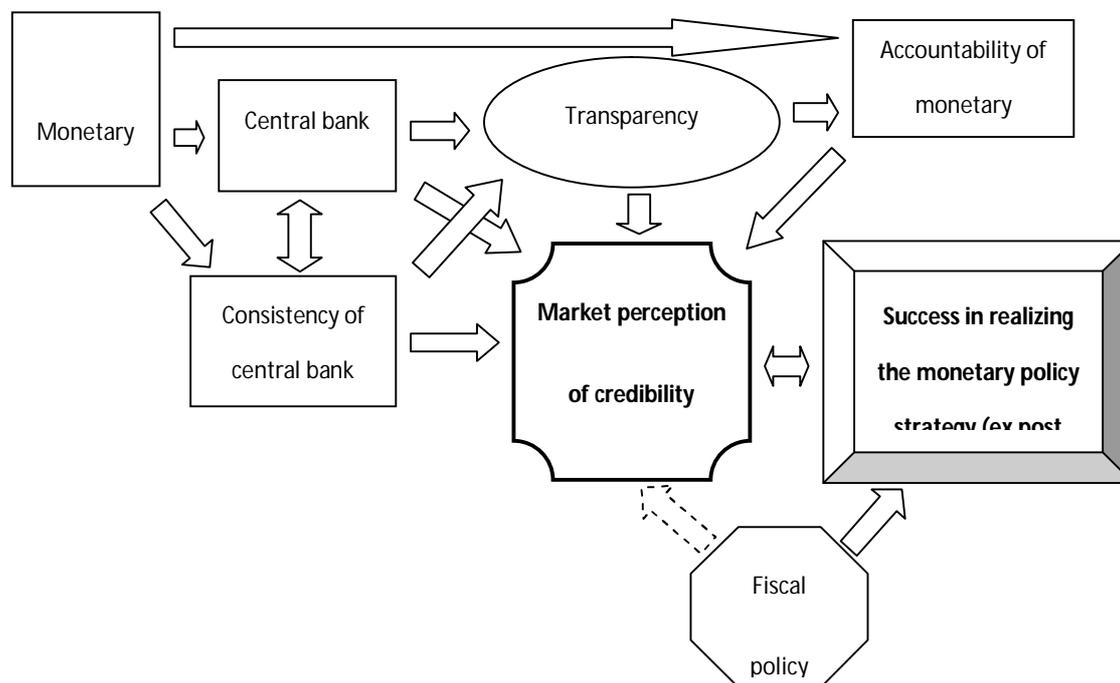
(2005) outlines, communication can be about a number of factors important in the monetary policy decision-making process such as general economic conditions – most notably, the dynamics of inflation and unemployment and the stability of the financial system –, policy decisions, monetary policy strategy – that is, the specific targets and objectives of monetary policy – and the outlook – bias – for future policy.

Communication is important in establishing credibility for a number of reasons. First, it makes the commitment of the central bank to the monetary policy strategy verifiable in the eyes of the stakeholders of monetary policy (Woodford, 2005). Communication, be it regular or ad hoc, gives a firsthand feedback to financial investors as to whether the central bank consistently follows the monetary strategy laid out for itself and helps investors test whether central bank action is aligned with the announced monetary policy strategy. In case of an inflation targeter, each act of communication has to reflect the logic of disinflation. Communication is also useful in “clarifying the consequences of the general strategy” (Woodford, 2005, p. 12). The central bank might wish to illustrate through “regular, detailed and structured” (Woodford, 2005, p. 12) communication – such as Inflation Reports – the potential consequences of following the monetary policy strategy. Moreover, communication helps economic agents better predict policy decisions of the central bank. Financial investors continuously match central bank communication with policy actions and see for themselves whether communication is useful or useless in signaling policy moves. If financial investors see a central bank that “will do what it says” (Blinder, 1999, p. 4), they will conclude that the signals of this particular central bank are indicative and will act accordingly. This will be reflected in the prices of major financial assets, i.e. they will move in the direction in which the central bank ushers them with communication.

We shall call communication consistent when it serves the above purposes well and, thus, helps the central bank establish a good market perception of credibility. In case communication is inconsistent with policy actions, financial investors will conclude that central bank communication is confusing and irrelevant and will, therefore, ignore it and rely instead on their own predictions in forecasting policy actions. Investors will reach the same conclusion when communication is inconsistent within itself. For instance, it might happen when policy-makers communicate the direct opposite of what they had just communicated or, when policy-makers communicate ambiguously. Inconsistent communication will, therefore, destroy, rather than build, credibility.

For the sake of clarity, *Figure 3* illustrates how these different concepts interrelate in independent monetary policy-making.

Figure 3 Concepts related to credibility in monetary policymaking



Source: own illustration.

To sum up *Figure 3* in short, the decisions and the communication of an independent central bank's decision-making body reflect the general monetary strategy, that is, the targets and objectives the independent central bank is trying to fulfill. There is some interaction of central bank decisions and the consistency of communication as communication becomes more consistent when it explains decisions well while monetary policy decision-makers usually take into account central bank communication preceding decisions. Central bank decisions and the degree of consistency of communication together predetermine the level of transparency and predictability as well as affect the financial market's perception of the credibility of the monetary policy regime (ex ante credibility). Ex ante credibility is also affected by the predictability and transparency of central bank decisions and the accountability of central bank decision-makers. Ex ante credibility and the success of realizing monetary policy strategy – ex post credibility – have a unique relationship: the act of realizing the strategy makes the monetary policy regime more credible, while being more credible ex ante makes it easier for a monetary policy authority to realize its strategy.

A dynamic model of perceived credibility

In this short review, we present a dynamic method of measuring the credibility of monetary policy as perceived by the market. Dynamic models are used to grasp the evolution of credibility across time. They make it easier to track historical periods when the degree of perceived monetary policy credibility underwent significant changes

and examine, using anecdotal, historical or press accounts, what events prompted these changes to occur. This subsection provides a preliminary theoretical founding of the dynamic credibility measures, as well as the basic description of the model which we implement in the empirical part.

Goldberg and Klein (2005) presented a dynamic assessment of central bank credibility in their paper evaluating the evolving credibility of the European Central Bank, by. In this paper, the authors introduce a novel framework for quantifying the evolution of the financial market's perception of a monetary policy regime. In their analysis, they claim that it is possible to map the evolution of the market's perception of monetary policy stance by tracking the very short-term response of financial market asset prices or yields to innovations in inflation dynamics. They state that the surprise component of inflation announcements changes asset prices or yields in the very short term differently depending on the degree of credibility of monetary policy as perceived by financial investors.

More specifically, their model is based on earlier theoretical findings by Ellingsen and Söderström (1999), an analysis of the links between monetary policy decisions and market interest rates in an inflation-targeting monetary policy framework. The authors use an intertemporal loss function to model the central bank's decision problem, where the quadratic loss function of the central bank at any time t is:

$$L(\pi_t, y_t, \lambda_t) = \frac{1}{2} [\pi_t^2 + \lambda_t y_t^2]$$

where

π_t is the percentage deviation of the rate of inflation from the optimal level (inflation gap) at time t ;

y_t is the percentage deviation of real GDP from the optimal level (GDP gap) at time t ;

and $\lambda_t \geq 0$ is the central bank preference parameter, which is the weight attached to output stabilization

relative to inflation stabilization at time t , following a martingale so that $\lambda_{t+s|t} = \lambda_t$ for all $s \geq 0$.

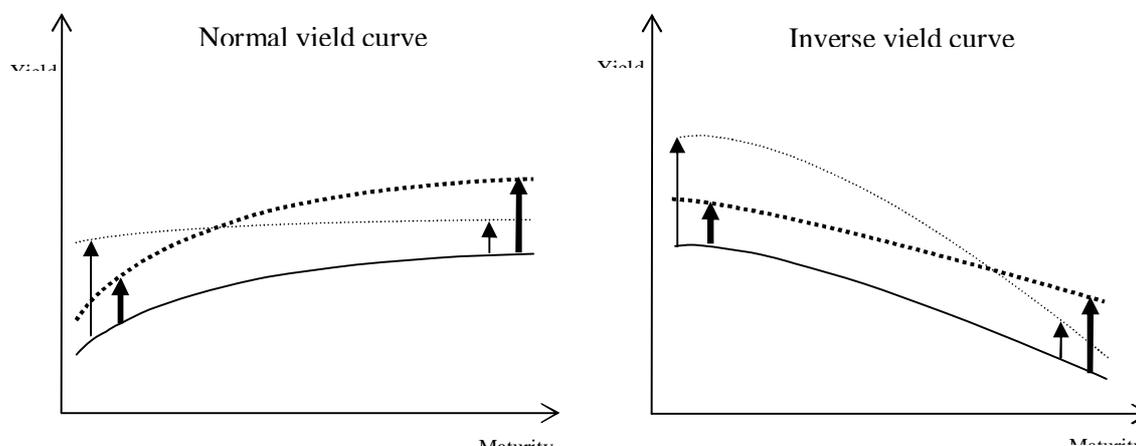
From the above specification, it follows that when a central bank becomes less inflation-averse, λ_t increases, as the central bank puts relatively more weight on output stabilization than before.

This study finds that with a less inflation-averse central bank – meaning a higher λ_t –, “short rates respond less and long interest rates respond more to a given shock”⁴¹ (Ellingsen and Söderström, 1999, p. 12). Given the level of abstraction at this point, it is useful to graphically illustrate this postulate, as Ellingsen and Söderström (1999) missed this opportunity in their paper. *Figure 4* shows the reaction of the short and the long end of the yield curve to the same inflation shock when credibility is higher, that is, λ_t is lower (normal width dotted curve) and when credibility is lower, that is, λ_t is higher (double width dotted curve). The figure on the left-hand side

⁴¹ In line with general macroeconomic theory, Ellingsen and Söderström (2005) specify two sorts of inflationary shocks: one emanating from shocks to aggregate demand and one from price shocks on the supply side of the economy. In the appendix of their paper, the authors show that the consequences of the inflationary shock on the different yields are independent of the source of the shock.

illustrates this on a normal yield curve, while the right-hand-side figure displays the case of an inverse yield curve, which is more pertinent to the Hungarian case in the investigated period (July 2001 – April 2009).

Figure 4 Credibility-induced changes in the pattern of the yield curve response to an inflation shock



Source: own illustration.

Based on this, as Goldberg and Klein (2005) note, when the central bank is less inflation-averse, it is true that:

$$d\left(\frac{di_t^L}{d\eta}\right)/d\lambda > d\left(\frac{di_t^S}{d\eta}\right)/d\lambda$$

where

i_t^L and i_t^S are long and short term interest rates, respectively;

and $d\eta$ is the innovation to inflation (a demand or supply shock).

This finding implies that changes in the relative reaction of short and long interest rates to inflation – demand or supply – shocks indicates a change in the market perception of a central bank's inflation aversion. Whenever long rates start to respond more and short rates less to inflation shocks than before, it is interpreted as markets perceiving the central bank less inflation-averse, or, more accommodating. Vice versa, when long rates start to respond less and short rates more to inflation shocks, one can infer that the central bank had become more inflation-averse.

In their paper, Goldberg and Klein (2005) are the first to identify the credibility of a monetary policy authority with its perceived inflation-aversion. They introduce a novel framework of measuring the gradual change and evolution in time of the inflation-aversion as perceived by economic agents and as implied by market prices and interest rates. In their specification, they use exchange rates and government bond yields as market data and examine how the reaction of these market prices and yields to the monthly publication of inflation data evolves over time. They regress the very short-term changes in the term spread of government bond yields – as well as changes in the exchange rate – on the surprise component of inflation announcements, where the time-varying coefficient of the surprise component of news is interpreted as a degree of inflation-aversion, or, credibility.

According to this specification, the perceived credibility of the central bank weakens as the coefficient of the surprise component increases.

Goldberg and Klein (2005) take the general form of the standard linear specification of asset prices reacting to innovations in inflation:

$$q_{t^+} - q_{t^-} = \alpha + \gamma_i(x_{t^+} - E_{t^-}x_{t^+}) + \varepsilon_{t^+} \quad [1]$$

where

$q_{t^+} - q_{t^-}$ is the change of the specific asset prices or yields that we use in the regression over a very short timeframe between t^- (the time of the last recorded value before the innovation) and t^+ (the time right after the innovation);

x_{t^+} is the new value of a variable affecting inflation expectations, and $E_{t^-}x_{t^+}$ is the expected value of this same variable as expected at time t^- ;

γ_i is the coefficient of the surprise component of the news announcement ($x_{t^+} - E_{t^-}x_{t^+}$), with the subscript i indicating that the value of the coefficient – that is, the inflation-aversion of the central bank as perceived by the market – may change over time;

and ε_{t^+} is the white noise error term.

Goldberg and Klein (2005) note – after Andersen, Bollerslev, Diebold and Vega (2003) – that this specification is useful for the analysis of asset price changes happening in a very short timeframe. The idea behind this specification is that changes in asset prices that occur in a very short timeframe following the announcement of an economic variable affecting expectations of inflation dynamics reflect the changes in the future path of inflation – or, inflation premium –, as expected by the participants of financial markets. In other words, looking at changes in asset prices over a very short timeframe, one can abstract from changes in other factors, such as risk premium, term premium, liquidity premium or real returns.

Goldberg and Klein (2005) specify the above findings of Ellingsen and Söderström (1999) by expressing the reaction function of the term structure of interest rates to innovations in inflation. According to this specification,

$$d(i_t^L - i_t^S) = \left(\frac{di_t^L}{d\eta} - \frac{di_t^S}{d\eta} \right) d\eta \quad [2]$$

where the relative change in the reaction of the long and short term interest rates after an inflation shock can be simply expressed as the change in the term spread of short and long term interest rates, that is, the slope of the

yield curve. They go on to link [1] with [2] and identify $q_{t^+} - q_{t^-}$, γ_i and $x_{t^+} - E_{t^-}x_{t^+}$ with $d(i_t^L - i_t^S)$,

$\left(\frac{di_t^L}{d\eta} - \frac{di_t^S}{d\eta} \right)$ and $d\eta$, respectively, thus giving the general linear specification a concrete meaning.

In their model, Goldberg and Klein (2005) make use of the statistical test by Elliott and Müller (2006) and a novel statistical method published by Müller and Petalas (2009), which is used to plot the time path of a parameter in any time series model⁴².

A more refined alternative of the Chow-test (Chow, 1960) – or the Quandt likelihood ratio test – for structural break, the Elliot-Müller test is a test for time persistent break in a regression model. Elliot and Müller (2006) address several of the structural break and time-varying stability models in the literature offering a general specification which nests these models in one test, which is called the quasi-local-level (qLL) efficient test for general persistence in time variation of regression coefficients. The authors apply “tests of the null hypothesis of a stable regression model, such as

$$y_t = X_t' \bar{\beta} + Z_t' \delta + \varepsilon_t \quad (t = 1, \dots, N)$$

from the alternative hypothesis of the unstable model

$$y_t = X_t' \beta_t + Z_t' \delta + \varepsilon_t \quad (t = 1, \dots, N)$$

with non-constant $\{\beta_t\}$ ” (Elliott and Müller, 2006, p. 909). Basically, they test whether the coefficient vector that describes the relationship between the X_t and y_t remains stable over time, while still letting some other stable links remain between y_t and Z_t .

The calculation of qLL follows the steps below (based on Elliott and Müller, 2006, p. 914):

1. Compute the OLS residuals $\{\varepsilon_t\}$ by estimating the model given in [2];
2. Construct a consistent estimator \hat{V}_X of the $k \times k$ long-run covariance matrix of $\{X_t \varepsilon_t\}$;
3. Calculate $\{\hat{U}_t\} = \{\hat{V}_X^{-1/2} X_t \hat{\varepsilon}_t\}$, and let $\{\hat{U}_{t,i}\}$ denote the k elements of $\{\hat{U}_t\}$, $i = 1, \dots, k$;
4. Calculate the series $\{\hat{w}_{t,i}\}$ for each $\{\hat{U}_{t,i}\}$ series such that

$$\hat{w}_{t,i} = \bar{r} \hat{w}_{t-1,i} + \Delta \hat{U}_{t,i}$$

Let $\hat{w}_{1,i} = \hat{U}_{1,i}$ and $\bar{r} = 1 - \frac{c}{T}$, where c is a constant made to equal 10;

5. Compute the squared residuals $\hat{v}_{t,i}^2$ from OLS regressions of $\{\hat{w}_{t,i}\}$ on \bar{r}^t individually, and sum all of those over $i = 1; \dots; k$:

$$\hat{v}_t = \sum_{i=1}^k \hat{v}_{t,i}^2$$

6. The qLL statistic is obtained as follows:

$$qLL = \bar{r} \sum_{t=1}^T \hat{v}_t - \sum_{i=1}^k \sum_{t=1}^T (\hat{U}_{t,i})^2$$

⁴² Goldberg and Klein (2005) worked from earlier but identical versions of Elliott and Müller (2006) and Müller and Petalas (2009).

As Baum (2007) describes in a presentation discussing the practical implementation of the qLL test using a Stata program, in the second step of the qLL calculation more options are available. If ε_t can be assumed uncorrelated, Baum (2007) recommends to choose the heteroscedasticity robust estimator

$$\hat{V}_X = \frac{1}{T} \sum_{t=1}^T X_t X_t' \hat{\varepsilon}_t^2$$
. In the more frequent case of possibly auto correlated ε_t , Baum (2007) suggests using the Newey-West heteroscedasticity and autocorrelation consistent (HAC) estimator. For small values of qLL the null hypothesis of parameter stability is rejected, according to Baum (2007). The critical values for this test do not depend on the dimension of Z_t , only on the dimension of X_t , that is, on k . We will use the qLL statistic for the cases $k = 1$ and $k = 2$ only, so the critical values will be reported besides the respective estimations.

The qLL statistic calculated above can be of utmost help in discovering a structural break or any time-varying parameters present in an estimated regression model. Nevertheless, plotting the evolution in time of the time-varying regression coefficients should shed more light on the pattern of the structural break and provide more clues that might help to explain it.

Müller and Petalas (2009) introduce a method of estimating a general unstable time series regression model by minimizing weighted average risk and maximizing weighted average power. The Müller-Petalas procedure has much in common with smoothing problems and, to its advantage, only general assumptions are necessary about the instability in time of the modeled regression coefficients. Assuming a stable, mean-reverting time series model with parameter $\theta \in \mathbf{R}^k$, and the relating unstable model with time varying parameter

$\{\theta_t\}_{t=1}^T = \{\theta + \delta_t\}_{t=1}^T$, the goal is to estimate the time path of θ by minimizing weighted average risk. β is defined

as the first $p \leq k$ estimated parameters of θ with the last $k - p$ elements of δ_t being equal to zero. Define

$$\hat{H}_\beta = T^{-1} \sum \hat{s}_{\beta,t}(\hat{\theta}) \hat{s}_{\beta,t}(\hat{\theta})'$$
, where $\hat{s}_{\beta,t}(\hat{\theta})$ indicates the scores of the relating parameters evaluated at

maximum likelihood estimator $\hat{\theta}$, including any potential instability. Assuming that δ_t is a (demeaned)

multivariate Gaussian random walk, the authors offer the following algorithm to obtain an asymptotically weighted average risk minimizing path estimator (based on Müller and Petalas, 2009, p. 7):

1. Compute the time series $x_t = \hat{H}_\beta^{-1} s_{\beta,t}(\hat{\theta})$, $t = 1, \dots, T$;
2. Let $z_1 = x_1$, and generate a $p \times 1$ AR(1) process initialized at x_1 and updated by Δx :

$$z_t = r_c z_{t-1} + (x_t - x_{t-1}), \quad t = 2, \dots, T,$$

where $r_c = 1 - \frac{c}{T}$;

3. Compute the residuals $\{\tilde{z}_t\}_{t=1}^T$ of a linear regression of $\{z_t\}_{t=1}^T$ on $\left\{ \begin{matrix} r_c^{t-1} \mathbf{I}_p \\ \mathbf{1}_p \end{matrix} \right\}_{t=1}^T$;
4. Let $\bar{z}_t = \tilde{z}_t$, and compute the following time series:

$$\bar{z}_t = r_c \bar{z}_{t+1} + (\tilde{z}_t - \tilde{z}_{t+1}), \quad t = 1, \dots, T - 1,$$
5. The efficient estimator of the parameter path for β is defined as

$$\left\{ \hat{\beta} + x_t - r_c \bar{z}_t \right\}_{t=1}^T,$$

6. An asymptotically weighted average power maximizing test for parameter stability of the first p parameters of θ can be computed using the qLL statistic outlined in the description of the Elliott-Müller test above.

The parameter c corresponds to the signal-to-noise ratio in the smoothing problem: the smaller c is, the

smoother the estimated parameter path $\left\{ \hat{\beta} + x_t - r_c \bar{z}_t \right\}_{t=1}^T$ becomes. In case of the path estimation problem, $c = 10$ roughly corresponds to the magnitude of instabilities found in macroeconomic time series.

In our paper, we use the conceptual framework of Goldberg and Klein (2005) to apply the above Elliot-Müller test for persistent time variation of regression coefficients to indicate the evolution of the market perception of monetary policy credibility and, afterwards, implement the Müller-Petalas procedure to illustrate the estimated parameter path of the unstable regression coefficients in question.

The variables

We use two dependent variables ($q_{t^+} - q_{t^-}$ from [1]) in our analysis, identically with the method implemented in Goldberg and Klein (2005). In the first specification, we use as dependent variable the change in the term spread between the benchmark yields of the ten-year government bond and the three-month treasury bill issued by the Government Debt Management Agency (ÁKK) of Hungary. We decided to use shorter terms for the observed term spread than the terms used by Goldberg and Klein (2005) because the meaning of short and long term bonds was different in Hungary in the observed period⁴³. The change in the term spread is, thus, calculated as the change in the difference of the 10-year and 3-month benchmark yields from its value registered at 14:15 on the day preceding the announcement of the inflation data to its value registered at 14:15 on the day of the inflation announcement⁴⁴. We observe two periods using these dependent variables: one runs from July 2001 to February 2008, the last month when the currency exchange rate floatation band was intact, and the other runs from July 2001 till April 2009, the end of our entire observed period.

⁴³ Goldberg and Klein (2005) used the yield on the two-year government paper for the short term, which would have been considered medium term in Hungary.

⁴⁴ We use the daily benchmark fixing of bond yields because we found these the most suitable and relevant for our analysis. Considering the relatively low turnover and volatility of the market for Hungarian fixed income assets compared to the core US and euro zone markets analyzed by Goldberg and Klein (2005), this fact should not deter results significantly. The dates of the inflation data releases did not coincide with any other major economic news releases or MC/Governor comments so the effect on the slope of the curve can always evidently be connected with the CPI announcement.

In the other specification, we use as dependent variable the high-frequency change in the euro-forint exchange rate (EURHUF). In this case, $q_{t^+} - q_{t^-}$ becomes the change in the log value of the foreign exchange rate from its value registered half an hour before the publication of the monthly inflation data to its value registered half an hour after the data release. The change is negative when the forint appreciates against the euro (log of EURHUF decreases) and positive when it depreciates (log of EURHUF increases). The foreign exchange rate data we use are the transaction data registered in Reuters spot matching trading system such that we determine the closing price for a given period as the price at which the last deal of that period was struck.⁴⁵ Exchange rate data were only provided until February 2008, which is why the observed period in this specification runs from July 2001 to February 2008 (80 observations).

The independent variable ($x_{t^+} - E_{t^-} x_{t^+}$) is the same in the two specifications and also identical with what is used in Goldberg and Klein (2005), that is, the surprise component of the monthly inflation announcement. We approximate this surprise as the difference between the consensus inflation estimate of Hungary-based macro analysts surveyed by the online journal portfolio.hu⁴⁶ and the actual Hungarian monthly headline consumer price index (CPI) in percentage points, published by KSH. The difference is then normalized by its standard deviation. As it is apparent from Appendix 3, one is unable to reject the unbiased nature of the CPI survey of portfolio.hu as a good predictor of the actual inflation data. The inflation data are usually published at 9:00 on the day previously announced in KSH's publication schedule, while the consensus is usually one day before the announcement by KSH.

In the following section, we perform the three above mentioned Elliot-Müller tests for time variation in the slope and, jointly, in the slope and intercept of the specifications described above, then we implement the Müller-Petalas procedure for the dependent variables if we find some evidence of time variation. In the Elliot-Müller test, a value of the qLL statistic smaller – more negative – than its critical value signals a change in the market perception of MNB's policy stance over time in the observed period. Both for performing the Elliot-Müller test and for calculating the estimated time paths using the method of Müller and Petalas, we used a Stata program which was kindly made available to us by the authors of Goldberg and Klein (2005). As suggested by Müller and Petalas (2009), we used $c = 10$ throughout the calculations.

Results of the Elliot-Müller tests

In *Table 1*, we present the results of the Elliot-Müller tests we performed in the indicated periods. The results of the test using the term spread specification both in the shorter and in the longer period suggest a conclusion to reject the null hypothesis of the stability of the regression coefficient. This result means that some persistent

⁴⁵ These high frequency data were kindly made available to us by Reuters Hungary Ltd.

⁴⁶ We used the Reuters consensus before November 2004 – the publication of the first portfolio.hu estimate –, but we opted for portfolio.hu's consensus estimates afterwards, as they were more reliable than those of Reuters.

time variation is prevalent in the reaction of the term spread to the CPI releases, meaning that the bond market's perception of MNB's credibility was unstable throughout the period of July 2001 – February 2008. Such a conclusion cannot be made in case of the EURHUF exchange rate specification, where the null hypothesis of parameter stability in time cannot be rejected at the 90% significance level.

Table 1 The results of Elliot-Müller tests for persistent time variation

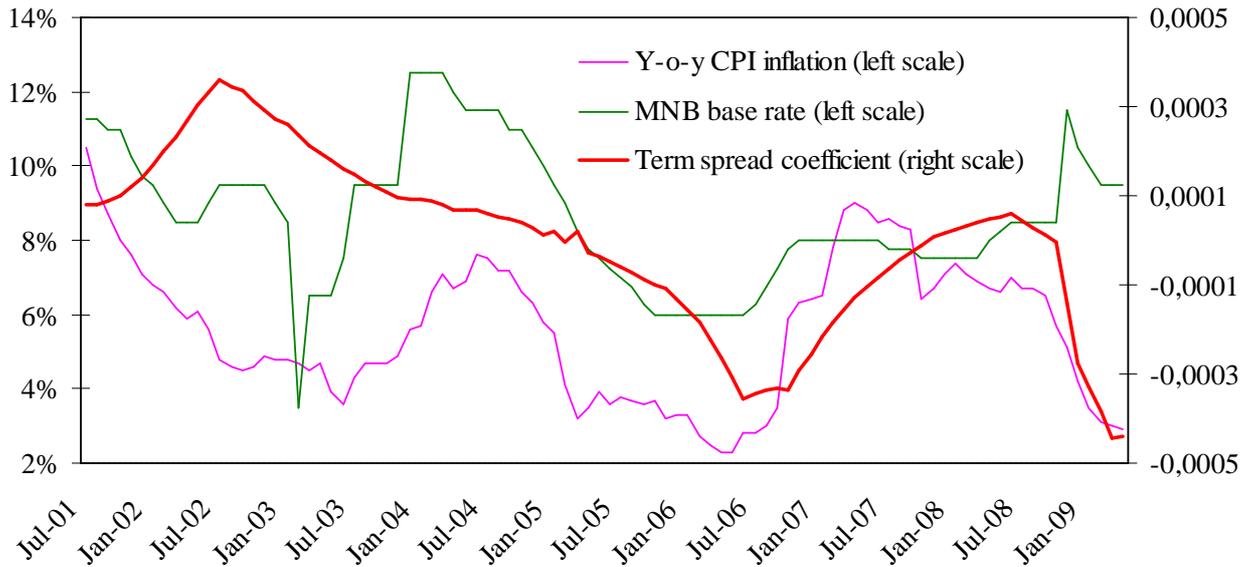
Test of time variation of	the change in the term spread	the change in EURHUF
Slope (γ_i) only	-7.3949*	-5.473
Joint slope (γ_i) and intercept (α)	-12.448	-11.398
Number of observations (July 2001 – February 2008)	78	80
Slope (γ_i) only	-4.7767	-
Joint slope (γ_i) and intercept (α)	-12.920*	
Number of observations (July 2001 – April 2009)	91	
Critical values	Slope: -11.05*** (1%), -8.36** (5%), -7.14* (10%) Slope and intercept: -17.57*** (1%), -14.32** (5%), -12.8* (10%)	

Source: own calculations from data by www.akk.hu, www.ksh.hu, www.portfolio.hu and Reuters Hungary.

Results of the Müller-Petalas procedure

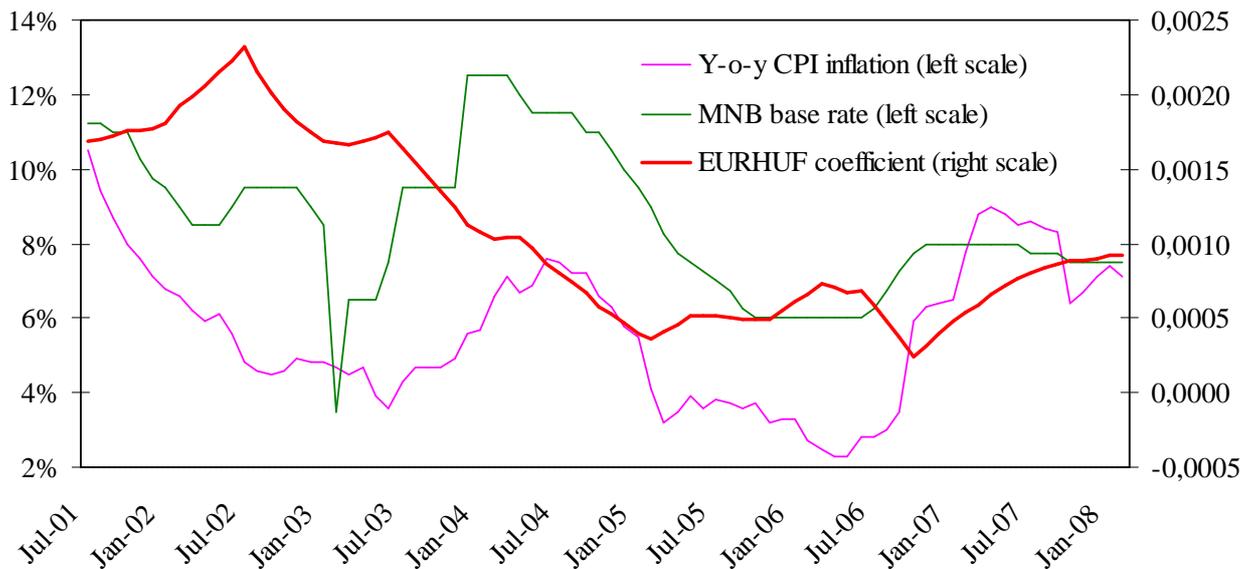
We now perform the Müller-Petalas procedure to illustrate the evolution in time of the credibility of the central bank as perceived by the bond market. In *Figure 5*, we present the smoothed estimated parameter path of γ_i using the Müller-Petalas procedure for the best specification based on the data set of July 2001 to February 2008, where the change in the term spread is the dependent variable. We back the smoothed estimated parameter path by the time-path of the actual base rate and the annual rate of headline CPI inflation in the observed period so that one can put the parameter values into historical context. For the sake of curiosity, we also visualize in *Figure 6* the curve of the estimated parameter path of the specification where the change of the log value of the high-frequency EURHUF exchange rate is the dependent variable. Although the results from the Elliot-Müller test of the later specification were not significant, it is interesting to see whether this estimated EURHUF parameter time path shows a similar picture to that shown by the term spread specification.

Figure 5 Estimated smoothed parameter path of γ_i of the term spread change and the MNB base rate



Source: own calculations based on data from www.akk.hu and www.mnb.hu.

Figure 6 Estimated smoothed parameter path of γ_i of the EURHUF change and the MNB base rate



Source: own calculations based on data from Reuters Hungary Ltd. and www.mnb.hu.

Apparently, the estimated time paths of both γ_i parameters shows the same declining trend in the observed period, and even the timing of the upswings and downturns of the two curves appears to be very similar, almost identical if one focuses on the big picture. In a short first phase, an upward trend is visible on both parameter paths, followed by a long-going period of decline – both curves turn downwards on July 11, 2002 –, which later ends in another upward trend – beginning on both curves on October 11, 2006. In the longer period of the term spread specification, another downward spiral breaks this upward trend on July 11, 2008. Apart from the cycles in the curves, if one looks at the values of the parameters at the beginning and the end of the observed period, one can conclude that, overall, the perceived credibility of monetary policy was better at the end of the period than it was in the beginning. According to our model, this is because the reaction of both bond and foreign

exchange market asset prices to news in the CPI announcements changed gradually in a way to reflect a slowly ameliorating perception of credibility of monetary policy. In other words, the market's perception of the central bank was more of an inflation-averse monetary policy authority at the end of the period than it was in the outset. This result is very similar to that obtained by Goldberg and Klein (2005), who examine these same specifications for the euro zone and the United States in the aftermath of the establishment of the European Central Bank in 1999. They conclude that the market perception of ECB was evolving after its inception in a way that reflected a gradual improvement in the market's perception of ECB's anti-inflation stance, while, on the other hand, the market's perception of the Federal Reserve's reputation as an inflation-fighter remained relatively stable in the very same period. Goldberg and Klein (2005) argue that the evolution of perceived credibility should come as no surprise in the case of a newly established central bank, such as the ECB was in 1999, whereas one would expect perceived credibility to remain stable at the same time in countries with relatively older and more established central banks, such as the Federal Reserve in the US. Applying the above logic to Hungary and the MNB, whose mandate to fight inflation was granted in July 2001, it should also come as no surprise that the Hungarian case is analogous to that of the ECB. In July 2001, MNB was a central bank whose real stance on the fight against inflation was unclear to the market players, who started to dynamically adjust their opinion on MNB as an inflation-fighter as time passed by – based on the central bank's decisions and communication as well as the inflationary tendencies. Over the entire span of the examined eight-year-period, the market's perception of MNB improved palpably.

Nevertheless, it is worth mentioning the peculiar political cycles of the Hungarian case. Clearly, two out of the three major turnarounds on the curve of the term spread coefficient coincide with the aftermath of a parliamentary election (2002 and 2006). After the elections of 2002, investors could witness a sharp break in the rhetoric of the Governor of the central bank – appointed by the previous government – from a benign, overlooking stance to a very critical, sometimes adversarial stance on the increasing laxness of fiscal policy and the dangers of fiscal overspending on inflation. The curve shows that investors might have interpreted this change as a more anti-inflation stance. In 2006, the situation was a bit more complex. It became clear that inflation was going to rise soon because of fiscal measures no matter what the central bank does and there was also a great sense of general uncertainty overhanging the mandate of the government following the nation-wide airing of the renowned Balatonöszöd speech, which was probably interpreted by investors as further obstacles ahead of monetary policy. The imminent appointment of a new Governor probably meant even more uncertainty. The reasons for the last turn of the estimated parameter path in 2008 are the least clear, but they probably had something to do with the elimination of a great deal of uncertainty from monetary policy following the abolition of the EURHUF floatation band in February 2008.

Conclusions

Our econometric analysis based on Goldberg and Klein (2005) suggests that the coefficient of the inflation news surprise in the regression specification describing the reaction of the term spread of bond yields to the surprise component of CPI announcements was time-varying in the investigated period, its ending value being lower than its initial value. In other words, the market's perception of credibility of MNB's IT regime as implied in the reaction of financial asset prices to inflation surprises improved in the investigated period. This finding is evidence, according to Ellingsen and Söderström (1999), that the market's perception of the central bank's inflation aversion improved in the investigated period. This is in line with the findings of Goldberg and Klein (2005) and Amisano and Tronzano (2005) on the experience of ECB.

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Session D

“The Mauritian Trade Balance: Evidence from Cointegration and Causality Analysis”

Maylene Damoense-Azevedo (Monash University-South Africa Campus, South Africa)

Purpose

The purpose of this study is to investigate the existence of a long-run relationship between Mauritian exports and imports using quarterly time series data spanning the period 1962:Q3 to 2008:Q4. Engle-Granger cointegration and Granger causality analysis is adopted in this study. The study employs values of imports and exports in US dollar terms, nominal local currency terms and in real local currency terms (Mauritian Rupee). Nominal values are converted using the CPI index. Data is obtained from the International Financial Statistics database.

Theoretical framework

This study adopts the theoretical framework developed by Husted (1962) and the revised testable model suggested by Arize (2002) to investigate the long-run relationship between Mauritian imports and exports:

$$\ln X_t = \alpha + \beta \ln M_t + \mu_t \quad (1) \quad \ln M_t = \alpha + \beta \ln X_t + \mu_t$$

(2)

Methodology and estimation results: In brief

ADF and PP unit root tests are utilized to determine the stationary properties of the series. The unit root test results indicate that the series are integrated of the order I(1). The Engle-Granger (1987) bivariate cointegration approach is used to examine the existence of a long-run relationship between imports and exports in this study. A long-run (LR) model is estimated and the residuals from the LR equation are investigated. If the residuals from the LR equation is I(0) the existence of cointegration between series *M* and *X* are implied. As expected *a priori*, there exists positive relationship between Mauritian exports and imports. The error correction model (ECM) is also estimated and the error correction term (lagged) is negative and highly statistically significant. In addition, the ECM passes a series of diagnostic tests to validate the model. Next, the Wald coefficient restriction test is used to examine whether the slope coefficients are equal to 1 or not. Accordingly, the results are mixed such that we do not reject the null that the slope coefficients are equal to 1 for the export equation but reject the null for the import equation. Finally, Granger causality (1988) tests are conducted in the ECM to investigate the direction of causality between imports and exports. The estimation results indicate a bi-directional causal relationship between imports and exports in Mauritius.

Policy implications

The findings of this study reveal that macroeconomic and trade policies in the Mauritian economy are partially effective in stabilizing the country's international trade balance and propose policy strategies to achieve a sustainable long-run trade imbalance.

“Determinants of FDI Inflows to the MENA Region: Macroeconomic and Institutional Factors”

Leila El Sayed (Economic Research Analyst, Lebanon)

The level of FDI inflows to MENA countries has been modest over the past 25 years compared to their economic growth performances and continues to be disappointing relative to other developing countries. The purpose of this paper is to shed light on the determinants of foreign direct investment (FDI) inflows through an empirical investigation of these determinants using a panel data of 19 countries in the region over the 1995-2009 period. By means of fixed effects panel regression, this paper finds that macroeconomic factors such as the size of the economy and the level of trade openness measured by the size of merchandise trade and imports of services attract FDI inflows into MENA countries, while inflation risk expectedly deter capital inflows. With the increasing wave of globalization, the mentioned traditional factors are no longer ample to explain the changing levels of FDI, but the quality of institutions and economic freedom are increasingly integrated into the direction of investors' choices. Therefore, these factors are included in the paper and the results convey that less tariff and non-tariff barriers, lower levels of tax rates, higher fiscal freedom and lower corruption play a vital role in attracting capital inflows to the region. Hence, evidence support the argument that while the MENA region offers competitive advantages to foreign investors regarding economic growth, the lack of trade openness and the poor performance of institutional factors has hindered its effort to receive higher capital inflows.

Introduction

Foreign Direct Investment (FDI) has become an increasingly important substance over the past years as a source of capital, technology, and management for developing countries. Many studies proved that foreign investment promotes development and creates new channels for growth in different sectors of the economy. The emphasis on the new resources that foreign investors bring to reduce the bottlenecks that constrain development is a common theme among international business groups and multinational agencies, which urge greater acceptance of international corporations within the developing countries and countries in transition (Moran, 1998).

In the MENA region, the majority of countries have expressed interest in attracting FDI and outlined a broad policy, but there is little evidence of concrete targets and the recognition that world competition for FDI claims strong government support and dedicated strategies and structures (MENA-OECD Investment Program). These countries are in greater pressure today to provide sustained economic growth, adequate employment levels, and ample welfare benefits to their citizens. Therefore, the works of investment promotion and enhancing institutional capacities that are mainly obstructed by corruption could pave the way for greater FDI inflows and thus towards the channels of development and growth. I study the main macroeconomic factors that have affected the levels of FDI inflows to MENA countries during period 1995-2009, in addition to the institutional aspects that are becoming widely stressed upon in studies of economic and social reforms.

Overview of FDI definitions and trends

FDI is defined as 'an investment made to acquire lasting interest in enterprises operating outside of the economy of the investor, the investor's purpose being to have an effective voice in the management of the enterprise', according to the International Monetary Fund's *Balance of Payments Manual*. The United Nations 2010 *World Investment Report* (UNCTAD, 2010) conveyed that developing and transition economies attracted half of global FDI inflows, and invested one quarter of global FDI outflows. It added that these countries are leading the FDI recovery and will remain favorable destinations for investments. However, overcoming barriers for attracting FDI remains a key challenge for small, vulnerable, and weak economies, where they need to move towards further investment liberalization and promotion, and to increase investment regulation under state policy objectives. Although foreign investment accounts for a small share of gross investment, but it shapes the most vital bridge towards obtaining technologies, capital, and access to export markets. Developing countries have increasingly attracted FDI inflows over the past several years due to their growth prospects along with their global integration via higher liberalization in trade and investment. Developing countries attracted 42.9% of the world FDI inflows in 2009, significantly greater than the 16.9% ratio in 1990. When looking at MENA countries included in this study, the growth in their FDI inflows was among the highest as it attracted 8% of total inflows in 2009, as compared to only 0.5% in 2000 and 0.77% in 1990.

Studies on Arab capital flows found that the bulk of investments in Algeria, Kuwait, Oman, Qatar, Saudi Arabia, and Yemen are in the fuels sector while in Bahrain, Egypt, Lebanon, Morocco, and Tunisia they are distributed among various sectors such as tourism, banking, telecommunications, construction, and manufacturing industries (Bolbol and Fatheldin 2006). Oil revenues building up to some MENA governments effectively result in some governments not needing FDI's economic and financial contribution classically needed by other countries. However, these governments could benefit from jobs, exports, technology transfer, regional development, and diversification of its industry sectors (MENA-OECD Investment Program).

In parallel, countries can create a competitive advantage by ensuring that their agencies are better than those of competitors. Investment Promotion Agencies (IPAs) serve as development agencies, proactively seeking to not just undertake promotion but to provide business solutions to potential investors and to improve the wider environment for investors by liaising with relevant government and other bodies concerning the changes needed (MENA-OECD Investment Program). However, the majority of IPAs in MENA countries still lack the needed structure and capacities to lead the role in competitive FDI.

Table 1. Nominal FDI Inflows in billions of dollars

	1990		2000		2009	
	Nominal Value	(%) of total	Nominal Value	(%) of total	Nominal Value	(%) of total
Developing Economies	35.1	16.9	256.5	18.3	478.3	42.9
Transition Economies	0.1	0	7	0.5	69.9	6.3
Developed Economies	172.5	83.1	1,138	81.2	565.9	50.8
World	207.7	100	1,401.5	100	1,114.2	100
MENA	1.6	0.8	7.1	0.5	85.6	8
South America	5	2.4	57.1	4.1	54.8	4.9
East & South Asia	9	4.3	121.5	8.7	196.2	17.6
South-Eastern Asia	12.8	6.2	23.7	1.7	36.8	3.3

Data source: UNCTAD (2009)

Literature Review

Literature written on the determinants of FDI in developing countries and more specifically in the MENA region, focus on the macroeconomic aspects of these determinants while little examine the institutional factors. However, Onyeiwu (2003) explain that much of the qualitative research have pointed out that differences in the flow of FDI among developing countries depends upon the nature of democracy, transparency, and good governance. Onyeiwu's main findings are that some of the variables that influence FDI flows to developing countries are not central for flows to MENA countries. These include the rate of return on investment, infrastructures, economic growth, and inflation. He adds that trade liberalization and privatization are important preconditions for FDI flows to the region. Similarly, Mohamed and Sidiropoulos (2010) find that the key determinants of FDI inflows in MENA countries are the size of the host economy, the government size, natural resources, and the institutional variables. They explain that countries that are receiving fewer foreign investments could make themselves more attractive to potential investors by removing all barriers to trade, developing their financial system, and building appropriate institutions.

New Institutional Economics

The dual determinants of FDI, macroeconomics and institutions, are now known as the New Institutional Economics approach to FDI (Wyk & Lal 2010). NIE can be defined as an expansion of macroeconomic determinants of FDI to include socio-political interactions and the evolution of institutions (ibid). Institutions are vital to any economy, especially those in development, since it can promote the way to fairly distribute growth to its various sectors. For instance, multinational enterprises entering a new market must adapt their strategies to the host country environment. Institutions reduce transaction costs by reducing uncertainty and establishing a stable structure to facilitate interactions (Meyer, 2001). What is the role of institutions in MENA countries and where do they stand with respect to other countries?

According to the Doing Business in the Arab World Report (2011), 10 economies out of the 21 included Arab economies implemented business regulation reforms which made it easier to start and operate a business, improved transparency, strengthened property rights, and helped streamline commercial dispute resolution and bankruptcy procedures. For instance, the report indicated that Bahrain built a modern new port, improved its electronic data interchange system, and introduced risk-based inspections. Similarly, Tunisia upgraded its electronic data interchange system for imports and exports, speeding up the assembly of import documents. Further, modern customs centers are being recognized at major ports in Egypt. Also, Saudi Arabia reduced the time to import by launching a new container terminal at the Jeddah Islamic Port. Despite these improvements and the ways paved towards institutional development to enhance investments in the discussed countries, only four out of the total 21 Arab countries rank amongst the top 50 countries in the ease of doing business index, while 8 rank in the bottom 50 category⁴⁷.

Qasrawi (2004) find that the main disincentives to FDI in the UAE were, in decreasing order of importance, the limitation of 49% ownership on foreign investors, regulations on the foreign ownership of real estate, the UAE's agency law, government red tape, and government charges and fees. Also, in most areas of Lebanon, electricity is provided only 12 to 18 hours per day, and water supply and public transportation are underdeveloped and are key needs demanded by the citizens. Moreover, the telecommunications sector in Lebanon generates underdeveloped services at a high cost with a duopoly of mobile phone operators. Such deficiencies are at hand in most countries in the region and were alleged to be the main obstacles to growth and economic and social development.

Data and Empirical Strategy

The data for the dependent variable, FDI inflows, and the explanatory variables, merchandise trade, imports of services and exports of services are collected from UNCTAD statistics database (2009). Data of other explanatory variables included in the three equations, GDP in billions of dollars, the current account balance, government lending, and the inflation rate are gathered from the *IMF World Economic Outlook (2010)*. Institutional variables in equations (1) and (2) include those measuring the sub-components of the economic freedom index of the *Heritage Foundation* and the *Wall Street Journal*. In equation (3), World Bank Governance indicators on political stability and the control of corruption are added.

The model of this study consists of three equations using panel data with a set of 19 MENA countries, collected for the period 1995-2009 in equations (1) and (2) and the period 2002-2009 in equation (3). One of the advantages of using panel data is that it is assumed that estimators based on them are quite more accurate than

⁴⁷ The 2011 aggregate ranking on the ease of doing business is based on indicator sets that measure and benchmark regulations affecting 9 areas in the life cycle of a business: starting a business, dealing with construction permits, registering property, getting credit, protecting investors, paying taxes, trading across borders, enforcing contracts and closing a business. For further insight check www.doingbusiness.org

from other sources since they are typically larger than cross-sectional or time series data sets, and explanatory variables vary over two dimensions rather than one (Verbeek, 2008).

Hausman (1978) specified the simplest panel model as

$$y_{it} = \beta x_{it} + \mu_i + \varepsilon_{it}, \quad (i = 1, N \text{ and } t = 1, T)$$

When averaging this equation over time for each i , we get:

$$\bar{y}_i = \beta \bar{x}_i + \mu_i + \bar{\varepsilon}_i$$

where μ_i is the individual effect. The fixed effects model treats μ_i as a fixed but unknown constant differing across individuals. Therefore, to get rid of μ_i , the second equation is subtracted from the first to give the within transformation:

$$y_{it} - \bar{y}_i = \beta(x_{it} - \bar{x}_i) + \varepsilon_{it} - \bar{\varepsilon}_i$$

The OLS estimator for β obtained from this transformed model is often called the within estimator or fixed effect estimator.

Regression Results

Table 1 shows the results of the panel regression. First, the Hausman specification test is done to check whether the fixed effect estimator or the random effect estimator in panel regression is more appropriate for this model. The null hypothesis is rejected in all equations and so a fixed effect model is more efficient.⁴⁸

As most studies found earlier, the main steps that a host government in developing countries can acquire to increase the attractiveness of its sectors for foreign investors is through fostering its fundamentals. In equation (1), observations of variables cover period 1995-2009 upon the availability of the index of economic freedom and two of its sub-indices. Macroeconomic variables with positive link to FDI inflows in this equation are found to be the size of the economy which is captured by the level of GDP, merchandize trade, and the value of imports of services. Consequently, it is found that if the level of the average GDP across the selected countries increase by the level of its standard deviation, then the average level of FDI inflows will increase by \$3.34 billion.⁴⁹ In the

⁴⁸ The general idea of a Hausman test is that two estimators are compared: one that is consistent under both the null and alternative hypothesis which is the fixed effects estimator, and the other is consistent under the null hypothesis only which is the random effects estimator.

⁴⁹ The use of a standard deviation change is equivalent to employing standardized coefficients versus metric coefficients for the analysis of results. Since the scale differ between billions of dollars for the macroeconomic variables and a scale from 0 to 100 for the indices of economic freedom, then it is difficult to compare between the coefficients of the independent variables. For an interesting debate on the use of standardized coefficients, see

Kim, J. & G. Ferec. 1981. Standardization in Causal Analysis. *Sociological Methods and Research*, 10(2), 187-210.

same context, inflows will increase by \$2.19 billion with an increase of merchandise trade by the level of its standard deviation, \$3.37 billion for the level of imports of services, while flows are found to decline by \$1.6 billion with a standard deviation increase in the current account level and decrease by \$0.89 billion dollars for the value of exports of services. Also, the levels of correlation between explanatory variables are found to be low and therefore no risks of multicollinearity are evident.

Further, it is conveyed that in addition to fostering its fundamentals, a country should implement policies on the grounds of institutions that might obstruct the flow of investments if the right minimal measures were not taken. In equation (1), the overall score of economic freedom is highly significant but with a negative sign. The sign could be attributed to the fact that the overall index is composed of 10 specific components of economic freedom, some of which are composites of additional quantifiable measures. In 2009, the average of the 29 MENA countries on the economic freedom index came at 60.2 points, slightly higher than the global average of 59.4 points. Also, the average score in the trade freedom component came at 75.1 points compared to the global average of 74.2 points, while the MENA region performed better in the fiscal freedom component at 88.2 points as compared to 75.4 points globally. Out of the 10 sub-components of the economic freedom index, only two are found to be significant with positive signs; the trade freedom and the fiscal freedom indices.⁵⁰ Also, since the trade freedom and the fiscal freedom indices are sub-categories of the economic freedom index, they are found to be highly correlated with the latter and so the economic freedom index is omitted in equation (2) to avoid the problem of multicollinearity.

To excavate comparatively the possible disparities between oil exporting and oil importing countries, the value of oil exports is included with the variables of equation (1) but is found to be insignificant. In equation (2), an additional factor is incorporated which is the inflation rate measured as the growth of average consumer prices. Expectedly, results convey that inflation deters capital inflows as it is a risk factor that foreign investors seek to escape from. If the level of inflation rises by a value equal to its standard deviation, then FDI inflows will decline by \$0.29 billion. Inflation affects the purchasing power of consumers and can be an adverse feature for foreign investment.

In equation (3), the same macroeconomic variables are incorporated, adding two of the World Bank's governance indicators which are significant in the model. The level of GDP and imports and exports of services are still found to be significant with similar coefficients and signs. Further, the level of government net lending or borrowing is found to be significant with a positive sign, such that if the average level across the 19 countries increase by a level equal to its standard deviation then the average level of FDI inflows will increase by \$0.74bn.

⁵⁰ Trade freedom is a composite measure of the absence of tariff and non-tariff barriers that affect imports and exports of goods and services. Fiscal freedom is a measure of the tax burden imposed by government. It includes both the direct tax burden in terms of the top tax rates on individual and corporate incomes and the overall amount of tax revenue as a percentage of GDP inputs. For further insight see the *Heritage Foundation* and the *Wall Street Journal* Index of Economic Freedom on <http://www.heritage.org/index/>

The balance of net lending or borrowing may be viewed as an indicator of the financial impact of general government activity on the rest of the economy and non residents. Further, a higher level of political stability and the absence of violence as defined by the Worldwide Governance Indicators⁵¹ are found to be negatively affecting the level of FDI inflows. On the other hand, results show that the higher control of corruption increases the attractiveness for foreign investment in the region. This is to say that up until 2009, many dictatorship regimes in the MENA region were able to hold a level of adequate political stance despite the high level of corruption. For instance, Libya was the third worst performer with the average control of corruption indicator for period 2002-2009, while it ranked in fifth place for the average political stability indicator during the same period among the 19 selected MENA countries.

Conclusion and Recommendations

By setting up a model to highlight the main determinants of FDI in the MENA region, this paper is intended to find how the economic and institutional framework of a host country affects the level of its FDI inflows. There are strong evidences that weak and corrupt institutions in MENA countries played a vital role in outpacing its macroeconomic performances in the way to obstruct FDI inflows. Investing abroad generally incurs higher costs separate from the normal costs due to the nature of the foreign market. Therefore, weak and corrupt institutions resemble the main rationale behind the low participation of MENA countries in inward FDI, despite its high growth in the past 20 years. Results suggest that the good economic stance in these countries attracts FDI, while risks dissuade investments. In particular, countries with high level of inflation post higher country risks for investors. Also, these countries need to choose the effective measures that raise their trade and fiscal freedoms to achieve higher participation. In parallel, since the continuous resistance of economic reform in MENA countries is the creation of political governing regimes, an economic reform in the future could only hold with

⁵¹ Political Stability and Absence of Violence/Terrorism captures perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism. Control of Corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.

changes in the logic of policies and diminishing the powers of ruling elites. Governments need to realize that investment promotion starting with institutional development is a vital measure for higher inward FDI.

Table 2. Fixed effects panel least squares estimation, Equations (1) and (2) using period 1995-2009 and Equation (3) using period 2002-2009.
Dependent Variable: FDI in bn dollars

	Equation (1)	Equation (2)	Equation (3)
Macroeconomic variables			
Constant	-1.990*** (0.741)	-2.931*** (0.582)	-10.795*** (3.121)
GDP	0.031*** (0.003)	0.027*** (0.003)	0.032*** (0.006)
Inflation		-0.018* (0.01)	
Current Account	-0.098*** (0.035)		
Merchadize Trade	0.090*** (0.034)		
Imports of Services	0.348*** (0.038)	0.437*** (0.025)	0.434*** (0.038)
Exports of Services	-0.147** (0.067)	-0.182*** (0.053)	-0.406*** (0.108)
Government Net Lending/Borrowing			0.065* (0.032)
Insitutional Factors			
Economic Freedom, Overall Score	-0.088*** (0.026)		
Trade Freedom	0.041*** (0.013)		0.036* (0.021)
Fiscal Freedom	0.036*** (0.013)	0.017** (0.008)	0.092*** (0.034)
Control of Corruption			0.076** (0.035)
Political Stability			-0.081** (0.036)
R-squared	0.803	0.789	0.759
Number of observations	285	285	152

Notes: Standard errors are reported in parentheses. *** significant at 1 percent level; ** significant at 5 percent level; and *significant at 10 percent level. Reported R-squared is the within R-squared from the mean-deviated regression.

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“Tax Credits and Firm Performance: Firm-Level Evidence from Taiwan”

Chia-Hui Huang (Aletheia University, Taiwan)

Many countries have adopted policies to improve industry environments and firm performances, as a good industry environment can support firm's technology improvement and contribute to the country's sustainable economic growth. The question is whether devoting resources to encourage firm performance is an appropriate usage of limited government funds? Thus, it is important to investigate how the impacts of government policy on the firm performance. Previous empirical studies have focus on developed countries, such as the U.S., Canada, and France. It also important to understand tax incentive schemes for newly-industrialized and developing countries.

Over the past three decades, Taiwan's government has undertaken several measures to encourage firm growth and to promote their technological capability. It has been very successful in narrowing the technological gap with its counterparts among leading countries, especially in the electronics industry. During the process of technological development, the Statute for Upgrading Industries (SUI) that applies tax incentive, subsidies, and supporting measures to assist firm growth as considered one of the important policy for Taiwan industrial technology. Therefore, our firm-level data from Taiwan provides new evidence in emerging countries to the existing literature that merely concentrates on developed countries.

Using a dataset of 621 large enterprises listed on the Taiwan Stock Exchange over the period 2000-2008, we examine the impact of tax credits on firm growth. Specifically, we assess the potential performance-enhancing effect on recipients of tax credits compared with their non-recipient counterparts. Moreover, the potential difference in the performance-enhancing effect between high-tech and non-high-tech firms is also examined. This study employ the technique of the propensity score matching and find the recipients of tax credits appear to have higher growth than non-recipients with similar characteristics. The performance-enhancing effect of tax credits is stronger in electronic industries relative to non-electronic industries. This result suggests that the tax policy has indeed improved firm growth in Taiwan. While the existence of the performance-enhancing effect brought on by tax incentives is intuitive, the estimates can provide insightful implications for the industrial technology policies.

“Corporate governance and firm performance: impact of the two-tiered board system & state ownership”

Ellen Rouyer (National Chiayi University, Taiwan)

While the unitary board systems of the US and the UK have been widely investigated, the two-tiered system, whereby a Management Board is in charge of running the business and a Supervisory Board composed of independent directors controls the managers, has not been subjected to as much scrutiny. This gap in the literature needs to be addressed as the two-tiered system is the norm in Germany and the Netherlands, and is also common in Belgium, France, Italy and Sweden. Using a sample of 250 large, publicly traded French companies for the years 2006, 2007 and 2008, I investigate the relationship between a number of corporate

governance variables and firms' performance, as measured by Tobin's Q. Results show that the number of surveillance board members and the percentage of shares they own in the company both have a significant and systematic negative impact on a firm's performance. These results could suggest that supervisory board members seek to moderate the actions of managers and thus bring stability, rather than focus purely on short-term financial performance.

"Correlation Risk in financial turmoil"

Chrysi Markopoulou (Athens University of Economics and Business, Greece)

Accurate estimation of correlation risk is of paramount importance in asset allocation and risk management. There is growing literature that discusses the pricing of the correlation risk as well as the magnitude of the correlation risk premium. Moreover, a number of studies have provided evidence of increased correlation during periods of high volatility, leading to diminishing diversification benefits when said benefits are most needed. In this paper, we propose a model-free method of evaluating correlation risk as follows. By definition, S&P 100 is a capitalization-weighted index consisting of stocks from several industries. Consequently, save for transaction costs and other market inefficiencies, an investor should be indifferent between an index option on S&P 100 and a capitalization-weighted portfolio of individual options on the constituents stocks. Intuitively, fluctuations in the price of the index options are associated with fluctuations of prices of individual options as well as fluctuations in the correlation structure. Therefore, any arising difference between the price of the index and the price of the portfolio may be attributed to variations of the correlation structure, namely correlation risk. We examine and evaluate the time-series behaviour of correlation risk using data on the S&P 100 options. Taking into consideration empirical results of increased correlation during bear markets, our analysis extends from the beginning of 2007 until the end of 2009, covering the period before, during and after the latest financial turmoil.

“Outward FDI and Productivity: Panel Granger-Causality Evidence for Taiwan’s Manufacturing Firms”

Tony Chieh-tse Hou (National Dong Hwa University, Taiwan)

The home country effects of outward foreign direct investment (FDI) have attracted widely attention in globalization debates. Recent studies have classified the relationship between outward FDI and firm’s productivity into two aspects. One is the firm’s learning-effect or the reallocation effect on its productivity which induced by outward FDI. The other one is the self-selection effect by estimating the function of outward FDI. However, the direction of Granger causality between outward FDI and productivity is less cleared, and this question is important for Taiwan as the country has witnessed an increasing outward FDI, especially to China in the past decade.

This study investigates the direction of causality between outward FDI and firm’s total factor productivity using a dataset of 347 large enterprises listed on the Taiwan Stock Exchange over the period 1997-2005. Employing the technique of the panel Granger causality test, we find the outward FDI Granger cause firm’s total factor productivity, vice versa. However, after consider the potential endogeneity problem, we only find the direction of causality from outward FDI to firm’s total factor productivity. More interestingly, the phenomenon of the post-FDI productivity effect is stronger in non-electronic industries relative to electronic industries. Our results indicate that, the reallocation effect on productivity induced by FDI in non-electronic industries is stronger than the learning effect on productivity induced by FDI in electronic industries.

Session E

“How does Openness to Trade Affect Government Size?”

Michael Jetter (University of Memphis, United States)

Alex Nikolsko-Rzhevskyy (University of Memphis, United States)

William T. Smith (University of Memphis, United States)

This paper revisits the relationship between a country's openness to trade and its size of the public sector. Although this topic has been heavily researched empirically, there has been surprisingly little effort to establish a sound theoretical foundation of this relationship. Rodrik (1998) models the link between openness and government size by modeling a small open economy subject to uncertainty about the terms-of-trade. Private sector production requires an imported intermediate good, so external risk may encourage workers to call for a stronger public safety net and switch to jobs in the safer public sector. Since then, a variety of papers have tested Rodrik's theory empirically (e.g., Alesina and Wacziarg 1997, Islam 2004, Benarroch and Pandey 2008, Ram 2009); some have confirmed it, while others have rejected it.

In light of these ambiguous empirical results, we develop a richer theoretical model of the interplay of openness, risk, and government size. External risk may indeed play an important role, as pointed out by Rodrik. However, we argue that other forces may be at work. First, there may also be internal risk. This may strengthen or weaken the incentive to “hedge” against external risk by expanding the public sector, depending upon the correlation between internal and external shocks. Second, the possible gains (or losses) from increased trade should not be neglected in this analysis. In Rodrik's terms, openness to trade may not be solely modeled as a mean-preserving spread of the terms-of-trade. The increased size of markets could cause gains from trade (or losses), so that the change in the distribution of the terms-of-trade might not necessarily be mean-preserving. The model will predict a broader set of conditions under which the correlation between openness and government size will be positive or negative. Taking all of these factors into account suggests that, empirically, the overall effect of opening trade borders on the size of government should depend on various country-specific parameters. In addition to providing an intuitive theoretical model, our goal is to test its results empirically.

“Assessing the Endogeneity of OCA Conditions in EMU”

Isabel Vieira (University of Evora, Portugal)

Carlos Vieira (University of Evora, Portugal)

Is EMU more justifiable *ex post*? Yes, was the straightforward answer of Frankel and Rose in a 1997 paper. Not for all members, suggests our evaluation of EMU's first decade, based on the observation of OCA indices computed from panel data estimates of a model explaining exchange rate variability with OCA-related determinants. This paper assesses the endogeneity of OCA properties, a hypothesis that received much support in *ex ante* analyses and may have motivated peripheral countries' will to enter EMU at the first chance, in the

hope that membership would facilitate real convergence. The results show that, after ten years of monetary integration, the endogeneity hypothesis is not verified for all participating countries. Our study also suggests that, in retrospect, the OCA index would have been a better indicator of the candidates' readiness to join the single currency, and may serve as a useful tool to countries now queuing for the euro.

"The Financial Imbalances and Financial Fragility"

Frederic Boissay (Senior Economist, European Central Bank)

This paper develops an equilibrium model to analyze the link between financial imbalances and financial fragility. Financial imbalances primarily refer to the rapid growth of the market-based banking sector (e.g. in terms of size and leverage) with respect to the rest of the economy (e.g. real sector productivity). Financial fragility refers to the coexistence of two self-fulfilling expectation equilibria on the wholesale financial market. The "normal time" equilibrium is characterized by a deep wholesale financial market with highly leveraged financial institutions. The "crisis time" equilibrium is associated with deleveraging, a market run, and liquidity hoarding. These two equilibria do not always coexist: the wholesale financial market is fragile only when there is too much savings and liquidity with respect to investment opportunities. In fact, the economy is shown to have a limited liquidity absorption capacity, which depends notably on real sector productivity. I extend the model in order to analyze the effects of financial integration of an emerging and a developed country on the fragility of the international financial system. I find results in line with the recent literature on global imbalances (e.g. Mendoza et al. 2008, Caballero et al., 2008). On the one hand, financial integration permits a more efficient allocation of savings worldwide in normal times. On the other hand, however, it also implies a current account deficit for the developed country. The current account deficit makes financial crises more likely when it exceeds the liquidity absorption capacity of the developed country. Implications of financial integration and global imbalances in terms of output, welfare, wealth distribution, and policy interventions are also discussed.

“Asymmetric Baxter-King filter: business cycle estimation in real time”

Buss Ginters (Central Statistical Bureau, Latvia)

The paper proposes an extension of the symmetric Baxter-King band pass filter to an asymmetric Baxter-King filter. It turns out the optimal correction scheme of the ideal filter weights is the same as in the symmetric version, i.e, cut the ideal filter at the appropriate length and add a constant to all filter weights to ensure zero weight on zero frequency. Since the symmetric Baxter-King filter is unable to extract the band of frequencies at the very ends of the series, the extension to an asymmetric filter is useful whenever the real time estimation is needed. The paper assesses the filter's properties in extracting business cycle frequencies, in comparison to the symmetric Baxter-King filter and symmetric and asymmetric Christiano-Fitzgerald filter, by using Monte Carlo simulation. The results show that the asymmetric Baxter-King filter is superior to the asymmetric Christiano-Fitzgerald filter for the whole sample space, including the very ends of a sample, thus indicating that the asymmetric Baxter-King filter should be preferred over the asymmetric Christiano-Fitzgerald filter in real time signal extraction exercises.

“Media bias and central bank response. Evidence from the nominal exchange rate behavior in Colombia”

Rodrigo Taborda (Universidad del Rosario, Columbia)

Colombia introduced a market-determined Nominal Exchange Rate (NER) with the US Dollar in 1991, after more than 20 years of controlled and multiple exchange rates. The first nine years the NER was set by an exchange rate band system, since 1999 the exchange rate is determined in a “dirty float” market. The behavior (revaluation / devaluation) of the NER is constantly reported in news, editorials and op-eds of major newspapers of the nation. This paper shows that there is media bias in favor of reporting a revaluation episode in contrast to a devaluation one. At the same time Colombia's central bank allegedly intervenes in the exchange rate market to reduce volatility. However, it is also shown that the central bank buys US dollars to lessen a revaluation event as a response to the media bias and not volatility. It is also found that the media bias was higher during the exchange rate band system in contrast to the free market period

Session F

“The impact of group-based programme: Evidence from Ghana”

Paul Onyina (Macquarie University, Australia)

Following the perceived success of the Grameen Bank and other microfinance institutions in recent years, the role of microfinance as a potential policy tool for poverty alleviation has received great attention. Empirical evidence from existing research shows *some* positive signs in poverty reduction from *some* microfinance schemes. The aim of this paper is to add to the existing literature by evaluating the impact of a group-based lending programme on clients who received credit from the Sinapi Aba Trust of Ghana. We grouped clients into new and old, and then evaluated the impact of the programme on each group. The analysis shows that *old clients* have received greater benefits and are more empowered from the programme compared to *new clients*. However, on average new clients receive larger volumes of credit. We construct empowerment indicators finding that years of borrowing from the microfinance scheme determine the level of empowerment. The analysis further show that *old clients* are more likely to acquire assets, save beyond group dues, increase food consumption, and spend larger amounts on their children’s education than *new clients*.

1 Introduction⁵²

The role of microfinance institutions (MFIs) as a potential policy tool for poverty alleviation has received increasing attention around the world in recent years. Empirical evidence from existing research demonstrates positive impacts from some microfinance schemes (see, for example, Pitt and Khandker 1998; Pitt et al 2003; Pitt et al. 2006; and Maldonado and Gonzales-Vega 2008). Yet, other studies show mixed and even negative results, and suggest that many MFIs are concerned with profit from their operations (see Goldberg 2005 for a review) rather than poverty alleviation. As a result, the poorest of the poor do not gain from such schemes (Amin, Rai and Topa 2003).

This paper carries the argument further and evaluates the impacts of an MFI group-based programme to poor borrowers in urban communities in Ghana. Analysis of the data collected shows that apart from clients portraying a spirit of entrepreneurship, they are empowered in other areas. New participants of the scheme, on average, receive bigger loans but our result shows that longer-term participants have received greater benefits. We constructed empowerment indicators from the survey instrument and found that *old clients* received greater impact than *new clients*. Some of the specific impact includes asset purchases, consumption smoothing, employment creation and improvement in the earnings of regular income.

1.1 Group-based Lending

⁵² This paper forms part of a study undertaken in Ghana for a PhD thesis at the Macquarie University in Sydney.

Group lending refers to a situation where MFIs provide credit to their clients who form self-selected groups. Group members differs from scheme to scheme (Armendáriz de Aghion and Morduch 2005). In group-based programmes no collateral is required to receive loans. Instead group members monitor themselves to ensure none defaults. In his celebrated work, Stiglitz (1990) used the expression 'peer monitoring', and contends that it is an important factor in the achievement of many group-based lending programmes. A body of theoretical and empirical literature on group-based peer lending among others could be found in Stiglitz (1990); Besley and Coate (1995); Morduch 1999; Ghatak (1999); Armendáriz de Aghion and Gollier (2000); and Armendáriz de Aghion and Morduch (2005).

2 The Description of Data

To investigate and assess the impacts of group-based schemes, we collected data between July and September 2009, from 672 clients of 'Sinapi Aba' Trust (SAT), a leading MFI in Ghana. The SAT, like most microfinance institutions provides group-based loans to clients. We selected clients randomly without replacement during community meetings at many SAT branches. However, in some centres, clients attended meetings at irregular intervals, so a systematic sampling method (every third client) was interviewed. The gender composition of clients in the data is 87 percent female and 13 percent male. Selection bias is a major problem that researchers encounter in impact assessment of microfinance schemes; we deal with this important issue in the following section.

2.1 Dealing with Selection Bias

Impact assessment studies usually face several problems (Hulme 2000). One such problem is selection bias. This arises because of non-random sampling of firstly, clients to participate in the programme, and secondly, non-random placement of programmes. Since clients are not randomly selected, borrowers of the programme and non-borrowers may differ in many ways. Therefore, in order to reduce selection bias in any assessment study, such key endogeneity issues should be considered (Pitt and Khandker 1998; Maldonado and Gonzales-Vega 2008). Secondly, programmes are not randomly sited but based on criteria. Accordingly, linking microfinance services to differences in measured outcomes under these circumstances may be mistaken due to selection bias, and non-random placement of programmes.

This paper uses Maldonado and Gonzales-Vega's (2008) approach to minimize selection bias. To control for any possible unobserved characteristics that may affect programme participation, we alienated the sample into two — old and new clients, but did not capture the *dropout rate*. We conferred with programme officers and clients, and established that SAT had no hand in the selection of clients; entry is determined by group members.

Additionally, since programmes are sited in poor urban communities, the localities have similar characteristics. After controlling for these, the disparity in impact of the programme between the groups can be classified as programme outcomes, as our expectation that the regression estimates are not biased. Also, the individual characteristics of the sub-sample of the two groups are closely related. Descriptive statistics of the individual clients in the two groups show no significant differences.

Table 1: Main Statistics for Old and New Clients Sub-groups

Variable	New Clients				Old Clients			
	Mean	Std dev.	Min	Max	Mean	Std dev.	Min	Max
SEXHH	0.319	0.468	0	1	0.314	0.466	0	1
HSIZE	4.256	1.660	1	10	4.364	1.718	1	10
RESAGE	40.112	8.686	21	65	40.686	7.569	25	65
EDUCAT	2.614	0.826	1	4	2.678	0.761	1	4
Observation	544				118			

2.2 Loan Statistics

SAT provides progressive lending to the groups. In progressive lending, clients receive tiny loan amounts at first and, with additional loan amounts increasing based on good repayment behaviour. A careful examination of loans procured by clients (shown in the main study) indicate gradual increases in loan size, such that by the time a client takes the fifth loan, the size might have increased by almost 10 times. A further observation is that, generally, new members had received relatively larger loans. On average, 'new clients' take greater loan amount than 'older clients'.

3 Description of Variables

We construct empowerment indicators from a set of the survey questions and use them as dependent variables. We then run a logit regression model to estimate the effects of the independent variables on the dependent variables which are the empowerment indicators of overall empowerment. We constructed the indicators in ways similar to Hashemi et al. (1996); and Garikipati (2008). In designing the questions, we considered empowerment in relationship to the Ghanaian society as a whole. The outcome variables employed in our data for empowerment were reduced to dichotomous variables to run logistic regressions (see Amemiya 1981; Hosmer and Lemeshow 2000). A cut-off point was made for most of the variables around the 25th to 35th percentile. Researchers define empowerment in different ways (see, for example, Rahman, 2007, Kabeer 2001; Goetz and Sengupta 1996). In this paper however, we have defined empowerment as: *the ability to own assets*;

able to save; able to spend on child education; and having improved household food consumption. We construct and describe the variables in the next section.

3.1 Dependent variables

a) *Asset Ownership* (ASSETS): Great admiration is attached to assets ownership in Ghana. The use of assets here includes property of any form that a client has acquired since they joined the programme. Those that have acquired assets of any form were coded 1, and 0 otherwise.

b) *Ability to Save against Risk* (ABSAVE): Savings helps people to deal not only with emergencies but also more routine risks. SAT clients pay group dues (that cannot be withdrawn even in 'hard times') during weekly meetings. Beyond compulsory group savings, some clients do other savings (i.e. saving with a *Susu* collector or ROSCA or both). A client with more than one savings was coded 1 and 0 otherwise.

c) *Improvements in Food Expenditure* (FDEXP): One point was awarded if a client had benefited from the credit in food expenditure otherwise zero. If expenditure was greater after they joined the scheme, one point was awarded and zero otherwise. A client with a total score of 2 was assumed to be less vulnerable and coded as 1, otherwise zero.

d) *Expenditure on education* (EDUEXP): Educating a child is important in a society; the group-based programme helps clients to achieve this aim. A score of 1 was awarded a client with expenditure on education otherwise 0.

e) *Composite empowerment* (EMPOWER): A client was classified as empowered and coded 1, if for all the (4 indicators listed here) he or she had a score of 3 or 4 and 0 otherwise.

3.2 Independent Variables

We used three different types of independent variables in the regression model: loan variables; clients' household characteristics; and individual personal characteristics.

Programme Variables: a) *Number of years with SAT* (SATDUR): Clients who have borrowed for over three years were classified as 'old clients', and 'new clients' were those who have borrowed for less than three years. 'Old client' were coded 1 otherwise 0.

b) *Average loan size received* (AVLOAN): We divided total loan received by number of loan(s) to compute average loan size.

c) *Before SAT loan* (LBSAT): Clients who received loans from other sources before they joined the programme were coded 1, and 0 otherwise.

Household Characteristics: a) *Head of household gender* (SEXHH): Female household heads were coded 1 otherwise 0.

b) *Household size* (HSIZE): The size of the household.

Respondent's Characteristics: a) *Respondent's age* (RESAGE): The age of the respondent.

b) *Respondent's education (EDUCAT)*: We used respondents' education as a categorical variable. It takes the value of 1, 2, 3 and 4 (where 1 represents no schooling years, 2 corresponds to basic school or up to 10 years in schooling, 3 represents secondary school or between 10 to 13 years of schooling, and 4 represents tertiary education or over 13 years of schooling).

The descriptive statistics of the variables are shown in Table 2. The general equation that we use to estimate the logit regression model is:

$$Y = \beta_0 + \beta_1 SATDUR + \beta_2 AVLOAN + \beta_3 LBSAT + \beta_4 SEXHH + \beta_5 HSIZE + \beta_6 RESAGE + \beta_7 EDUCAT + \epsilon_i \quad (1.1)$$

where Y is a dependent variable, α is the intercept, the β 's are the parameters of the independent variables to be estimated and ϵ_i is the unobserved term, other variables are as defined above.

Table 2: Descriptive Statistics for the Variables

variables	Mean	St dev.	Min	Max	Sample
Dependant variable					
<i>Empowerment Indicators</i>					
FDEXP	0.380	0.486	0	1	672
ABSAVE	0.700	0.460	0	1	672
ASSETS	0.390	0.488	0	1	672
EDEXP	0.440	0.496	0	1	672
EMPOWER	0.270	0.445	0	1	672
Independent Variables					
SATDUR	0.180	0.318	0	1	672
AVLOAN	559.747	329.906	80.00	4933.330	672
LBSAT	0.250	0.435	0	1	672
SEXHH	0.320	0.465	0	1	672
HSIZE	4.28	1.839	1	10	669
RESAGE	40.210	8.498	21	65	672
EDUCAT	2.63	0.815	1	4	672

4 Empirical Results: Effects of Credit on the Empowerment Indicators

The regression results are presented in Table 3 showing the odds ratio and the confidence intervals. Statistical significance at ($p < 0.05$) is shown when the confidence intervals do not contain 1. Each dependent variable represents a one equation.

Table 3: Effect of the Independent variables on the dependent variables reporting coefficients, odds ratio and 95 % confidence intervals from logistic regression model

Independent Variables	Dependent variables					
	ASSET		ABSAVE		FDXEP	
	Odds Ratio	95% C.I*	Odds Ratio	95% C.I	Odds ratio	95% C.I
SATDUR	5.1458	(3.2608, 8.1203)	1.7862	(1.1127, 2.8675)	1.5344	(1.0083, 2.3351)
AVLOAN	1.0007	(1.0001, 1.0012)	0.9994	(0.9989, 1.0000)	1.0003	(0.9998, 1.0008)
LBSAT	1.2472	(0.8380, 1.8564)	2.0355	(1.3210, 3.1367)	0.6074	(0.4063, 0.9080)
SEXHH	0.6217	(0.4141, 0.9333)	1.4911	(0.9944, 2.2359)	2.2238	(1.5163, 3.2614)
HSIZE	0.9028	(0.8090, 1.0075)	0.9968	(0.8977, 1.1070)	1.2879	(1.1607, 1.4290)
RESAGE	0.9532	(0.9318, 0.9752)	0.9827	(0.9616, 1.0043)	0.9875	(0.9668, 1.0087)
EDUCAT	1.1293	(0.9096, 1.4022)	1.0300	(0.8344, 1.2715)	1.0021	(0.8174, 1.2285)

Table 3 (continue)

Independent variables	Dependent variables			
	EDEXP		EMPOWER	
	Odds ratio	95% C.I.*	Odds ratio	95% C.I.
SATDUR	2.2477	(1.4408, 3.5065)	3.3739	(2.1914, 5.1945)
AVLOAN	1.0008	(1.0002, 1.0014)	1.0007	(1.0001, 1.0012)
LBSAT	0.5432	(0.3598, 0.8202)	1.0528	(0.6858, 1.6164)
SEXHH	3.0180	(1.9965, 4.5620)	0.7266	(0.4709, 1.1211)
HISIZE	1.6175	(1.4371, 1.8204)	1.0141	(0.9039, 1.1377)
RESAGE	0.9731	(0.9514, 0.9952)	0.9721	(0.9488, 0.9961)
EDUCAT	0.8784	(0.7096, 1.0875)	1.2090	(0.9563, 1.5285)

* CI is Confidence Intervals

Statistical significance ($p < 0.05$) is shown when 1 falls outside the confidence intervals.

4.1 Assets Ownership (ASSETS)

Central to this study, an important finding here is that the odds ratio for the number of years with SAT is 5.14, and statistically significant. This suggests that 'old clients' are 5.14 times more likely to own assets than 'new clients', thus, the longer the years a client borrows from the scheme, the more assets the client is likely to purchase.

This outcome is similar to most findings in the literature where microfinance clients become enabled to own assets when they participate in such programmes (see Garikipati 2008; Pitt and Khandker 1998; Hashemi et al. 1996). Again, the odds ratio of average loan size received is 1.0007 but not statistically significant. Gender of household head is negatively related and significant, suggesting that female household heads are less likely to purchase assets than male household heads. The odds ratio for respondent's age is 0.953 (negatively related) and statistically significant; suggesting aged client is less likely to purchase assets than younger clients.

4.2 Ability to Save (ABSAVE)

Clients' ability to save cushions them during unforeseen events, and other life emergencies and thus reducing their vulnerability to risk. The odds ratio of SATDUR is 1.79 and statistically significant. This suggests that 'old clients' are 1.79 times more likely to save against risk and are less vulnerable than 'new clients'. It implies that the longer the clients borrow from SAT, the higher they are likely to save to cushion themselves against income changeability. The odds ratio of pre-SAT loans is 2.04 and significant, suggesting that clients who took loans before they joined the scheme are 2.04 times more likely to save than clients' who did not take such loans. The gender of household head is positively related but not significant. Though not important determinant, it suggests

that female household heads are more likely to save (with the *Susu* collector and or be a member of a ROSCA) than male household heads. Of course, in practice, most *Susu* customers are female. Average loan size received by clients, household size, clients' age, and education categories of client are statistically not significant; however, only education level is positively related, thus, educated clients are more likely to save.

4.3 Food Consumption (FDEXP)

Membership duration (SATDUR) is related to FDEXP by 1.53 times and statistically significant; this suggests that 'old clients' are 1.53 times more likely to purchase food than 'new clients'. Thus, it means 'old clients' had received greater impact compared to 'new clients' in food purchase. The odds ratio for SEXHH is 2.22, suggesting that female household heads are 2.22 times more likely to spend on food than male household heads. The size of the clients' household is suggestive of expenditure on food. Odds ratio for household size is 1.29 suggesting that large families of 8 members for example, are 1.29 times more likely to spend on food than a family of say, 5 members. In contrast, years of schooling, average loan size of clients, and age of clients are not statistically significant. The survey results suggest that a female client who is also the head of the household, and has participated in the programme for more than three years, is better placed to increase the household's food consumption than her colleague who had participated in the programme for less than three years.

4.4 Expenditure on Children's Education (EDEXP)

With the support of MFIs group-based programmes, most clients are likely to spend a lot more on their children's education. Such expenditure, in most cases, is likely to be in two ways. First, it is likely that clients make additional expenditure on children who are already in school. Second, and since microfinance clients earn 'higher' income, they send more children to school. Our results show that the odds ratio for membership duration (SATDUR) is 2.25 and significant, suggesting that 'old clients' are 2.25 times more likely to spend on their children education compared to 'new clients'. Other significant and positively related variables are gender of household head (with odds ratio of 3.02), average loan size and household size. Before SAT loans and clients' age are significant, but negatively related.

4.5 Composite Empowerment Indicator (EMPOWER)

With the composite empowerment, the length of a client's relationship with the programme has an odds ratio of 3.37 which is statistically significant. This suggests that 'old clients' are 3.37 times more likely to be empowered

than 'new clients' based on overall empowerment. Average loan is also positively related and statistically significant, suggesting the importance of average loan size received. On the other hand, the age of the respondent is negatively related and significant. This suggests that empowerment reduces with the increase in the age of the client.

We tested the robustness of the results based on two of the methods Garikipati (2008) used. First, we used 'backward stepwise regression' to check SATDUR which begins with the full or reported model, and variables that are not significant illuminated in an iterative process. We tested the fitted model when a variable was illuminated. The aim was to make sure that the model fits the data adequately. The analysis is accomplished once all variables are significant. We then used the likelihood ratio test to accept the illuminated variables or otherwise. The analysis indicated stable SATDUR coefficients throughout the process, suggesting that our conclusions made on membership duration on the credit programme are robust. Second, we tested the significance of each of the indicators separately before it was developed into the indicator. At the individual level, we found that the important variables maintained their signs and significance.

5 Conclusion

This paper set out to identify the impact of group-based programmes using a survey of SAT clients in Ghana as a case study. Clients were split into two groups — new clients who have borrowed from SAT for less than three years, and old clients who have borrowed from SAT for more than three years. We found that, even though 'new clients' on average received larger loan, 'old clients' had received greater benefits. 'Old clients' on average had earned higher monthly incomes than 'new clients'. The results of the regression suggest that membership duration in the programme is an important determinant of asset ownership, the level of spending on a child's education, the ability to save against risk, and improvements in food consumption. In all these areas, old members of the group-based programme were more likely to have received comparatively greater benefits. These findings largely concur with most others in the literature in suggesting a vital role for MFIs group-based lending in poverty alleviation.

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“Use of Expert Methods to Evaluate Uncertainty of Investment Process in Innovative Organizations”

Kusheleva Irina (St. Petersburg State Polytechnic University, Russia)

Dmitry Rodionov (St. Petersburg State Polytechnic University, Russia)

The article is dedicated to the potential of expert methods when being used to evaluate environment uncertainty of investment processes in organizations involved in innovative activities.

In the context of the Russian economy, the environmental uncertainty of investments has a tendency to grow. It is confirmed by the statistical data on dwindling investments into organizations, whose development forms an innovative vector of the economy (research and educational organizations).

Uncertainty can decrease only in case investment priorities are accommodated among all the participants of the investment process, who, in the context of Russia, are federal and local legislative and executive bodies, investors and investors' partners in the recipient country. The article reveals criteria and objectives for each of the investment process participants, defines the degree of their impact on the environmental uncertainty. It also states the conditions for taking an accommodated investment decision, whose implementation contributes to the decrease of the environmental instability and investment risks.

The results of the multidimensional expertise are suggested as a criterion for making such a decision that decreases environmental uncertainty. The processes of the expertise with regard to investment decisions are described in detail. They help to identify the investor's value chain, which forms investment priorities. The results of the examination say that economic growth, active anti-crisis methods with relatively lower, comparing to the developed countries, labor costs and raw materials availability are the factors which allow forecasting growth of foreign investment. The value chain formed by the investors reveals prevailing of the 'anti-cycling' index. I.e. investments into the instable Russian economy provided there are certain legal safeguards can be seen as a mechanism to decrease instability in the investing country. Economic and financial criteria as such (benefits of mass production and low production costs) turn out to be last on the list.

Introduction

The processes in the investment sphere depend to a large extent on the general economic situation, above all, on the dynamics of production and inflation, direction and type of the economic development, stability of legal control, condition of the finance and credit system and level of the effective demand.

Today, the Russian economic system sees some negative trends, primarily related with constant modifications of legal, administrative and financial environment, caused both by the necessity to redirect the economic development (to modernize) the country and by the world's financial crises effects. This results in the growth of entropy in the business environment of economic agents which primarily affects investment processes in a negative way. Uncertainty of the investment environment leads to lower activity of its participants with the trend

being more visible in case the investment recuperation period gets longer. This circumstance imposes certain requirements on strategic plans. Certain methods to raise investment and options to finance venture companies are needed, as well as different approaches to apply the mother corporation's potential and different strategies to stand down business. For innovative organizations the uncertainty of investment processes, related with the environmental uncertainty, produces increased risks with consequent decrease in activity in this business. That's why examination of ways to expand tooling backup to take decisions in the sphere of investments into innovative activities seems important both from theoretical and practical standpoint.

Today, Russian government has declared the policy of modernization and innovative character for the economy development. Urgency of this policy cannot be doubted, since today Russian economy depends largely on export of raw materials (mainly, oil and gas) and correspondingly on the energy products prices in the world market, on the condition of the world financial system, when importing technology and equipment at the same time (Postalyuk P.M. 2009). However, practical implementation of the policy is rather contradictory, since measures proposed often do not meet the consistency requirements. Objectives to modernize Russian economic system are to be reached under the effects of the world financial crisis, which has resulted in budget deficit (Belkin V.D. 2009). Taking into account the necessity to maintain social programs, this has diminished significantly the capacities of the country in the field of financial support for the innovative sphere. In its turn, the investment activities of private investors are seen to have fallen dramatically. Only by the end of 2008, innovative market losses comprised around 400 billion rubles. According to the statistics of the National Association of Innovations and Information Technology Development (NAIITD) the investments into innovations decreased by 70-80% in 2009. Big corporations reduced their investment up to 90%, business angels up to 60% and venture funds up to 45%. So, in effect, private investments have been decreased considerably (Belova A.N. and Zaslavsky A. 2009). At the same time the state financial support cannot be considered sufficient. Statistics say that funding of the innovative activities, even though the policy of modernization and innovations in the economy of Russia has been proclaimed, grew only by 0.1% in 2009. One gets confused when analyzing the data on the structure of the investments into the capital stock of the organizations which influence innovative development (Table 1). The authors refer to the organizations involved in scientific research and development and educational institutions.

Table 1

Dynamics of the investments contribution into the capital stock of innovative organizations

Economic activity of innovative organizations 0	200	2003	2004	2005	2006	2007	2008	2009
Research and development	0,5	0,7	0,6	0,5	0,5	0,4	0,5	0,7
Education	1,3	1,5	1,8	1,9	2,1	2,2	1,9	1,8

As the table says, the proclaimed governmental policy of innovative development vector not only fails to get implemented in the processes of economic environment, but, on the contrary, there are trends to reduce investment resources of the innovative sphere. The investments, contributed into the capital stock of educational institutions have been reduced in the total volume of the investment contribution in all types of economic activities for the past three years; the investments into the capital stock of scientific research and development organizations have reached the level of year 2003, which means one cannot speak about any serious growth with

a potential to change the direction and type of development. As for innovative entrepreneurship, its major problems in Russia are contradictory legal regulation, ineffective activity of funds which support innovative enterprises, and lack of financial resources.

Thus, today we can mention two public investment funds meant to form financial resources for Russian innovative organizations. They are Russian Venture Company (RVC) and Rosinfocominvest fund. The latter, despite being set up as early as 2006, started its activities in 2009 due to different red tape barriers. As for RVC, we can speak with confidence about it being low-effective. Thus, according to the experts, the financial resources have been allocated by this institution prevalingly to invest into foreign innovative business (more than 70% of all funds). This even resulted in the inspection into the institution's activities by the law bodies on the grounds of inappropriate use of the public funds. RVC operated on the basis of the 'fund of funds', when the government institution provides private companies with public funds but, at the same time, does not bear any responsibility for their effective use. That's why the institution is being restructured which means that this financial vehicle is practically inaccessible now.

Thus, innovative organizations, on one hand, continue their operations under the conditions of low predictability of the legal environment and, on the other hand, obvious lack of financial resources. Moreover, the governmental policy of modernization of the economy results in constant changes of the legal environment that are often impossible to foresee (since, no doubt, they are related to changes of the legal regulations). However, this fails to entail considerable growth of financial support. Development and implementation of separate big innovative projects aggravates the problem related with the fundraising for the innovative organizations that already exist. In this respect, it is worth mentioning, that now the uncertainty of investment processes, connected with the growth of the environmental uncertainty, is increasing.

Investment processes in innovative enterprises can be ensured by means of different financial sources (vehicles), which should include:

- funds, allocated for the development of the innovative sphere in terms of special purpose federal programs, including the ones which are to activate modernization processes;
- grants, provided by the federal executive bodies;
- grants and subsidies, provided by the regional governmental authorities;
- funding by venture funds;
- funding by governmental investment funds and non-governmental organizations;
- funding by private investors, including foreign ones;
- innovative enterprise's own funds: retained profits and depreciation fund.

Under the conditions of meeting the effects of the financial crisis, which has increased the environmental uncertainty, resulted in reduced financial resources of the government, decreased capacities of enterprises themselves, and caused fall in the private investments levels, foreign investments are becoming a vital source of funding.

Insufficient funding, growth of the environmental uncertainty make the management of the innovative organizations meet the objective to define priorities when developing strategic plans for attracting investments,

including foreign ones. Under today's conditions it is foreign investment that appeals to innovative organizations, as, due to the aforementioned reasons, it is hard to gain financial support inside the domestic economic system.

Conditions and characteristics of accommodated partners' interests when attracting investments

Investment processes take place in the environment whose characteristics are affected in a different way by the economic system agents. The authors of the present article identify participants of the investment process (participants or partners of the investment process are considered to be those economic system agents, whose interests, preferences and activities form characteristics of the investment process). Taking into account the federal state structure of Russia, such participants are:

- federal legislative bodies, which define legal treatment of the investor's activities;
- federal executive bodies, which implement the legal treatment of the investor's activities;
- regional legislative bodies, which correct and supplement legal treatment of the investor's activities within the limits of their authority;
- regional executive bodies, which implement federal and regional components of the legal treatment of the investor's activities;
- the investing company;
- the investor's partner company in the recipient country.

The analysis of the Russian investment processes shows that each participant has his own, specific goals, on the basis of which he defines the criteria of their activities (Matsnev O. 2006). The characteristics of the participants' goals and spheres of influence are given below.

1. The federal legislative bodies (FLB) as agents with function to control national resources – definition of conditions and access limits and foreign investors' functioning in the national economy for growth of the budget profits. The term 'access' herein also includes possible tax and non-tax incentives and preferences.
2. The federal executive bodies (FEB) as agents with the control function – control over the foreign investor's compliance with the conditions and limits of functioning, including tax revenues into the budget, as well as control over regional legislative and executive powers in the field of collaboration with foreign partners.
3. The regional legislative bodies (RLB) as agents with control over regional resources – definition of conditions and access limits and foreign investor's functioning to ensure that a definite region is more attractive in comparison with neighboring regions, to the extent limited by the federal law.
4. The regional executive bodies (REB) as agents with regulatory function – control over compliance with the legislation within limits of their authority.
5. A foreign investor (FI) – profit taking due to exploration of resources that belong to the investing company.

6. Foreign investor's partner companies (FIP) – profit taking out of resources that belong to this company. These investment process participants, due to their capacities to influence the environment, form a pyramid (Fig.1), where upper blocks are more influential than lower ones with regard to political and juridical capacities of the investment process. Correspondingly, the higher the position of a participant is in the pyramid, the more power he has to change the characteristics of the environment and, thus, to increase or decrease its uncertainty. Obviously, the participants' interests can contradict with each other and result in increased investment risks (Campbell K. 2008).

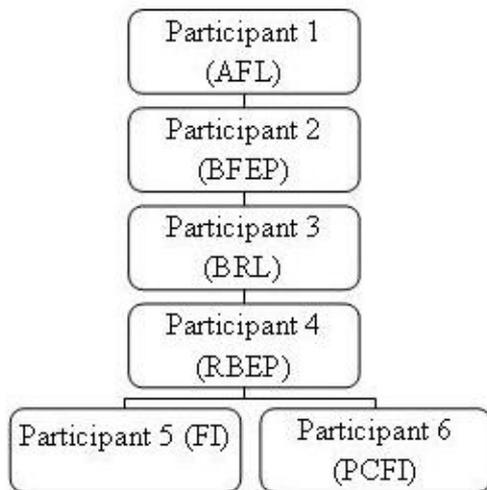


Fig.1. Hierarchy of investment process environmental impact made by its major participants (partners)

The first four blocks are strictly hierarchical and based on the narrowing responsibility in the field of regulation: from the national economy level to the regional one. The time interval of responsibility is defined by the terms of office for the participants of the process and depends mostly on the institutional business environment. It implies, in the first place, frequency of authorities change on all levels both under the law and as a result of political decisions. Russian political and economic system has specific features leading to the situation when participants (partners), who define investment environment, take decisions which often should be implemented within the time limit exceeding the terms of office of this particular participant.

The time interval of responsibility of the participants, presented in blocks 5 and 6 as agents with ownership function, is potentially not limited; it is actually defined by the economic feasibility of activities in this country and periods within which investment projects are being implemented. Thus, there is contradiction between limited validity periods and instability of political and legal basis for investors' business and their long-term strategic interests in the country.

So, to make the mechanism of foreign investments attraction effective, it is essential to accommodate interests and priorities of all participants (partners) of the investment process.

An effective investment mechanism can be built in case interests of the agent with ownership function dominate, i.e., in this case, those of the investing company, and the criterion of the accommodated decision can be defined as follows: 'To provide capacities for production use of the invested capital in terms of the national legislation within unlimited time interval'. This criterion, being fixed on the federal level, can result in dramatic decrease in

the investors' anxious expectations and reduce instability forecast by them. This refers to the legal component of the foreign investments attraction mechanism, which is being developed in terms of certain policy. The directions of such policy can have different vectors, for example:

- policy of foreign investments and trade restriction up to their absolute embargo in most industries;
- policy of foreign capital restriction in a national company, implying strict tax regime for foreign investors, limitation of profit export, complicated procedure for investment capital return;
- policy of foreign investments stimulation (tax and duty exemption, insurance of foreign investors' risks, etc.).

The metropolises Moscow and St. Petersburg hold a unique position in Russian economy, being a sort of locomotives, experimental grounds to build an effective mechanism of foreign investments attraction. For St. Petersburg (population almost 5 million people, excluding migrants), due to its beneficial economic and geographic position and high industrial and scientific potential, it is natural to use the policy of foreign investments' stimulation. Referring to its content there can be suggested the following priority areas for the activities of investment process participants (partners), who perform regulatory functions and define characteristics of the environment:

1. In the field of creation of favorable regulatory conditions of the investment process – law-making job of the city representatives in the federal legislative bodies (the Federation Council and State Duma) related with development and approval of the legislation which limits ownership rights and relations, and, thus, decreases environmental instability of the investor's activities. Urgent regulatory acts, which define the investment climate in St. Petersburg, should include:

- St. Petersburg law [«On participation of St. Petersburg in public private partnerships»](#);
- Law of St. Petersburg "On strategic investment projects, strategic investors and strategic partners of St. Petersburg";
- Decree of the St. Petersburg Government N1592 dated 21.09.2004 "On enactment of the Order to make decisions about allocation of properties for construction and reconstruction";
- The Decree of St. Petersburg Government N 2020 dated 21.12.2004 "On the order of interaction between the St. Petersburg executive governmental bodies when defining investment conditions for acquisitions by St. Petersburg of non-residential properties, which are needed for dispositions of social facilities, on the territory of St. Petersburg";
- Decree of the St. Petersburg Government N 61 dated 01.02.2006 "On enactment of the Order of interaction between the St. Petersburg executive governmental bodies and St. Petersburg public organizations regarding incurrence of liabilities by the investors".

2. In the field of organizational and procedural work to organize investment process, the following directions should be considered as perspective ones:

- tax and duty exemption from the contribution to the city budget for the companies with foreign participation, created in the sphere of science and scientific service, as well as in the field of innovations' commercialization – so as to use the scientific potential of the city to the maximum – for the period of up to 3 years from the moment of registration;

- tax and duty exemption from the contribution to the city budget for the companies with foreign participation, which bear costs for reconstruction and redecoration of historical monuments and improvement of the city in the amount not less than the amount of tax payments.
- development of the long-term investment program in St. Petersburg on the basis of business objectives and priorities of foreign investors accommodated with the city government and attraction of investors to work at it on a competitive basis;
- development of the methods to define incentive rental rates and insurance of conditions and terms of rent with a mandatory compensation by the city (under the guarantee of a first-class bank) of the losses the company bears in case the provisions of the contract are violated.

The authors of the article believe that distrust and adaptation difficulties of the foreign investors towards the conditions of financial and business operations in Russia root in the considerable differences in the roles of ownership and regulatory functions. While the stability of traditional market structures is based on the dominance of ownership function, which works, as described above, in the non-limited time interval, the transit economy is characterized with hypertrophy of regulatory function, which works in the time interval limited with power authorization and some other non-economic factors. Modifications of the administrative institutions diminish the time interval of the regulatory agent and increase the feeling of “temporary worker” which it objectively has.

Moreover, state monopolizing, which is a characteristic of our country’s economy, is dangerous, apart from negative features of any monopoly, because it also considerably deforms the controlling functions of the government over the ownership agent. In fact, in the chain “ownership agent – regulatory agent – user agent”, due to the hierarchy of the specific interest, each previous agent is also in the control function towards the next agent and has the right to substitute the latter, in case there are contradictions between their specific interests. One can draw a conclusion from the analysis performed that the investment process in Russia can become sustainable only provided that the legal treatment of this process is based on the dominance of the ownership function and, correspondingly, on the dominance of the specific interest of the ownership agent (investor) over the specific interests of the regulatory agents, which are understood here as representatives of federal and territorial administrative bodies. This conclusion put a condition on forming the foreign investments attraction mechanism on the federal microeconomic level, since legislative regulation of the ownership issues is in the competence of the federal regulatory bodies. All the afore-mentioned implies that the law should apply to domestic and foreign investors without discrimination, since domestic investors, alike foreign ones, are owners of their production resources, including capitals.

Use of multidimensional expertise results to identify investors’ value chains and to make accommodated investment decisions

One of the procedures which allows revealing possible inconsistencies in the definition of the criterion for setting up the accommodated regime of foreign investments and mechanism of their attraction is multidimensional

expertise. With its help it is possible to compare some items under several characteristics. It is suggested that the results of this expertise should be used to increase effectiveness of the investment process on the level of the constituent agent of the federation (second level in three-level model of federal establishment, participants (partners) 3 and 4 in Fig. 1) and also in order to improve the strategic planning processes for the participants (partners) 5 and 6. According to the general scheme of this procedure, first, each expert should identify significant, in his opinion, characteristic of the effectively operating mechanism of investment resources attraction, excluding those aspects that are within the competence of the federal centre (participants 1 and 2). Thus, the expert should give his own variants of answer to the question: "What are the principles or lines of business of an innovative organisation that can be accepted as the basis for an effectively operating mechanism of investments attraction?".

Below there are factors that can be accepted as a basis for a list of necessary qualities to be made by each expert individually:

- anty-cycling development;
- increased fast growth;
- prolonged demand;
- benefits of mass production;
- differences in the operational activities (low production costs);
- resource access;
- competitive advantages.

The list of these factors was proposed by the authors on the basis of the qualitative analysis of the characteristics of the modern investment processes in Russia, which have been detected on the basis of statistical and analytical surveys.

The choice of an accommodated strategic interest of the investing company and innovative organization is the first stage of the expertise. The second stage is to choose forms and methods to attract investments, which should include:

- formation and implementation of strategic investment programs of an innovative organisation;
- granting guarantees and incentives to the investors in accordance with the federal and regional programs of innovative activities support.

The procedure has been put into practice by the authors of the article. Managers of lending divisions from five banks with foreign participation, which are investing or plan to invest in innovative organizations in Russia, acted as experts.

Each expert has identified the following strategic criteria for the first stage of the expertise (See Table 2).

Table 2

Experts' choice of strategic criteria

I Expert	II Expert	III Expert	IV Expert	V Expert
Access to resources	Competitive advantages	Extended Demand	Access to resources	Faster growth
Life extension technologies	Access to resources	Access to resources	Faster growth	Access to resources
Counter-cyclical	Extended Demand		Persistent-Susceptibility	Differences in activity
Faster growth	The benefits of mass production		Honesty	The benefits of mass production
The benefits of mass production				Counter-cyclical

The consultant who carries out the expertise analyzes the revealed characteristics and removes those which coincide in contents from the list. Each characteristic is awarded with a letter code (See Table 3).

Table 3

N n \ n	Alphabetical Index	Name tag	Selection
		Antitsiklichost	
A		Faster growth	
B		Extended Demand	
C		The benefits of mass production	
D		production	
E		Differences in terms of	
F		(low cost)	
G		Access to resources	
H		Life extension technologies	
		Competitive advantages	

The cards with answer tables are handed out to the experts and each of them in the box "Choice" marks with a special symbol those characteristics which are most important from his standpoint.

On the basis of all the tables obtained from and filled in by the experts, Table 4 is made. This table includes all the characteristics according to their priority – the first ones are the characteristics mentioned by all the experts, followed by the ones mentioned by the majority of the experts. Further on there are characteristics identified as working ones. In the expertise that has been carried out there are five of such characteristics – A, B, C, E, F.

Table 4

N n \ n	Signs	Experts Index	Experts					Selection
			1	2	3	4	5	
1	Counter-cyclical	A	+	+	+	+	+	X
2	Faster growth	B	+	+	+	+	+	X
3	Extended Demand	C		+	+	+	+	X
4	The benefits of mass production	F	+	+	+	+	+	X
5	Differences in activity	E	+	+	+			X
6	Access to resources	H	+	+	+	+		-
7	Life extension technologies	D		+	+			-
8	Competitive advantages	G	+					-

The results of the first stage of the expertise include the list, made on the basis of the data obtained from the experts, of significant characteristics to evaluate the effectiveness of the decision to be made.

The first step of the second stage demands that each expert should make all possible pair comparisons of the characteristics. They are made with the use of special deck of cards, every of which bears a pair of characteristics.

The number of cards in the deck depends on the quantity of the identified characteristics. In the expertise that has been carried out, the number of cards is equal to the quantity of possible pairs – 10, ten.

The cards are shuffled and given out to the experts. Each expert has to distribute 100 points in between the two characteristics stipulated on the card.

The second step of this stage includes definition of the priority (significance) of the characteristics for every expert.

Table 5 shows the calculation of the significance of the characteristics for each of the five experts in our example.

Table 5

Signs	A	B	C	F	E
Cards:					
1	50	50			
2	70		30		
3	80			20	
4	80				20
5		60	40		
6		80		20	
7		60			40
8			70	30	
9			70		30
10				40	60
Total points	280	250	210	110	150
Significant signs	1	0,89	0,75	0,39	0,53

Table 5 includes numbers of cards in rows and letter definitions of the revealed characteristics in columns.

Evaluations of characteristics have been transferred from each card into the corresponding columns of the table and the total score has been calculated for every characteristic. Significance of the characteristic that got maximum score has been taken as one; evaluations of other characteristics' significance have been defined as the ratio between their scores and the maximum one. Thus, for example, for the first expert, characteristic A gets the maximum score – 280 points (See Table 5). The significance of this characteristic has been taken as one.

Correspondingly, the significance of characteristics are as follows:

$$B = 250 : 280 = 0,89$$

$$C = 210 : 280 = 0,75$$

$$E = 150 : 280 = 0,53$$

$$F = 110 : 280 = 0,39$$

As a result the characteristics have been classified according to their significance for each expert. Thus, for the first expert, the most significant characteristic is characteristic A (significance 1), then – characteristic B (0,89),

characteristic C (0,75), characteristic E (0,53), characteristic F (0,39). For the second expert, the most significant characteristic is characteristic B (significance 1), then – characteristic A (0,92), characteristic C (0,77), characteristic F (0,73), characteristic E (0,42). For the third expert, characteristic B is the most significant, too (significance 1), then characteristics C and E (significance 0,88), characteristic A (0,75), characteristic F (0,67). For the fourth expert, classification of characteristics from the point of their significance looks as follows: characteristic E (1), characteristic A (0,88), characteristic C (0,73), characteristic B (0,65), characteristic F (0,58). For the fifth expert: characteristic B (1), characteristic C (0,88), characteristic F (0,77), characteristic A (0,65), characteristic E (0,54).

To identify the general priority of the strategic criteria for all the experts, the summary table of characteristics significance for all the experts has been made up (See Table 6):

Table 6

Significance signs by experts	1	2	3	4	5
A	1	0,92	0,75	0,88	0,65
B	0,89	1	1	0,65	1
C	0,75	0,77	0,88	0,73	0,88
E	0,53	0,42	0,88	1	0,54
F	0,39	0,73	0,67	0,58	0,77

To identify the general priority of characteristics it is necessary to detect the characteristic whose significance in Table 6 gets maximum unities. Such a characteristic is called the leading characteristic. In the expertise that has been carried out, the leading one is characteristic B, which has a maximum significance for the second, third and fifth expert.

Then, significance ratios between the leading characteristic B and all other characteristics have been calculated. For instance, for the first expert the following ratios have been defined:

$$B:A = 0,89 : 1 = 0,89;$$

$$B:B = 0,89 : 0,89 = 1,0;$$

$$B:C = 0,89 : 0,75 = 1,19;$$

$$B:E = 0,89 : 0,39 = 2,28;$$

$$B:F = 0,89 : 0,53 = 1,68.$$

Then, on the basis of the data obtained, the average value has been calculated for the priority of the characteristics which are compared. Thus, for characteristic A, the average value of the characteristic ratio for all the experts is the following:

$$(0,89 + 1,09 + 1,33 + 0,74 + 1,54) : 5 = 1,12$$

As a result the final scale has been formed, which identifies the significance of the characteristics chosen by the experts (See Table 7):

Table 7

Evaluation of strategic criteria significance

Signs	Coefficient value
-------	-------------------

A	0,90
B	1.00
C	0,89
E	0,60
F	0,72

Thus, characteristic B has proved to be the most significant (most rapid growth), characteristic A has become the next (anti-cycling development), followed by characteristic C (prolonged demand) and characteristic F (benefits of mass production) with characteristic E as the last one (differences in the conditions of business – low production costs). Thus, the foreign investors' value chain can be formed. Consequently, economic growth, active anti-crisis measures with still relatively low, comparing to the developed countries, labor costs, and availability of raw material resources are the factors which justify the foreseen growth of foreign investments.

The results of the expertise show that potential investors see Russia, in the first place, as a zone of strategic interests, which provides a larger, comparing to their own country, market share and gives insurance against production, sale and technology cycling. This result of the expertise proves to be unexpected and interesting, since it shows that instable economy of Russia can still be seen as a sort of buffer which diminishes instability in one's own country. Economic, financial criteria as such (benefits of mass production and low production costs) have been put by the investors in the last place in their value chain. This situation allows forecasting potentially possible appeal of the innovative business for foreign investors.

Conclusion

The contemporary situation in the Russian economic system characterizes with inconsistency and instability of the business environment for all economic agents, which results in increased instability of investment processes. The policy of modernization and innovative development of the economy, proclaimed by the government, is connected with modification of the legal base and increases instability in the investments sphere. Moreover, the administrative choice of "points of innovative growth", accompanied by redirection public financial resources flows, decreases access to the centralized financial resources of already existing innovative organizations. Problems in the investment processes environment are aggravated with the world financial crisis effects, complete with generally low efficiency of the Russian economy. This has already resulted in considerably reduced investment resources of the innovative sphere and the situation has not improved so far.

The aforementioned negative trends significantly diminish opportunities to use multi-vehicle funding for innovative organizations and make them pay more attention to the mechanism of foreign investments attraction. All agents of the economic system whose interests, preferences and activities affect the uncertainty of investment processes (increasing or decreasing risks) are to be seen as participants (partners) of the investment process. Participants' (partners') interests, objectives and spheres of influence have hierarchical and

contradictory character. The basic contradiction appears when implementing regulatory function (federal and regional legislative and executive bodies have it) and ownership and user functions (this function is primarily that of investing companies and partner companies in the recipient country). It is related with the necessity to take decisions in the field of investment climate and implement innovative projects, whose implementation periods can exceed considerably the periods of power authorization, established by the political system.

The effectively functioning mechanism of investments attraction is possible on the basis of accommodated strategic criteria for taking investment decisions. The condition for reduction of the environmental uncertainty, affecting uncertainty of investment processes in Russia, is appearance of legal treatment of investments which is based on the ownership function prevailing over regulatory function. This will ensure the priority of economic interest for agents performing ownership and user functions (the investor and investor's partner company) in comparison with the interests of agents with regulatory function (government bodies). Such legal treatment helps reduce corruption risks, which are bound to arise in case there is no accommodation of interests in the investment process.

It is reasonable to use the multi-dimensional expertise as a mechanism to identify the investor's value chain in the specific Russian conditions. Approbation of the proposed methods for expert survey has shown, that an opportunity to expand sales market and level off the effects of the economic recession (opportunity of anti-cycling influence) has proved to be of most interest for foreign investors. The obtained results can be used to form a system of measures to improve the investment climate on the level of a region, as well as to work out strategic plans of investment development by innovative organizations. The results of the expertise, carried out on the methodologically justified and correct basis, if being used, allow increasing the strategic planning quality and create prerequisites for risk reduction in innovative business. If the aforementioned prerequisites are implemented, possibility that the foreign investors' interests will shift from strategic priorities, mainly related with marking their presence in the Russian market, towards financial criteria, expressed in the grown profitability of investments, increases.

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“An Empirical Study of the Nonlinear Adjustments to UIP Using STR Model”

Dandan Li (University of Bath, United Kingdom)

This paper has considered the nonlinearity in the relationship between expected spot exchange rate changes and interest rate differentials. Many of the estimated STR models (ESTR and LSTR) with Sharp ratios, interest rate differentials and exchange rate volatilities as transition variables have been tested. The linearity tests are used to decide the nonlinearity behaviour and to select the best model. The estimation results based on the Sharp ratio and the exchange rate volatility as transition variables generally give a better interpretation, which conclude that the UIP condition hold in the upper regime, consistent with the transaction costs and limits to speculation hypothesis. However, the interest rate differential is generally found not much used as transition variable and the nonlinear model could not support the UIP valid in the upper regime because Japanese yen and Swiss franc are the funding currency due to low interest rate. The interesting finding is that developed countries have a better nonlinear dynamic adjustment in the UIP condition, which could explain the UIP puzzle rather than the conventional OLS model, on the other hand, the emerging countries generally could not find the mean-reverting to the equilibrium in the upper regime, but tended to work in the OLS model.

“On the Response of Economic Aggregates to Monetary Policy”

Zainab Jehan (The University of Sheffield, United Kingdom)

Abdul Rashid (The University of Sheffield, United Kingdom)

This study empirically investigates how shocks to monetary policy measures (short-term nominal interest rate and broad money supply) affect economic aggregates, namely output growth, price levels and nominal exchange rate. The study is carried out for Pakistan using quarterly data covering the period 1980-2009. In doing this, Johansen's (1988) co-integration technique and vector error correction model are applied to explore the long-run relationship among the variables. We find significant evidence on the existence of a long-run stable relationship between our monetary measures and the economic aggregates. The impulse response functions (IRFs) graphs reveal a price puzzle in closed as well as in open economy model. However, an initial appreciation of exchange rate is observed, indicating the overshooting hypothesis phenomenon for Pakistan.

1. Introduction

Since the seminal work by Friedman (1963), the role of monetary policy in stabilization of macroeconomic aggregates is an inconclusive issue. Besides the development on theoretical grounds, a substantial body of empirical literature contributed to the ongoing debate by providing significant evidence on how does monetary policy affect output growth, prices and exchange rate. No doubt, the adoption of floating exchange rate, the slogan of financial reforms, the trade liberalization and relatively more autonomy of central banks have further enhanced the significance of monetary policy. Therefore, both academics and policymakers are keen to understand how, when and to what extent the economic aggregates respond to changes in monetary policy (both anticipated and unanticipated).

In theory, the debate on monetary policy has evolved from policy ineffectiveness to the identification of the long-run and short-run impact of monetary policy. Monetary policy appears to be significantly effective for the short run and completely ineffective in the long run as viewed by monetarist school of thought. While, with respect to the long-run neutrality of monetary policy, both the New-Keynesian and classical school of thoughts have same views, adherents of the New-Keynesian believe that monetary policy may affect the output and inflation in the short run as they presume the nominal wages are rigid at least in the short run. Moreover, rational expectation theory considers expectations as crucially important for analyzing the effect of monetary policy (see, for further theoretical debates, (Goodfriend 2005)).

Recent studies have focused on how one can measure monetary policy and its innovations, particularly. Studies such as Bernanke et al. (2005), Bernanke et al. (1998), Eichenbaum et al. (1995), and Sims (1992) have significantly contributed in this context. These studies mainly utilize vector autoregressive methodology to measure the responsiveness of macroeconomic aggregates to monetary policy shocks. Although the findings of these studies provide significant evidence on the response of macroeconomic variables such as real economic

activity, price levels, and exchange rate to changes in monetary policy, there are number of measurement problems and various anomalies. These inconsistencies generally include price, exchange rate, and liquidity puzzles. To overcome these issues, researchers have made numerous attempts to develop much more advance estimation methods and shocks measuring techniques. Factor augmented vector autoregressive, known as FAVAR, developed by Bernanke et al. (2005) and structural factor augmented model proposed by Forni (2010) are examples of these advancements.⁵³

The functioning of monetary policy appears more complicated and challenging when we discuss in context of developing countries because most of the developing countries face lack of organized financial markets and have weak channels of transmission. The unorganized financial markets mechanism and weak channels of transmission may responsible to the inconsistent relationship of monetary policy with macroeconomic aggregates. Regarding empirical evidence, there is a small amount of studies which focus on developing countries. Thus, we relatively know less how economic aggregates such as output, prices and exchange rate respond to monetary policy shocks in developing countries. However, the understanding of the role of monetary policy in real and nominal sector of the economy is of great significance not only to academics but also to policy makers as in developing countries the market mechanism and the level of transparency significantly differ from developed countries. Further, evidence on the effectiveness of monetary policy in developing countries would enhance our overall understanding of using monetary policy as a tool to control the real and nominal dynamics in economic aggregates.

Differing from the studies which largely focus on developed countries, the prime aspire of this paper is to examine the significance of monetary policy for a developing and relatively small open economy namely Pakistan. Specifically, the paper empirically investigates how shocks to monetary policy measures – short-term nominal interest rate and broad money supply – affect economic aggregates: output growth, price levels and nominal exchange rate, using quarterly data covering the time period from 1980 to 2009. To that end, we first explore how and to what extent monetary policy helps these three economic aggregates in converging towards the long-run equilibrium. We next turn to examine how these variables respond to one standard deviation shock to monetary measures.

To carry out our empirical investigation we first test the order of integration of the variables by estimating augmented Dickey-Fuller unit root test proposed by Dickey and Fuller (1981) with and without including trend in the specifications. After confirming the order of integration we test for long-run association among the variables. Specifically, we apply Johansen's (1988) cointegration process to test the possible cointegration vectors. To examine the direction of the short- and long-run causation and to estimate the speed at which the variables converge to their long-run equilibrium position we estimate vector error correction model (hereafter VECM). Finally, to investigate how macroeconomic aggregates respond to one standard deviation shocks to monetary measures, we estimate impulse response functions (hereafter IRFs) based on VECM. Throughout our empirical

⁵³Despite an extended empirical research and intensified methodological applications, the findings are inconclusive at best (see for further details Bjornland (2009)).

analysis our approach is to first estimate a bivariate model of closed economy as a baseline model and then gradually we include other variables and finally extend our model to open economy by incorporating bilateral nominal exchange rate and international commodity prices. This approach enables to examine how the response of underlying variables to monetary measures changes when we include more information in the model.

Furthermore, it allows us to do a comparison between close economy and open economy models.

The empirical literature on this issue for Pakistan is very limited not only in applying new methodologies but also in terms of diversifying aspects. Qayyum (2002) computes the monetary condition index (MCI) for Pakistan based upon the estimated weights to the measures of monetary policy such as interest rate and exchange rate.

However, the application of MCI for Pakistan is questionable as MCI index is more useful in the absence of supply shocks but the supply shocks are dominant in case of Pakistan. Therefore, the results of the study may not be reliable.⁵⁴ Another study by Aga et al. (2005) uses six months Treasury bill (T-bill) rates as a measure of monetary policy and uses VAR technique for empirical examination. Besides the short time span, the study has estimated a VAR model using variables at their level even though some of the variables are integrated of order one (non-stationary at level) which not only leads to the efficiency loss but also calls into question the validity of the results. Finally, recently Khan (2008) has made an attempt to investigate the impact of unanticipated changes in monetary policy on output and inflation estimating structure VAR (SVAR). The study uses nominal shocks in SVAR as a proxy for unexpected changes in monetary policy. However, this measure suffers the problem of lack of theoretical rationales.

Our study significantly differs from the above cited studies in following three ways. First, we utilize more recent sample period focusing on quarterly data rather than annual. The use of quarterly data enables us not only to harvest the gain of higher degree of freedom but also allows to use a deeper lags to identify a well-specified model without losing the informational credibility of the sample. Secondly, unlike the previous studies we take a great consideration of the time-series properties such as non-stationary behavior of the variables before utilizing in estimation. Finally, we prefer VECM approach over the SVAR because SVAR does not account for the long-run association. We also take into account the world oil prices by including the world commodity price index as a control variable in our investigation.

The estimates on the cointegration test provide significant evidence of the existence of a long-run relationship among macroeconomic aggregates and both measures of monetary policy used in the study. Estimating the VECM models we find that coefficient of error term is negative and statistically significant in most of the cases as required for convergence towards equilibrium. Overall, the findings of the study are in line with the conventional wisdom as impulse response functions of exchange rate exhibit declining pattern after a positive shock to money

⁵⁴ Although Khan and Qayyum (2004) provide empirical evidence of superiority of the MCI over Bernanke and Mahivo (1998) measure of monetary policy while measuring the macroeconomic impact of monetary policy for Pakistan, Bernanke and Mihov's measure of monetary policy is better theoretically as it uses more financial variables which plays an important role in monetary policy formulation.

supply. This implies the absence of exchange rate puzzle. On contrary, price puzzle is observed after giving a positive shock to monetary policy.

The rest of the study is organized as follows. Section 2 reviews the existing empirical literature and highlights the strengths and weaknesses of their methodologies. Empirical methods, data sources and the definition of the variables are given in Section 3. Section 4 presents our empirical findings. Finally, Section 5 concludes the study.

2. Literature Survey

Since Friedman's (1963) seminal work on the association between monetary policy and national income, how the output of economy responds to monetary policy is still a debate among academics and researchers. Theoretical framework has been improved considerably from money demand function and Fisher's (1977) equation to rational expectations hypothesis. There is general consensus that monetary policy is effective in the short run but the views vary on the long-run effectiveness of monetary policy (Bernanke et al. 1995). The relationship between output and interest rate is a representation of investment-saving (IS) curve which describes a negative relationship between output and interest rate. Moreover, the relationship between consumer price index (CPI) with its lagged values and manufacturing output portrays the Phillips curve.⁵⁵

In theory, exchange rate not only responds to monetary policy significantly but also plays an important role in monetary policy formulations. The standard exchange rate model by Dornbusch (1976) explains the appreciation in nominal exchange rate as a response of contractionary monetary policy. Below we review empirical studies that examine the impact of monetary policy on economic aggregates.

2.2 Review of Empirical Literature

Forni et al. (2010) assess the dynamic exogenous effect of monetary policy by employing standard recursive scheme through a dynamic structural factor model for USA covering the time period 1973:3-2007:10. Their empirical analysis is based on the variables which are used by Stock and Watson (1998). There are 16 static factors chosen based on Bai and Ng (2002) criterion. They argue that the factor analysis model is superior to FAVAR proposed by Bernanke et al. (2005) because it helps in eliminating the puzzles in monetary policy analysis. They find that a positive shock to Federal Funds Rate (FFR) leads to an appreciation of real exchange rates. This confirms overshooting hypothesis of Dornbusch (1976). Computing impulse response graphs they show the absence of price puzzle. Further, they argue that industrial production falls, although temporary, to a large extent with a humped shaped response.

⁵⁵ The equation does not incorporate expectations therefore it cannot be regarded as expectations augmented Phillips curve (see, for further details, Clarida et al. (1999)).

Bjornland (2008) examine the response of macroeconomic economic aggregates to monetary policy by including the exchange rate in macroeconomic variable set. He used quarterly data over the period 1993-2004. The study use Cholesky ordering and Kim and Roubini (2000) identification to determine the order of the variables.

Bjornland (2008) shows that there is a temporary increase in the interest rate which normally takes four quarters to converge to its normal path. However, the analysis does not provide any evidence of the exchange rate puzzle or price puzzle.

Ansari et al. (2007) explores the relationship between money income and prices by estimating VECM. They use narrow and broad money as measures of monetary policy. Using quarterly data, they document that for any divergence from long-run equilibrium; output will increase by 6% to adjust to its long-run equilibrium point. Furthermore, they show that a positive shock to money leads to adjustment in output after 5 quarters. However, the study did not mention the order of integration which is pre-requisite for cointegration analysis.

Bernanke et al. (2005) introduced a combination of VAR model and factor model to capture large information set which a simple VAR analysis is unable to incorporate. They use a diffusion indexes develop by Stock and Watson (2002) to estimate the factors by utilizing a balanced panel of 120 monthly macroeconomic series (1959:1-2001:8). A recursive structure is assumed with identifying assumption of no contemporaneous response of unobserved factors to monetary policy shocks.⁵⁶ The comparison of 3-variable VAR with two FAVAR specifications reveals the fact that standard VAR results show a significant price puzzle and inconsistent production response with the long-run money neutrality. However, the FAVAR approach improves the results as price puzzle disappears after one year, real activity declines, monetary aggregates fall and exchange rate appreciates for USA. As in Forni et al. (2010), since the study did not distinguish between number of static factors and structural shocks, a large number of economic restrictions are imposed to reach the identification. Moreover, the restrictions are imposed on IRFs of static factors instead of IRF of variables.

Holtemoller (2004) investigates the relationship between macroeconomic variables such as output, prices and money supply for Euro area. The study covers the sample period 1984-2001. Specifically, he estimates money demand function by incorporating short-run along with long-run rate of interest. Co-integrating vectors has been identified through Johansen's (1996) approach and the long-run causation relationship is identified through the VECM. He reports three cointegrating vectors. Although his results are strongly significant, one cannot ignore the fact that the selection of the right vector is a critical issue in case of more than one cointegrating vectors. Moreover, the long-run as well as short-run interest rates and money supply are potential measures of monetary policy which are used in the same equation without addressing the issue of multicollinearity.

Jang and Ogaki (2004) examine the relationship between monetary policy shocks and Dollar/Yen exchange rate, prices and output level for USA. The empirical analysis is carried out, following the model of Jang (2000), through structural VECM and VAR by employing long-run and short-run restrictions on the model. They find that an appreciation of exchange rate is the result of a contractionary monetary policy. Furthermore, they find that output in domestic and foreign country significantly decreases due to the long-run neutrality restrictions with an exception of USA where a decline in output becomes negligible after four years. Finally, a fall in price is observed

⁵⁶ Monetary policy variable is last in the variable ordering.

as a result of tight MP. While, estimating VECM and VAR with short-run restrictions for variables in their levels they fail to accept the UIP condition, they find strong evidence in support of the existence of price puzzle. Berument (2007) provides the empirical estimates of monetary policy in a small open economy namely Turkey, by utilizing the monthly data from 1986:05-2000:10. The study has introduced a new monetary policy instrument which is the spread between central Bank's interbank interest rate and depreciation of the domestic currency to deal with liquidity, price and exchange rate puzzles. Non-policy variables included in the model are national income, CPI, commodity price index, and money. The application of recursive VAR system and IRF towards a positive shock to spread yields a decline in industrial production but this declining trend is not persistent. They also show that the negative response of prices and exchange rate to interest rate spread eliminates price and exchange rate puzzles, respectively. Although the study appears to be successful in eliminating the famous puzzles, it is based on a narrow time span.

Fullerton et al. (2001) utilize error correction model to study the behavior of exchange rate for Mexican peso over the period 1976-2000. The variables included in the model are nominal ER, CPI, liquid international reserves, money supply and real GDP as non policy variables while one month and 3-month T-Bill rates as policy variables. Their empirical analysis based on the balance of payment framework and monetary model of exchange rate does not provide any support to the established theory. However, balance of payment framework with one month T-bill rate is marginally better than the monetary model.

Wong (2000) empirically investigates the impact of monetary policy on macroeconomic variables by applying time-varying parameter model for USA over the period 1959:1-1994:12. Output and prices are assumed to have lagged effect but FFR and reserves are considered to have contemporaneous effect. The rolling VAR has been estimated with maximum three lags. The empirical results suggest an increase in output with a contractionary shock to monetary policy. The output is more responsive to shocks during the periods when the central bank adopts inflation controlling policy, whereas it is less responsive when the central bank aims at promoting economic growth. Overall, the plots of IRF indicate the presence of price puzzle.

Despite a large amount of literature on the monetary policy, there is no consensus on the measure of monetary policy. Bernanke and Mihov (1998) develop a VAR based methodology to measure and assess the impact of MP on macroeconomic variables. The measure of MP is derived from an estimated model of Central Bank's Operating procedures and the market for commercial bank reserves which makes it more consistent than the previously used instruments of monetary policy. The model has been estimated for different time periods of post 1965-1996 for USA. The exogenous policy shocks are computed through a standard VAR method by applying Generalized Methods of Moments (GMM) in which the policy variables are placed at last in variable ordering. The IRFs indicate an increase in output as a response to expansionary MP, a slower but persistent rise in the prices. However, their results considerably vary across different measure of monetary policy. Although the study attempts to capture all the possible measures of MP but at the end it fails to notify which measure is relatively more efficient.

Eichenbaum et al. (1995) analyze the ER transmission mechanism of monetary policy for period 1974:1-1990:5. They use three measures of monetary policy which are commonly used in the literature. These measures are FFR, NBR and the narrative measure of Romer and Romer (1989). They estimate a multivariate VAR model by using

the ordering of the variables suggested by Wold. The estimates on IRFs reveal that contractionary monetary policy leads to a significant and continual decline in US interest rate, sharp and persistent appreciation of US exchange rate which is contradictory with overshooting hypothesis.

3. Empirical Methodology, Data and Variable Definition

This section discusses the methodology, variables definition and data sources. We divide the section into further two sub-sections. Section 3.1 presents the estimation methods. First we describe the unit root test, then we turn to discuss the cointegration technique and finally, we specify our VECM. In Section 3.2, we discuss data and present the definition of variables used in our empirical investigation

3.1 Estimation Methods

Following the previous studies, this study uses augmented Dickey-Fuller test proposed by Dickey and Fuller (1981) to examine whether the series follow unit root or not. The general practice to implement the ADF test is to follow the most general form of ADF test and then move to the specific form based upon the obtained outcomes of test in each stage. The ADF statistic is used to test the null hypothesis of unit root against the alternative of no unit root.

The following two specifications for the underlying series (x_t), without and with trend, are estimated:

$$\Delta x_t = \mu + \gamma x_{t-1} + \sum_{i=1}^m \beta_i \Delta x_{t-i} + \varepsilon_t \quad (1)$$

$$\Delta x_t = \mu + \gamma x_{t-1} + \delta t + \sum_{i=1}^m \beta_i \Delta x_{t-i} + \varepsilon_t \quad (2)$$

where μ denotes a drift term, Δ is the first difference operator, t is a linear time trend, and the term ε_t is the stochastic error term. Equations (1) and (2) present the ADF specifications without and with trend, respectively. The coefficient of interest is γ . If γ significantly differs from one, there is no unit root in the underlying series. The optimum lag length for estimating the ADF equation is selected by following a general to specific approach proposed by Campbell and Perron (1991). In this process, one should start with a relatively long lag-length m^* and apply t-statistic to test the statistical significance of lagged coefficient. The equation should be re-estimated with (m^*-1) lags. The procedure should be repeated until the t-statistic on the last lagged term appears to be statistically significant. In next step, we identify the cointegrating vectors. That is, we test whether there is any long-run association among the variables.

In literature, two methods namely Engle and Granger (1987) two-step methodology and Johansen's (1996) one step maximum likelihood estimator are commonly used for testing cointegration. However, the recent empirical work on cointegration analysis prefers Johansen's procedure, particularly in multivariate case as the Engle-Granger method is more appropriate for two variable cases (Enders, 2010).⁵⁷ Johansen's method is based on the relationship between the rank of matrix and its characteristic roots (Enders, 2010). For multivariate analysis,

$$\Delta X_t = \Pi X_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta X_{t-i} + \delta D_t + \varepsilon_t \quad (3)$$

where X_t is a vector of n endogenous variables and D_t is a vector of m deterministic variables. Furthermore, Π , Γ_i and δ are coefficient matrices of dimension $n \times n$, $n \times n$, and $n \times m$, respectively. Π may have reduced rank and, hence, it can be informative to decompose it with $\Pi = \alpha \beta'$, where both α and β are of dimension $n \times r$ and r is the rank of Π . Note that r can take any integer value from 0 to n . the case $r = 0$ corresponds to the case of no cointegrating relationships among variables, whereas the case $r = n$ implies that all variables in X are stationary. The latter illustrates that it is no problem to include one or more stationary variables in X .

Since the results of the cointegration tests are very sensitive to the lag-length of the variables, Akaike's Information Criterion (AIC) and Schwarz Information Criterion (SIC) are employed to select the optimum lag length. The prime objective here is to choose the lag length which gives white noise disturbances. As in Engle and Granger (1987), the dynamic behavior of a set of integrated variables can be empirically analyzed through vector error correction model (VECM) which is the reduced form of the model. The selected model is based on the backward looking behavior of output, prices and exchange rate. The study employs a bi-variate closed economy model as in Sims (1980) and Christiano et al. (1999) which is then extended to a multivariate and open economy model to measure the relationship between macroeconomic aggregates – output, prices and exchange rate – and monetary policy. In matrix notation, the VECM can be written as follows:

$$\Delta X_t = \beta_0 + \beta_1 t + \Pi X_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta X_{t-i} + \sum_{i=1}^{n-1} \phi_i \Delta Y_t + e_t \quad (4)$$

where $t = 1, 2, \dots, T$, $X_t = n \times 1$ vector of n endogenous $I(1)$ variables included in the VECM. These variables include industrial production index, prices and exchange rate. $Y_t = n \times 1$ vector of exogenous $I(1)$ variables such as broad money supply, money market lending rate and international commodity prices index. $\beta_0 = n \times 1$ vector of intercepts. β_1 , Γ_i and ϕ_i are $n \times n$ matrices of coefficients. $e_t = n \times 1$ vector of error terms distributed as i.i.d. and fulfills the Gaussian properties of zero mean and constant variances. $\Pi =$ matrix of parameters such that one element is non-zero. Moreover, Δ is the difference operator and all the variables are in log form except interest rate.

The time path of the cointegrating variables is influenced by the extent of any deviation from long run equilibrium as well as by their separate self feedback pattern plus stochastic shocks and exogenous variables. The long-run behavior of the system depends on the rank of Π . Granger representation theorem shows that if X_t

⁵⁷ In case of more than two variable there is no systematic procedure for the separate estimation of multiple co-integrating vectors

is integrated of order r then one can write $\Pi = \alpha\beta'$ where matrix β contains matrix of r cointegrating vector. The matrix α known as the speed of adjustment, which measures how quickly ΔX_t reacts to a deviation from equilibrium (Engle and Granger (1987)). After estimating the VECM, finally, we compute the IRFs to examine the response of macroeconomic aggregates to one standard deviation shock to monetary measures.

3.2 Data and Definition of Variables

To examine the response of macroeconomic aggregates to monetary policy we use quarterly data for Pakistan over the period 1980-2009. Pakistan moved from fixed exchange rate system to managed exchange rate therefore, for the model where exchange rate is used the time period starts from 1990Q1-2009Q2. All the data except broad money are obtained from the International Financial Statistics (IFS) database published by International Monetary Fund (IMF). Data on money supply are taken from Statistical Bulletins of Pakistan published by State Bank of Pakistan (SBP). All the variables are in log form except short-term interest rate. All the variables are on annual basis with millions of Pak Rupee as unit of measurement. World commodity prices index does not have data for the full length of the sample period under investigation; therefore, few missing values are interpolated by applying the two quarter moving average formula.

Following the prior studies we use two alternative measures of monetary policy namely broad money supply and short-term interest rate. Bernanke (1992) and Sims (1998) argue that short-term interest rate is a superior measure of monetary policy and it should be preferable over money supply. In addition, Berument (2003) suggests that broad money is a better indicator of monetary policy in a small open economy. In our empirical investigation we utilize both measures with an aim to do a comparison between both the said measures. Moreover, we use money supply as a measure of monetary policy as in Pakistan it has been used to formulate the monetary policy. However, recently, the monetary authority in Pakistan is giving relatively more weightage to short-term interest rate.

The variables are defined as follows:

- * Industrial Production Index (LPI): the index captures the current economic activity. It consists of mining and quarrying, manufacturing and electricity, and gas and water. The index refers to production of major primary commodities for many developing countries (IFS, 2010).
- * Consumer Price Index (LCPI): the index is most widely used measure of inflation. It illustrates changes in the cost of acquiring a fixed basket of goods and services by the average consumer (IFS, 2010)
- * World Commodity Price Index (LCOMP): it is included in the model to capture the oil price shocks and other supply side factors which influence output and inflation as suggest by Bernanke et al. (1995).
- * Exchange Rate: exchange rate is expressed in domestic currency (Pak Rupee) per unit of foreign currency (US\$) and the study uses "ae" definition of IFS series.

- * Money Market Rate (SR): money market rate is used to instrument monetary policy. It is defined as the rate on short-term lending between financial institutions (IFS, 2010).
- * Broad Money Supply (MS): broad money is used as another measure of monetary policy. It comprises of currency in circulation, demand deposit, time deposit, other deposits (excluding IMF A/C, counterpart) and resident's foreign currency (SBP, 2009).

4. Empirical Findings

We start our empirical investigation by plotting each underlying series against time. The plots are presented in Figure 1. All the series exhibit an increasing trend except for the interest rate. Next, the nature of each series is checked by computing the ACFs and PACFs.

Although one can get the idea about the nature of the series by plotting ACFs or PACFs, it is essential to be ensured about the stationary/non-stationary behavior of the series. To achieve this, we employ ADF test.

Following general to specific approach, the optimal lag lengths are selected for the ADF equations. Specifically, we start with a maximum 8 lags as our data is quarterly and presume that this length is enough to mitigate the problem of autocorrelation. The results are given in Table 1. The optimal lag length is marked by asterisk in the table.⁵⁸

The estimates do not provide any significant evidence to reject the null of unit root for level series. However, the first difference of the series appears stationary at the 5% level of significance. These findings are robust across different lag lengths used in the estimation.⁵⁹ Thus, we conclude that the variables are integrated of order one. In order to examine the long-run association we estimate the Johansen's cointegration test. Table 2 reports the results. Since the results of the cointegration are very sensitive to the lag length we select the optimal lag length by applying Bayesian Information Criterion (BIC). Further, we ensure that the estimated model has white noise disturbances. We start by estimating a bivariate model for each of our response variable. In next step, we extend the bivariate model to multivariate model by incorporating other control variables. One should note that when we include exchange rate in the specifications our model represents a case of an open economy.⁶⁰

The results in Table 2 provide evidence that there is a single cointegrating vector between LIPI and short-term interest rate, implying that both variables have co-movement in the long run. This piece of evidence is robust to the inclusion of other variables in the specifications. Our results suggest that there is only one cointegrating

⁵⁸ However, we also estimate the ADF equations with other lag lengths to check the robustness of the estimates at different lags.

⁵⁹ The results of ADF test for first difference are not given here, however, are available from authors upon request.

⁶⁰ Although we use response variables as control variables as well, we estimate separate model for each response variable to test for integration.

vector regardless of whether we estimate model for close or open economy. The existence of the one cointegrating vector at different specifications confirms the validity of our results.

When we turn to examine the long-run association between short-term interest rate and the second response variable, LCPI, similar to the case of LIPI, we accept the null hypothesis of one cointegrating vector at the 1% level of significance. Comparing the model with other macroeconomic determinants for LCPI such as LIPI, the Johansen's test identifies the presence of one linear combination of $I(1)$ variables which is $I(0)$. In the next step, adding LER and LCOMP in to the system we shift from a closed economy to an open economy model. Trace statistics reject the alternate hypothesis; estimated eigenvalues signify the presence of one cointegration relationships in both cases.

Third goal variable considered by this study is bilateral nominal exchange rate between PAK rupee and US dollar. Adopting the previous strategy, the model is extended from bi-variate to multivariate model. The estimated eigenvalues show that short-term rate of interest and exchange rate emerge to have one linear combination of variables that is $I(0)$. The trace statistic rejects the alternate hypothesis of more than one cointegrating vector at 5% level of significance. Further, when the model is comprised of LCPI and LIPI, the estimated eigenvalue points out one linear combination of $I(1)$ variables which is stationary.

As mention earlier, we use an alternative measure of monetary policy namely broad money supply. The results of the cointegration tests with this measure are given in Table 3. In general, the findings are consistent with the results reported in Table 2. However, in two of the cases we find two cointegrating vectors instead of one. In case of more than one cointegrating vectors, the general practice is to select the cointegrating vector which has highest eigenvalue because it is most associated with the stationary part of the model (Rashid, 2009).⁶¹ Following this, we select first cointegration vector as it has the highest value. The alternate measure of monetary policy (broad money supply) appears to have one cointegration vector with all the three equations with the exchange rate as dependent variable based upon the trace statistics at 5% critical value.

After confirming the presence of the long-run relationship, we estimate VECM for each model to examine the speed of adjustment towards the long-run equilibrium. The long-run relationship is captured by error correction term which appears to be statistically negatively significant for the first bivariate model, where we regress industrial production on short-term money market rate. The negative sign of the coefficient associated with error term is in line with the adjustment process, suggesting that LIPI converges to its long-run equilibrium. Specifically, the coefficient of error term is 0.021 which implies that any disequilibrium in industrial production will be adjusted at the rate of 2.1% in one quarter. However, when we add LCPI in the specifications, then the speed of adjustment substantially increases to 7.6% per quarter.

The estimates on the speed of adjustment have dramatically improved in the case of open economy model. For instance, the disequilibrium in industrial production is now corrected by rate of 56.2% in one quarter, while an addition of LCOMP into the model further increases the adjustment speed to 68.42% with a statistical significance of one percent. This suggests that the adjustment process of industrial production to disequilibrium is relatively fast in the open economy.

⁶¹ Although we use response variables as control variables as well, we estimate separate model for each response variable to test for integration.

The above model with the same order of variables has been estimated by using an alternative measure of monetary policy (broad money). The speed of adjustment is remarkably high for base line model as the disequilibrium is now corrected by rate of 76% in one quarter. Contrary to the first measure, the rate of convergence declines with the addition of more information into the model. This finding suggests that when the monetary policy is measured by short-term interest rate it is more effective for open economy, whereas the measures of money supply has significant role to play in closed economy. This finding makes somehow sense as theoretically the interest rate plays significant role in external capital flows along with its internal effectiveness, whereas money supply is relatively more effective tool to make adjustment in domestic accounts.

For LCPI, the long-run relationship appears to be statistically significant. The positive coefficient of error correction term (0.081%) specifies that the prices should decrease to reach to its equilibrium position. It is interesting to note that the inclusion of LIPI to the model yields statistically negatively significant estimates on error correction term. This implies that the short-run interest may affect price levels through its effects on industrial output. Next, we include exchange rate into the model to represent an open economy framework. Based upon one cointegration vector, the long-term equilibrium relationship appears to be statistically negatively significant at one percent level of significance. A 1.6% pace is identified by the error correction term with which the disequilibrium will be corrected by LCPI. However, the extension of the model by including LCOMP further improves the speed of adjustment to 3.2%. There is evidence that prices respond more quickly and the pace of movement to equilibrium point has increased by moving from closed economy to an open economy model. The model of LCPI is empirically tested for long-run equilibrium relationship by using the alternative measure of monetary policy as well. In a bivariate closed economy situation, there is a negative and statistically significant long-run relationship as identified by the error correction term. The system converges to its long-run equilibrium position at the rate of 5.7% per quarter. The open economy, adding LCOMP, once again increases the ability of prices to adjust to the long-run equilibrium.

For the third dependent variable namely exchange rate, the error correction term appears negative and statistically significant. However, the magnitude of the coefficient indicates that the system converge to its long-run equilibrium by a marginal rate. Including LIPI to the model we find that the adjustment speed has increased to 17% while the addition of LCPI further enhances the process of adjustments (at rate of 30% per quarter) towards long-run equilibrium position. These results suggest that the both industrial production and prices have a significant role to play in adjustment mechanism.

Regarding the money supply as a measure of monetary policy, we find that the speed of adjustment is 8.04% for model of exchange rate and money supply. In addition, the inclusion of LCPI in the exchange rate model enhances the speed of adjustment to 25.0% in one quarter. Further, when we include LIPI in the system, the estimates provide evidence that any deviation from the equilibrium is adjusted to the long-run equilibrium position with the rate of 33% per quarter.

Last but not the least, we compute the IRFs to examine the response of LIPI, LCPI and exchange rate to a standard deviation shock to monetary measures. Similar to the case of cointegration and VECM estimation, we start from a model of close economy (bivariate case), then, we extend the model to open economy by incorporating exchange rate and international commodity prices index. One of the major problems in IRFs is the

sensitivity with respect to variables ordering in the system. Therefore, following the empirical literature such as Forni et al. (2010) Bernanke et al. (2005), Bjornland (2008) and Holtemoller (2004), the study assume a recursive structure of ordering for the closed economy in which policy variables are ordered last. This implies that macroeconomic aggregates do not respond contemporaneously to monetary policy innovations but monetary policy might react towards any news from macro aggregates within the period. This is consistent with the transmission mechanism of monetary policy as highlighted by empirical studies such as Svensson (1997). In the closed economy, the variables are ordered as follows: $LIPI_t$ $LCPI_t$ and SR_t .

In open economy model, the exchange rate is placed last in the order of variables as suggested by Eichenbaum et al. (1995). It ensures a lagged response of monetary policy due to any exchange rate shock but this identification results in a delayed exchange rate response to monetary policy (Bjornland, 2008). Kim and Roubini (2000) propose a contemporaneous interaction between monetary policy and exchange rate to solve the problem of exchange rate puzzle. The present study employed Kim and Roubini (2000) methodology and introduced exchange rate and monetary policy interaction of contemporaneous impact (by reversing the place in variable ordering for IRF). Since Pakistan is a small open economy, international prices are assumed exogenous for the economy. In other words, central Bank does not have international prices in its information set (Juang et al., 2003). Therefore LCOMP are placed after exchange rate. Specifically, in our case, the variables ordering for the open economy model is $LIPI_t$ $LCPI_t$ SR_t LER_t and $LCOMP_t$.

The IRFs for the closed economy by using money market rate and broad money as measures of monetary policy are presented in Figures 3 and 4, respectively. In the bilateral model, a shock to short-term interest rate appears to have a negative impact on LIPI with a margin positive start. The overall impact is comprised of downward and upward fluctuations of LIPI curve with a declining trend. It is interesting to note that the inclusion of other variables in the baseline model neither changes the initial nor the long-run response of LIPI to a standard deviation shock to money market rate. These findings are consistent with results of prior studies such as Forni et al. (2010) and Bjornland (2008), who also report a negative response of output to monetary policy shocks. The response of LIPI remains negative with respect to short-term interest rate shocks even for a multivariate closed economy model.

LCPI respond positively which provide the evidence of the existence of price puzzle. Similar evidence is reported by Sims (1992). However, our findings are in contrast to Ogaki et al. (2003), who find that there is no price puzzle.⁶² The inclusion of exchange rate and LCOMP improves the response of LIPI towards positive monetary policy innovations as depicted in the figure. A positive shock to money market rate decreases the LIPI at a sharp rate before it starts increasing. This fact is in line with the findings of Bernanke et al. (1998) and Forni et al. (2010) that there is a decline in output after positive shock to FFR.

On contrary, in the open economy model, a sharp and abrupt increase in price level is observed after a shock to MP. This point out price puzzles (Leeper et al. (1992) and Bernanke et al. (1992)). Sims (1992) suggested that price puzzle can be tackled by including the international commodity prices but in our case the inclusion of international prices does not provide any significant help in eliminating the puzzle. Yet, our finding is consistent

⁶² However, he used different technique namely SVAR.

with Eichenbaum et al. (1999), who argue that the inclusion of international commodity prices does not improve the responsiveness of prices towards monetary policy innovations.

The initial response of exchange rate to monetary policy innovation is zero as can be observed from the figure. However, later on it appreciates followed by depreciation, confirming the overshooting hypothesis of Dornbusch (1976). This suggests that a contractionary monetary policy would lead to an appreciation in the nominal exchange rate before it depreciates in the long run. However, we find the evidence of exchange rate puzzle when we include international commodity price in the model.

The results for the alternative measure of monetary policy are consistent with the baseline model as depicted by IRFs. In the bivariate closed economy models the positive shock to broad money supply appears to increase the LIPI at first and then there is a decline in the production proceeded to an increase again. When the model is transformed into an open economy by incorporating exchange rate and then LCOMP, the response of LIPI remains similar to our earlier results. The results are in line with Berument (2003) and Ansari et al. (2007), who also found a positive response of GDP towards positive shock to money supply. Contrary to the money market rate measure of monetary policy, there is no evidence of price puzzle in the open economy. These findings are similar to Juang et al. (2003) and Forni (2010), and Bernanke et al. (2005). Similarly, exchange rate appears to appreciate (decrease) in response to a positive shock to monetary policy and then depreciates. This confirms the overshooting hypothesis of Dornbusch (1976) and provides no evidence of any exchange rate puzzle.⁶³

Collectively, the results suggest that there is a significant interaction between real and monetary side of the economy in Pakistan. The statistical significance of the error correction term clearly refers to the convergence to the long-run equilibrium of industrial production, prices and exchange rate with both measures of monetary policy. Similarly there is a significant response of the macroeconomic aggregates to shocks to monetary policy.

5. Conclusions and Recommendations

The study was carried out to empirically analyze the nature of the response of macroeconomic aggregates such as real economic activity, prices, exchange rate to shocks to monetary policy for Pakistan during the period 1980:Q1-2009:Q2. The ADF test is used to test the time series properties of the variables. The cointegration relationship is observed by applying Johansen's cointegration technique. We also estimate the VECM to estimate the speed of adjustment towards long-run equilibrium. Finally, we compute IRFs to examine the response of the macroeconomic aggregates to one standard deviation shocks to monetary measures.

We find that there is a significant co-movement between the macroeconomic aggregates such as industrial production, prices and nominal exchange rate, and our monetary policy measures namely short term nominal interest rate and broad money supply. The estimates of error correction term provide evidence that the industrial production adjusts at faster speed relative to prices and exchange rate over the examined period. Furthermore, the short-term interest rate has relatively stronger effects on output as compared to broad money

⁶³ Bjornland (2008) and Forni et al. (2010) also find an appreciation of ER in response to a positive shock to MP.

supply, whereas, prices and exchange rate adjust more quickly to their long-run equilibrium when money supply is used as a measure of monetary policy.

When money market rate is used as monetary policy, the graphs of IRF provide the evidence of price and exchange rate puzzles. By contrast, when broad money supply is used as a measure of monetary policy, no evidence of exchange rate puzzle is witnessed. This finding is in line with the Dornbusch (1976) overshooting hypothesis.

The findings of the analysis suggest that the interest rate oriented monetary policy is more effective when the monetary authorities have objectives to enhance the output growth of the economy. However, if the objective is to control the inflation, then the broad money supply seems more appropriate instrument. Furthermore, our findings suggest that the monetary policy has a significant role in stabilizing both real and nominal sector of the economy.

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Table 1: Estimates from ADF test

Variables	Model	No. of Lags					Conclusion
		8	6	4	2	1	
LIPI	Drift and Trend	-2.722	-2.603	-1.921 ^a	-2.589	-8.125	Non-Stationary
	Drift	-1.637	-1.644	-1.517 ^a	-1.175	-1.848	Non-Stationary
LCPI	Drift and Trend	-3.115	-1.860	-2.204 ^a	-1.138	-1.498	Non-Stationary
	Drift	1.051	0.626 ^a	0.725	0.998	0.675	Non-Stationary
LER	Drift and Trend	-1.763	-1.650	-1.777	-1.795	-1.747 ^a	Non-Stationary
	Drift	-0.827	-0.875	-0.805	-0.783	-0.795 ^a	Non-Stationary
LCOMP	Drift and Trend	-2.022	-1.517	-1.966 ^a	-1.267	-1.690	Non-Stationary
	Drift	-1.497	-0.924	-1.368	-0.433 ^a	-0.890	Non-Stationary
SR	Drift and Trend	-2.229	-2.039	-1.809	-2.208 ^a	-3.025	Non-Stationary
	Drift	-2.324	-2.125	-1.877	-2.229 ^a	-3.032	Non-Stationary
LM	Drift and Trend	-2.793	-2.094	-3.106 ^a	-2.263	-1.544	Non-Stationary
	Drift	-0.432	-0.341	-0.576 ^a	-0.354	-0.497	Non-Stationary

Note: 'a' represents optimum lag length selected by the Akaike Information Criterion (AIC)

**Table 2: Results for Cointegration Test and VECM
(Policy Variable: Short-term Interest Rate)**

Model specification	No.(Lags)	Rank	Qr	Eigenvalue	ECT	No.(Lags)
Model-1. Dependent Variable: LIPI						
LIPI, SR	114(4)	1	2.658	0.2094	0.0208*** (0.000)	114(4)
LIPI, LCPI, SR	112(6)	1	11.104	0.1836	-0.0762*** (0.000)	114(4)
LIPI, LCPI, LER, SR	115(3)	1	28.062	0.1638	-0.5622*** (0.000)	116(2)
LIPI, LCPI, LER, LCOMP, SR	115(3)	1	47.082	0.2452	-0.6842*** (0.000)	116(2)
Model-2. Dependent Variable: LCPI						
LCPI, SR	117(1)	1	0.439	0.1601	0.0008* (0.052)	109(9)
LCPI, LIPI, SR	114(4)	1	9.934	0.1823	-0.0199** (0.000)	111(7)
LCPI, LIPI, LCOMP, SR	116(2)	1	22.975	0.4584	-0.0157*** (0.000)	116(2)
LCPI, LIPI, LER, LCOMP, SR	115(3)	1	47.082	0.2452	-0.032*** (0.000)	111(7)
Model-3. Dependent Variable: LER						
LER, SR	78(7)	1	1.0381*	0.1752	-0.0038** (0.017)	78(7)
LER, LIPI, SR	78(4)	1	12.7371*	0.2521	-0.1682*** (0.001)	78(6)
LER, LIPI, LCPI, SR	78(4)	1	25.1796*	0.4194	-0.2978*** (0.002)	78(6)

Note: This table displays the estimates for short-run interest rate as measure of monetary policy. Lags in 2nd column refer to the number of lags for CIW while lags in 7th column are for estimation of vector error correction term. Qr is the LR trace statistic. ***, **, * denote the significance at the 1%, 5%, 10% levels, respectively.

**Table 3: Results for Cointegration Test and VECM
(Policy Variable: Broad Money Supply)**

Model specification	No.(Lags)	Rank	Qr	Eigen value	ECT	No.(Lags)
Model-1. Dependent Variable: LIPI						
LIPI, LM	116(2)	1	0.0004	0.3743	-0.7595***	116(2)
LIPI, LCPI, LM	113(5)	1	9.033	0.2365	(0.000) -0.3795***	113(5)
LIPI, LCPI, LER, LM	116(2)	1	28.742	0.5715	(0.000) -0.3571**	113(5)
LIPI, LCPI, LER, LCOMP, LM	115(3)	2	27.761	0.2286	(0.000) -0.4549***	113(5)
Model-2. Dependent Variable: LCPI						
LCPI, LM	109(9)	1	0.4011	0.1343	-0.0573***	113(5)
LCPI, LIPI, LM	113(5)	1	9.0338	0.2365	(0.000) -0.1524***	110(8)
LCPI, LIPI, LCOMP, LM	114(4)	1	20.1580	0.3805	(0.000) -0.1441	112(6)
LCPI, LIPI, LER, LCOMP, LM	115(3)	2	27.7615	0.2286	(0.000) -0.2207**	112(6)
Model-3. Dependent Variable: LER						
LER, LM	78(11)	1	2.526	0.1578	-0.0804** (0.019)	78(4)
LER, LIPI, LM	78(2)	1	9.806	0.2813	-0.2486*** (0.000)	78(5)
LER, LIPI, LCPI, LM	78(4)	1	26.798	0.3336	-0.3298*** (0.000)	78(6)

Note: this table displays the estimates for money supply (M2) as measure of monetary policy. Lags in 2nd column refer to the number of lags for CIV while lags in 7th column are for estimation of vector error correction term. Qr is the LR trace statistic. ***, **, * denote the significance at the 1%, 5%, and 10% level, respectively.

Figure 1: Time Series Trends

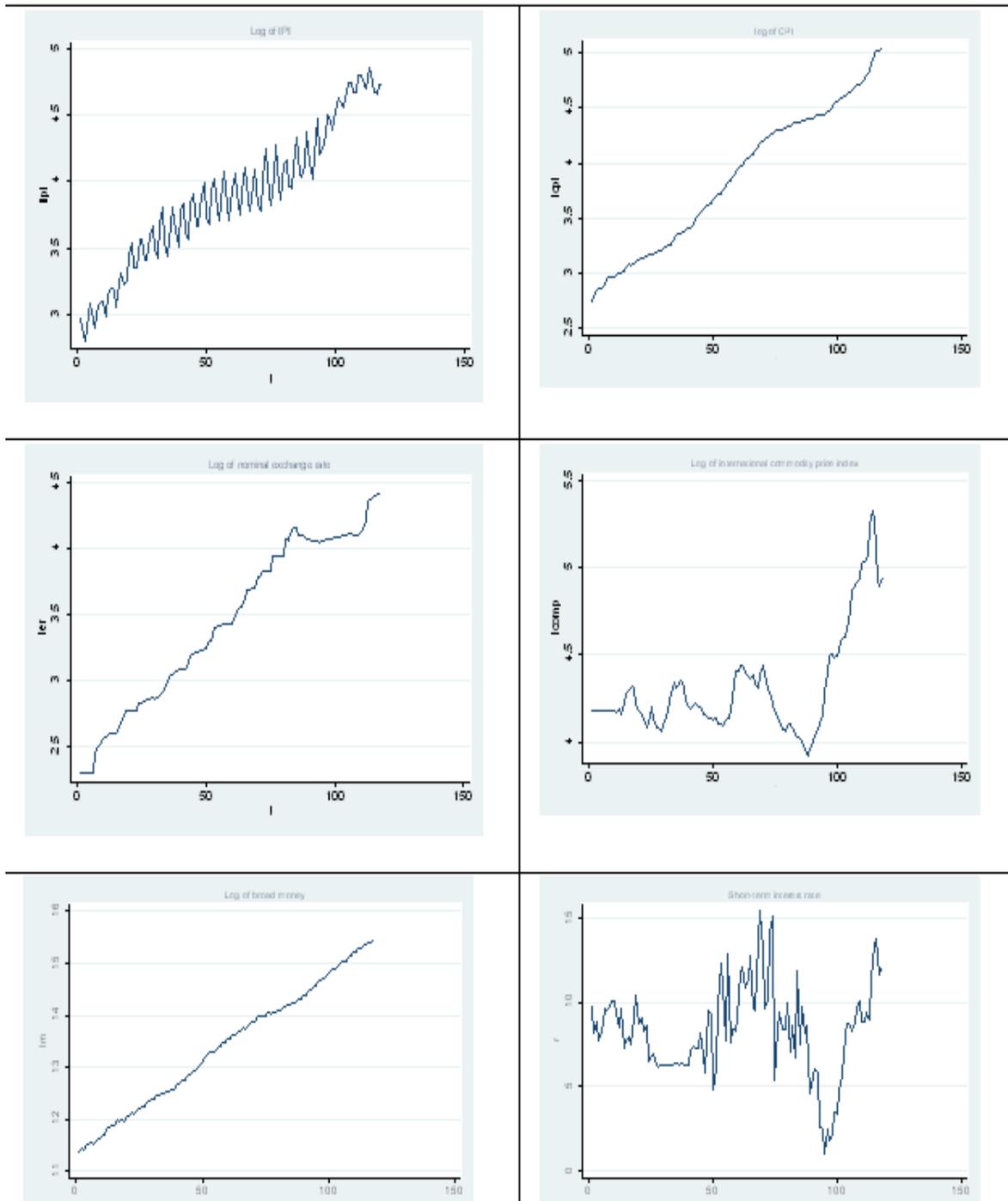
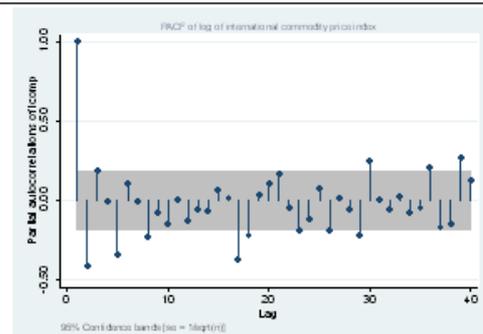
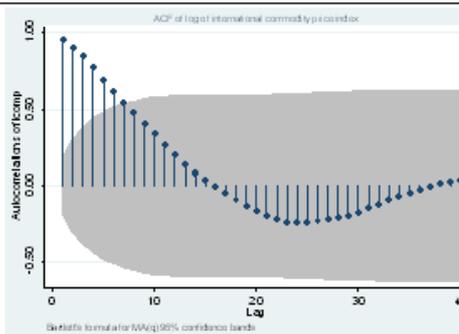
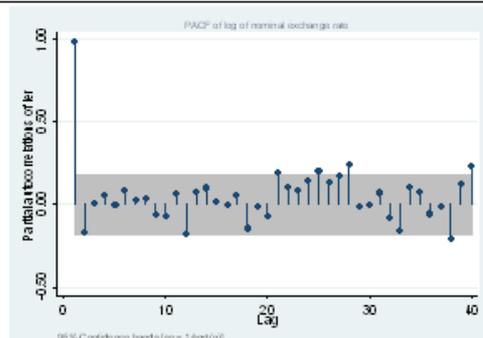
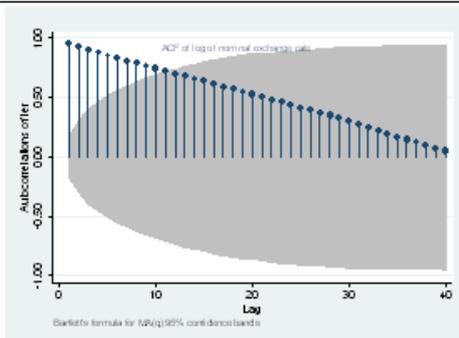
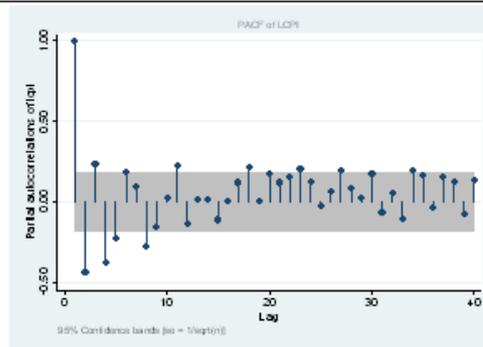
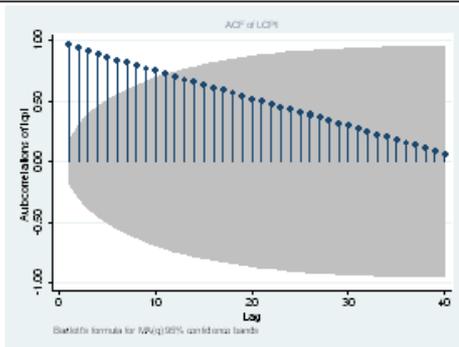
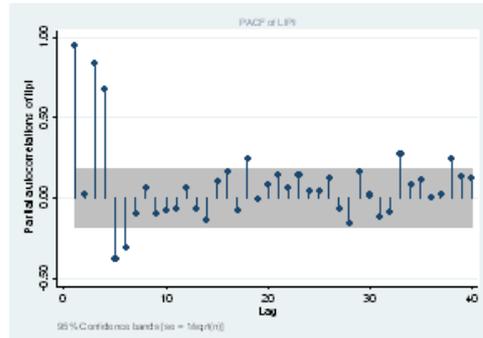
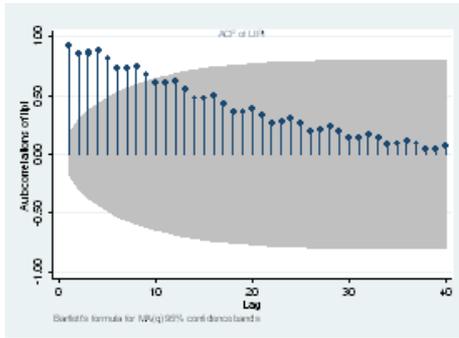


Figure 2: ACFs and PACFs



-Continued

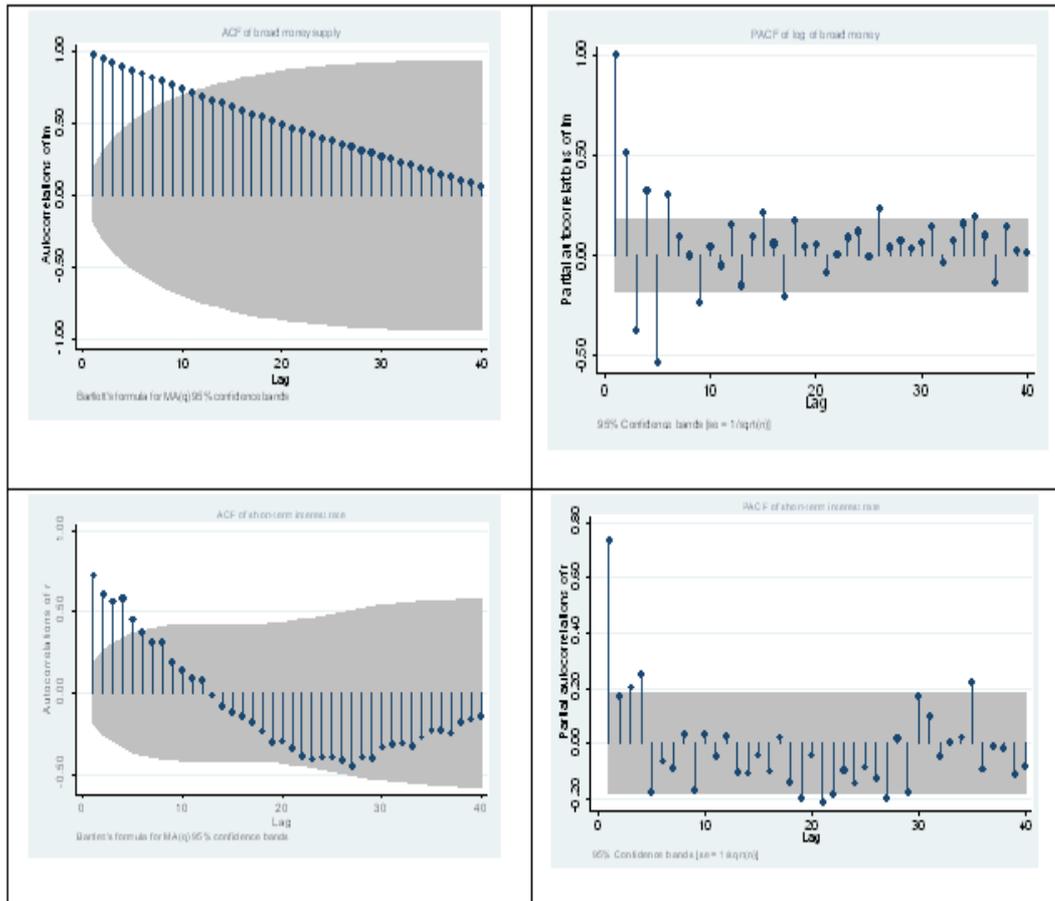


Figure 3: IRFs: Effects of Shocks to Short-term Interest Rate

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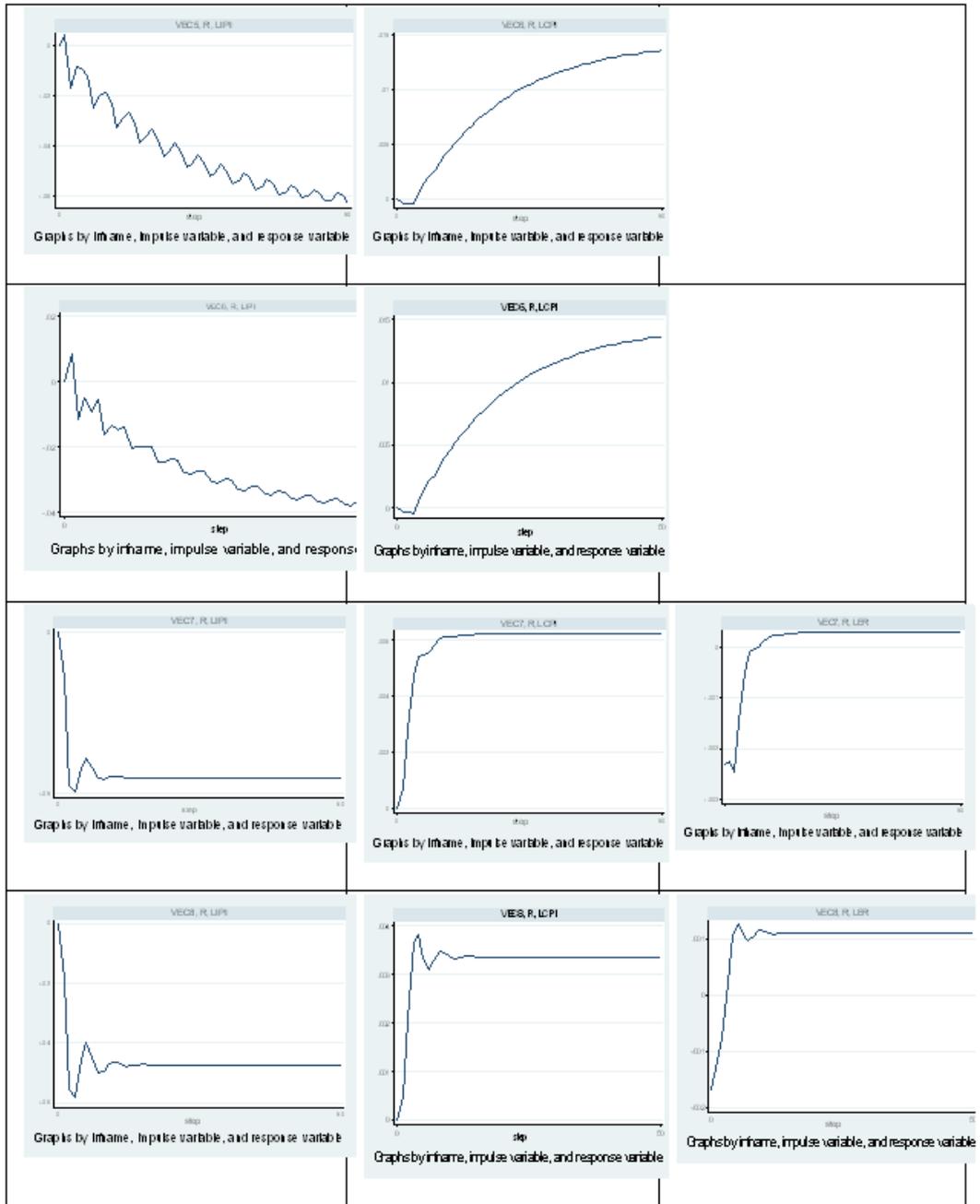
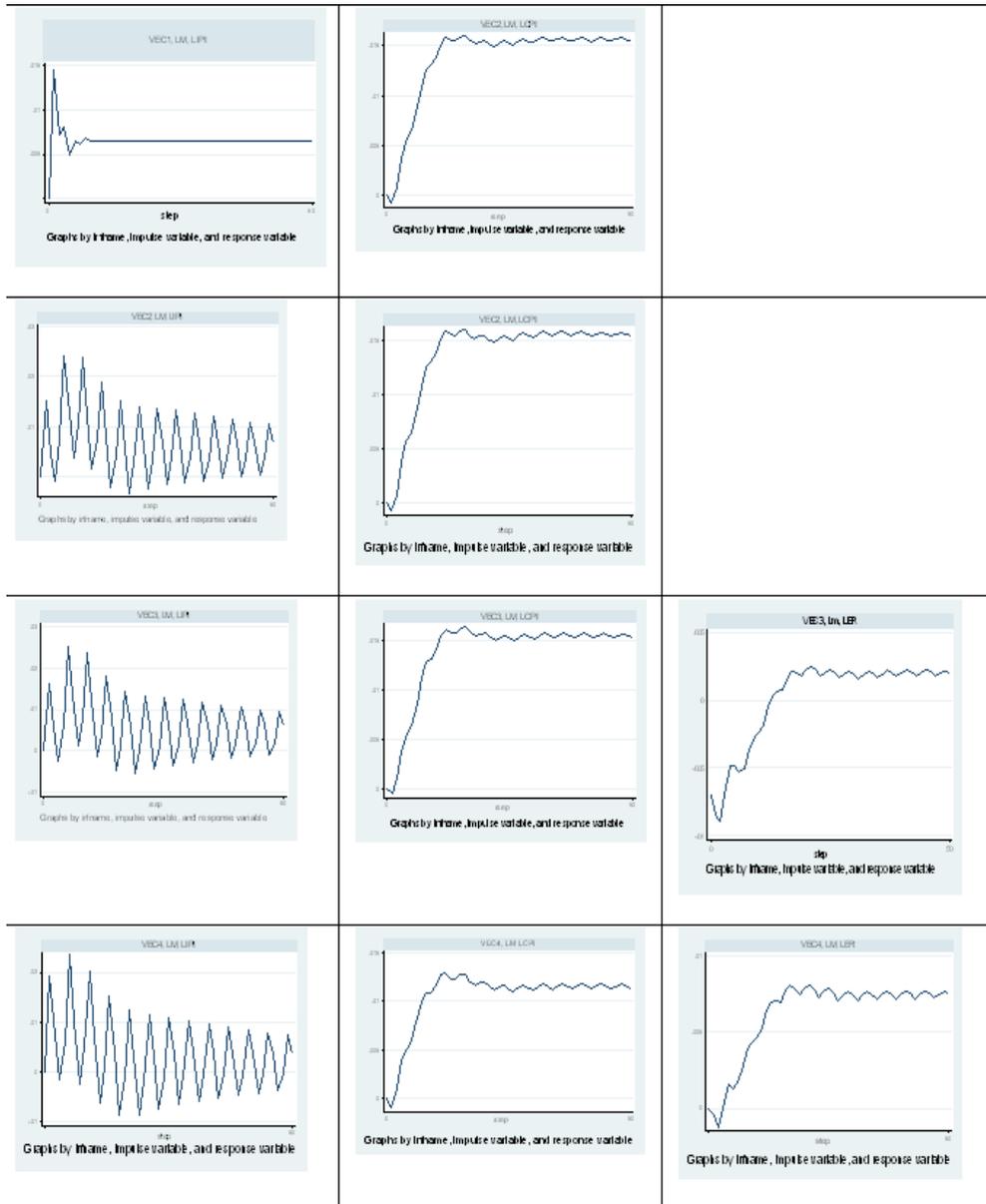


Figure 4: IRFs: Effects of Shocks to Broad Money Supply

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Session G (Room Candela)

“Consumption and Household finances in Remittance-receiving Families: a Case Study of a Contemporary Mayan Community from Mexico”

Marisol Cen Caamal (Universidad Anahuac Mayab, Mexico)

A survey carried out in Tunkas, a contemporary Mayan community in Yucatan, shows the composition of incomes and consumption patterns in remittance-receiving households. The survey obtained information from each household, and findings indicate that besides remittances and wages, government grants are the main source of household incomes. Evidence shows that a high percentage of remittance-receiving households do not perceive the importance of savings or investment and focus entirely on consumption. And what is most worrying is that 40% of households contract debts on which they pay high interest rates. In most cases, these debts are used to finance more consumption, to pay health care expenses or to pay off other debts.

Receivers and senders of remittances in this community have limited financial knowledge. They do not consider carefully how they use the money. When they fall into debt, in many cases they do not know how much interest will be charged to them, or how long it will take to repay the debt. The lack of financial education makes them vulnerable and very often leads them into an even worse financial situation.

“Using a Fuzzy MCDM Model to Evaluate Customers’ Perceived Credit Card Services”

Wei Hsu (Kainan University, Taiwan)

Customers possess considerable latent power to choose to use or not use the services, and thus customers’ perception, either customer preference or satisfaction, is regarded as a direct impact on the performance of services. Financial services often involve direct interactions between customers and providers, and customers always play an active role. According to the service gap model, successful service providers are those who are able to zero the gap between customers’ perceived services and expected services. Thus, service providers have to realize customers’ preference and satisfaction. However, a lacuna still empirically exists in evaluating simultaneously customers’ preference and satisfaction of credit card services. As a result, this study, based on service theories of service concept model and service gap model, provides a fuzzy multiple criteria decision making (MCDM) model to evaluate the performances of credit card services lunched by the banks in Taiwan. This fuzzy MCDM model integrated the Fuzzy Analytic Hierarchy Process (FAHP) and the Fuzzy Grey Relation (FGR) methods, and provides a complete process to evaluate the gaps between customers’ preference and satisfaction of credit card services empirically. This paper finally concludes managerial suggestions for managers to close the gaps of credit card services.

Keywords: Credit Card Services, Customer Perception, Multiple Criteria Decision Making (MCDM), Triangular Fuzzy Numbers

1. Introduction

The credit card service is a high manpower and computer intense product. In the past, financial attributes such as interest rates, speed, simplicity and ease of issuing credit cards, the content of bill statements, and other value-added attributes such as insurance and bonuses were crucial factors influencing customers to apply for the credit cards (Liang & Wang, 2006). With the advent of an era of one person with many credit cards and low interest rates, customers begin to put more emphasis on other attributes such as the quality of customer service, image of bank and other value-added activities. Customers possess considerable latent power, as they can choose to use or not use the services (Smith & Fischbacher, 2005), thus customer satisfaction is a direct impact on the performance of financial services. Customer expectations are primarily based on customer needs. They are also influenced by the company's reputation and the customer previous experience with the services or the company's marketing efforts (Edvardsson, 1997).

Financial services often involve direct interactions between customers and providers, and customers play a more active role in the financial service development process (Olsen & Sallis, 2006). Financial service sectors should emphasize more on fulfilling customers' needs and expectations for sustainable survival and continued growth in the industry. They also should take a systematic approach to analyze customers' preference and satisfaction to evaluate their own financial services (Gustafsson et al., 1999). Service concept model proposed by Edvardsson (1997) refers services should be designed according to customers' needs or preference. According to the service gap model, successful service providers are those who are able to zero the gap between expected services and perceived services. Thus, service providers have to be intelligent enough to integrate customers' requirements and expectations into service strategies (Kumar & Kumar, 2004). Zeithaml and Bitner (2003) developed the service gap model with the focus on the customer gap, which is the difference between customers' expected and perceptive satisfaction. Therefore, service providers not only need to focus on reducing the customer gap but also to consider customer preference.

In this study, five ordinary credit card services in five different banks in Taiwan were selected as an example of financial services and provided a fuzzy MCDM model, which can be used to evaluate the customer gap based on customers' satisfaction and preference. This MCDM model, which integrated the FAHP and FGR, can help investigate customers' satisfaction and preference simultaneously.

2. Literature Review

2.1 Customer Preference in Performance of Credit Card Services

The credit card service, one of the major instruments of consumer transactions, is a very important innovative financial product offered by banks. The core benefit of credit cards' system is built around the revolving credit concept; i.e., credit facility obtained can be extended in form of several easy installments, and this revolving credit appears to be an attractive feature of credit cards because consumer can enjoy and avail credit without any extra charge if he or she makes entire payment on time (Goyal, 2006). The credit card service does not provide just the facility of revolving credit but it enables customers to have additional benefits, called as supplementary services; e.g., free accident insurance coverage, free car parking, or free road assistance. By providing a revolving credit facility, credit cards empower customers to manage their cash requirements with convenience for a fee (Goyal, 2006). As the customers' demanding of credit card services are increasing, the issuing firms that are ready to satisfy this demand result in an intense competition. The prevalence of the intense competition in the financial service industry compels card issuers to become customer-centric and make the right decisions for the right customer at the right time. These management decisions all require the target customers' information and predictions regarding the value of the customers.

By the service concept, Edvardsson (1997) meant a description of the customer needs which are to be met and how these needs shall be met in the form of service content or design of the service package. The matching of customer needs and service offer is essential. The service concept, illustrated in Figure 1, refers to the prototype for the service, i.e. the customer utility and the benefits which the service and its various sub-services are intended to provide and convey to the customer. The service concept covers both the description of the customer needs to be satisfied and how they are to be satisfied in the form of the content of the service or the design of the service package. The service concept is a detailed description of what needs and wishes are to be satisfied and how this is to be achieved. The service concept specifies the domain of needs with respect to both primary and secondary customer needs and both core service and supporting services to meet this domain. Correspondence between customer needs and service offer is crucial. The service concept forms the point of departure and defines the demand for the prerequisites that must be present for a service with the right quality to be realized. When designing the service concept, attention should be given to the fact that individual services often form part of a system together with other services, existing and/or new. To achieve the right quality and high productivity, these aspects should also be taken into account.

<Insert Figure 1 around here>

According to the service concept model (Edvardsson, 1997), a successful financial service development must focus on customers' primary needs to design the core service. Hence, one crucial work of financial service development is to recognize the target customers' preferences. In order to understand customer preferences of a financial service, it would need to consider the relative benefits that customers attach to various features of the service that are available to customers at the time of purchase. When faced with a choice task, customers are likely to use features that they are already familiar with and are also willing to consider new features in their choices as long as they are made available and understandable to them. The propensity to use either one or both sets of features is a function of the users search costs and benefits associated with processing the information associated with the features. Therefore, to understand choice drivers for financial services, it would need to assess how customers make trade-offs among features of financial services.

2.2 Customer Satisfaction in Performance of Credit Card Services

Customer satisfaction has emerged as a key factor in modern marketing and consumer behavior analysis since retail banks have been concerned with continuously monitoring how effectively they meet or exceed the needs of their customers with this prevailing focus on customers and service quality (Shin & Elliott, 2001). Zeithaml and Bitner (2003) established the service gap model, presented in Figure 2. The service gap model positions the key concepts, strategies, and decisions in services marketing in a manner that begins with the customer and builds the organization's tasks around what is needed to close the gap between customer expectations and perceptions. The central focus of the service gaps model is the customer gap which is the difference between customer expectations and perceptions. Firms need to close this gap in order to satisfy their customers and build long-term relationship with them. Customer perceptions are subjective assessments of actual service experiences; customer expectations are the standards of, or reference point for, performance against which service experiences are compared. The sources of customer expectations consist of marketer-controlled factors, such as advertising, as well as factors that the marketer has limited ability to affect, such as innate personal needs. Ideally, expectations and perceptions are identical: customers perceive that they get what they think they will and should. In practice, a customer gap typically exists. Services marketing bridges this distance, and this study devoted virtually the entire text to describing strategies and practices designed to close this customer gap.

<Insert Figure 2 around here>

Preceding research evidences showed that greater customer satisfactions improve performances of financial services, including both of sales volume (Megicks *et al.*, 2005) and relationship quality through customer trust, commitment and loyalty (Ndubisi, 2006). Customers' perspective has positively significant effects on financial performance; customers purchase financial services according to their perceived relationship to investment retailers, with corresponding bonding tactics, which results in different levels of customer satisfaction, and is important in reinforcing customers' trust, commitment, repurchase intentions and corporate financial performance (Liang & Wang, 2008). Typically, customer satisfaction surveys requested participants to rate the performance or satisfaction. However, a lacuna still exists in empirically evaluating credit card services in Taiwan by customers' preference and satisfaction simultaneously.

2.3 Linguistic Variables and Fuzzy Multiple Criteria Decision Making (FMCDM)

Fuzzy numbers are a fuzzy subset of real numbers, representing the expansion of the idea of the confidence interval, and triangular fuzzy number should possess the following basic features (Laarhoven & Pedrycz, 1983). According to Zadeh (1975), it is very difficult for conventional quantification to express reasonably those situations that are overtly complex or hard to define. Therefore, the notion of a linguistic variable is necessary in such situation. A linguistic variable is a variable whose values are words or sentences in a natural or artificial language (Hsieh *et al.*, 2004). In this study, each scale of the fuzzy number is defined by three parameters of the symmetric triangular fuzzy number, the lower point, middle point and upper point of the range over which the scale is defined for either importance or performance. The linguistic variables in this study are primarily used as a way to measure the preference and performance values to assess the linguistic ratings given by the evaluators.

It can be difficult to quantify precise values in a complex evaluation system. A complex evaluation environment can, however, be divided into multiple subsystems to more easily judge differences and measure scores (Tsai *et al.*, 2011). FMCDM analysis has been widely used to deal with decision-making problems involving multiple criteria of alternatives. There are numerous attributes or features of credit card services, either their core services or supplementary services, so this decision-making that involved in evaluating credit card services can be formulated as a FMCDM problem for any financial service company.

In investigations in customer preferences of financial services chose, part of previously published papers gathered frequencies of importance associated with conjoint analysis, ANOVA method, or both (e.g., Karjaluoto, 2002; Pass, 2005; Vyas, 2005); others used the multinomial logit model (e.g., Verma *et al.*, 2004; Ding *et al.*, 2007). However, those researches never involved customer preferences in customers' perceptions and expectations. Helm *et al.* (2004) compared conjoint analysis and the AHP method and found the AHP method performed slightly better. The AHP method has an advantage in obtaining a set of weights from measuring relative importance of service attributes and this set of weights represented as customer preferences can be subsequently involved in the measurement of customer satisfactions. Moreover, a fuzzy version of AHP is very useful for measuring customer preferences within the linguistic ratings.

The concepts of ideal points have been used to solve MCDM problems in the literature (Tsai *et al.*, 2011), in terms of the principle that the most satisfying alternative should be the one as close as possible to the ideal level. The concept of grey relational space offered by Deng (1982) can be used capturing the correlations between the reference factors and other compared factors of a complex system (Deng, 1988). Grey Relation (GR) has been successfully used on various MCDM problems (Chen & Chen, 2008; Wu, 2003; Chiou & Tzeng, 2001; Feng & Wang, 2000). A fuzzy version of GR which considers uncertainties arising from data, modeling and human judgment in a fuzzy environment can involve the concept of measuring the distances between customers' perception and their expectation level simultaneously. In this study, the fuzzy

GR would be employed and the marginal evaluation of each alternative and the weight of each criterion are represented by triangular fuzzy numbers, and a distance is used to calculate the gaps between customers' perceptions and expectations.

3. Research Design

3.1 Sample and Data Collection

This study selected five banks in Taiwan, which are Taishin Bank, Taipei Fubon Bank, Citibank Taiwan Ltd., Cathay United Bank and Chinatrust Bank, as the research objectives and used each one of their new ordinary credit cards as our evaluated alternatives. These five banks are targeting relatively lower income customers with minimum application requirements, 20 year old with an annual income of NT\$220,000 (about US \$7,000). This study also categorized the characteristics of the target customers by interviewing five high-level executives in the financial services industry and along with these five executives collectively determined to focus on the target customers of 25 to 35 year old and NT\$22,000 to NT\$1 million annual earnings according to the employment rate and basic annual earnings of Taiwan people. According to the suggestions from the high-level executives and previous literature review, the attributes and criteria of ordinary credit card services were categorized and shown in Table 1.

<Insert Table 1 around here>

This study formed a consumer panel of 100 target customers (50% male and 50% female) from general manufacturing, business service industries, hi-tech industries, health care industries, and government and educational institutions. Customer panels are an appropriate sampling frame and have been used in various business applications (e.g., Lohse *et al.*, 2000; Iqbal *et al.*, 2003). These 100 volunteers were all qualified in application requirements of the five selected ordinary credit cards and all had more than three-year experiences of holding credit cards.

During the data collection phase of customer preferences, this study focused on measuring the relative importance of the nine criteria by the AHP questionnaire. Each respondent was requested to respond to twelve pair-wise comparison questions of the AHP questionnaire. Here, this study used this kind of expression to compare the nine evaluation criteria by five basic linguistic terms, as "absolutely important," "very strongly important," "essentially important," "weakly important" and "equally important" with respect to a fuzzy five level scale (Chiou & Tzeng, 2001). That is, $\tilde{1}$ represents "equally important" with scale of fuzzy number (1, 1, 3); $\tilde{3}$ represents "weakly important" with scale of fuzzy number (1, 3, 5); $\tilde{5}$ represents "essentially important" with scale of fuzzy number (3, 5, 7); $\tilde{7}$ represents "very strongly important" with scale of fuzzy number (5, 7, 9); $\tilde{9}$ represents "absolutely important" with scale of fuzzy number (7, 9, 9).

At the data collection phase of customer satisfactions, the respondents received the relevant information of the five selected ordinary credit card services. After reading the relevant information, the respondents evaluated the five ordinary credit cards on each criterion by using a five-point linguistic scale from "extremely dissatisfactory" to "extremely satisfactory." That is, $\tilde{1}$ represents "extremely dissatisfactory" with scale of fuzzy number (1, 1, 2); $\tilde{2}$ represents "dissatisfactory" with scale of fuzzy number (1, 2, 3); $\tilde{3}$ represents "ordinary" with scale of fuzzy number (2, 3, 4); $\tilde{4}$ represents "satisfactory" with scale of fuzzy number (3, 4, 5); $\tilde{5}$ represents "extremely satisfactory" with scale of fuzzy number (4, 5, 5). The consistency test would be applied to evaluate those who gathered AHP data and eliminated the data according to the consistency ratio (threshold value $CR \leq 0.1$). After screening for consistency, our total valid sample size was 74 which consist of 34 males and 40 females.

3.2 The Fuzzy MCDM Model

3.2.1 Finding the preference by criteria weights from the fuzzy AHP

The procedure for determining the evaluation criteria weights is using the fuzzy AHP. The first step of the fuzzy AHP is to use the criteria of the entire system to form a fuzzy supermatrix \tilde{C} through pair-wise comparisons. This is done by asking, "How important is one criterion compared to another criterion with respect to our interests or preferences?" The relative importance is determined using a scale of $\tilde{1}$ to $\tilde{9}$, which represents a range from "equal importance" to "extreme importance." The general form of the supermatrix is seen in matrix \tilde{C} . The form of the supermatrix depends on the variety of the structure.

$$\tilde{C} = \begin{bmatrix} 1 & \tilde{c}_{12} & \cdots & \tilde{c}_{1n} \\ \tilde{c}_{21} & 1 & \cdots & \tilde{c}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \tilde{c}_{n1} & \tilde{c}_{n2} & \cdots & 1 \end{bmatrix} = \begin{bmatrix} 1 & \tilde{c}_{12} & \cdots & \tilde{c}_{1n} \\ 1/\tilde{c}_{12} & 1 & \cdots & \tilde{c}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ 1/\tilde{c}_{1n} & 1/\tilde{c}_{2n} & \cdots & 1 \end{bmatrix}$$

The next step is using the geometric mean technique to define the fuzzy geometric mean and fuzzy weights of each criterion as follows:

$$\tilde{\gamma} = (\tilde{c}_{i1} \otimes \tilde{c}_{i2} \otimes \cdots \otimes \tilde{c}_{in})^{1/n},$$

$$\tilde{w}_i = \tilde{\gamma}_i \otimes (\tilde{\gamma}_1 \oplus \cdots \oplus \tilde{\gamma}_n)^{-1},$$

where \tilde{c}_{in} is the fuzzy comparison value of criterion i to criterion n , thus, $\tilde{\gamma}_i$ is the geometric mean of the comparison value of criterion i to each criterion, \tilde{w}_i is the fuzzy weight of the i th criterion, $\tilde{w}_i = (w_{iL}, w_{iM}, w_{iU})$, and w_{iL} , w_{iM} , and w_{iU} represent for the lower, middle and upper values of the fuzzy weight of the i th criterion. After the defuzzification of \tilde{w}_i , the nonfuzzy weights w_i can be obtained.

3.2.2 Measuring the performance by the fuzzy grey relation

This paper applies the fuzzy grey relation to measure performances and calculate the customer gaps. The first procedure of the fuzzy grey relation is generating the fuzzy performance series of each alternative ($\tilde{x}_i(1), \tilde{x}_i(2), \dots, \tilde{x}_i(j)$) in which $i = 1, 2, \dots, n$. Thus, $\tilde{x}_i(j)$ is the fuzzy performance of the i th criterion of the j th alternative, and can be represented in a matrix style. Then, the fuzzy distance of $\tilde{\Delta}_i(j)$ would be calculated. That is, the absolute value of the difference between $\tilde{x}_i(j)$ and $\tilde{x}_i^*(j)$. The $\tilde{x}_i^*(j)$ represents the best performance which is the ideal level of customers' expectations, and therefore, we set $\tilde{x}_i^*(j) = \tilde{5}$ in this study. The fuzzy grey relational coefficient $\tilde{\Gamma}_i(j)$ can be calculated by using the equation:

$$\tilde{\Gamma}_i(j) = \frac{\min_i \min_j \tilde{\Delta}_i(j) + \zeta \max_i \max_j \tilde{\Delta}_i(j)}{\tilde{\Delta}_i(j) + \zeta \max_i \max_j \tilde{\Delta}_i(j)}$$

where ζ is the distinguished coefficient and $\zeta \in [0, 1]$. Finally, the fuzzy degree of the grey equation coefficient $\tilde{\Gamma}^*(j)$ can be obtained as the following equation:

$$\tilde{\Gamma}^*(j) = \sum_{i=1}^n w_i \times \tilde{\Gamma}_i(j), \quad j = 1, 2, \dots, m.$$

where W_i is the i th criterion weight obtained from the fuzzy AHP. After the defuzzification, the nonfuzzy degree of the grey equation coefficient $\Gamma^*(j)$ can be obtained. Based on the grey relation method, once any one of the alternatives has a higher grey relational grade than the others, it is identified as the alternative with the best performance.

4. Results

This study empirically explored the customers' preferences and satisfactions to evaluate the five credit card services of Taiwan in a fuzzy circumstance. According to the formulated structure of building credit card service alternatives' evaluation, the weights of the dimension hierarchy and criterion hierarchy can be analyzed.

The results of customer preference analysis are displayed in Table 2. Comparing the results of FAHP and AHP, this study found the rankings are different between FAHP and AHP. By using AHP without considering the fuzzy environment, "Annual Fee (C_7)" is the most important criterion, followed by "Cash Bonus (C_8)" and "Other Charge (C_3)," and "Card Design (C_7)" is still evaluated as the lowest important criterion. The nonfuzzy weights (W_i) from the FAHP can be obtained; $W_i = (12.34\%, 10.00\%, 10.99\%, 8.06\%, 11.40\%, 9.79\%, 4.09\%, 22.06\%, 11.28\%)$; "Cash Bonus (C_8)" is the top one important criterion, followed by "Annual Fee (C_7)" and "Risk Assurance (C_5)," and "Card Design (C_7)" is evaluated as the lowest important criterion for the customers of credit card services in Taiwan.

<Insert Table 2 around here>

Involving the weight results from the fuzzy AHP, this study evaluated the five credit card service alternatives by using the fuzzy grey relation method. After the defuzzification, the nonfuzzy degree of the grey equation coefficients, $\Gamma^*(j) = (0.961, 0.839, 0.902, 1.009, 0.900)$, represent the nonfuzzy relative customer gaps of the five credit card service alternatives according to customers' preferences and satisfactions. It can be used to rank the five credit card services, and the ranking result is $A_4 \succ A_1 \succ A_3 \succ A_5 \succ A_2$.

5. Conclusions

This paper empirically incorporated the customer gaps of financial services involving customer preference based on conceptual theories. We are looking forward to this paper will help other researchers and practitioners adapt current frameworks to explain and understand a wider range of financial services than previously possible.

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Table 1. List of categories, attributes and criteria of ordinary credit cards

Attribute	Criterion/Feature	Explanation
Service Price (A ₁)	Annual Fee (C ₁₁)	Basic annual fee
	Penalty Charge (C ₁₂)	Revolving interest rate; late payment charge
	Other Charge (C ₁₃)	Replacement card fee; foreign currency transaction fee; statement copy retrieval fee; sales flip retrieval fee
Basic Service (A ₂)	Service Quality (C ₂₁)	Information disclosure of website; speed and simplicity of issuing; customer consultation quality
	Risk Assurance (C ₂₂)	Bank reliability; guarantee of consumption & card-missing
	Convenience (C ₂₃)	Convenience of consumption; convenience of payment
	Card Design (C ₂₄)	Artistry & freshness of card
Added Service (A ₃)	Cash Bonus (C ₃₁)	Cash back; consumption discount in allied stores
	Non-cash Bonus (C ₃₂)	Points reward; free gifts; free travel insurance; free road assistance; free airport pick-up; free parking hours; frequent flight mileage

Table 2. Customer Preferences of Credit Card Services

Attribute & Criterion	FAHP		AHP
	Fuzzy weight (%)	Nonfuzzy weight (Rank)	Weight(Rank)
<i>Service Price (A₁)</i>			
Annual Fee (<i>C₁</i>)	(22.40,37.19,61.35)	12.34% (2)	18.86% (1)
Penalty Charge (<i>C₂</i>)	(17.75,30.94,49.24)	10.00% (6)	15.69% (4)
Other Charge (<i>C₃</i>)	(19.90,31.86,55.93)	10.99% (5)	16.15% (3)
<i>Basic Service (A₂)</i>			
Service Quality (<i>C₄</i>)	(13.58,24.40,41.73)	08.06% (8)	05.83% (8)
Risk Assurance (<i>C₅</i>)	(19.73,35.65,57.34)	11.40% (3)	08.50% (6)
Convenience (<i>C₆</i>)	(17.51,28.10,51.18)	09.79% (7)	06.72% (7)
Card Design (<i>C₇</i>)	(07.56,11.85,21.07)	04.09% (9)	02.83% (9)
<i>Added Service (A₃)</i>			
Cash Bonus (<i>C₈</i>)	(45.74,65.70,96.35)	22.06% (1)	16.70% (2)
Non-cash Bonus (<i>C₉</i>)	(23.16,34.30,48.78)	11.28% (4)	08.72% (5)

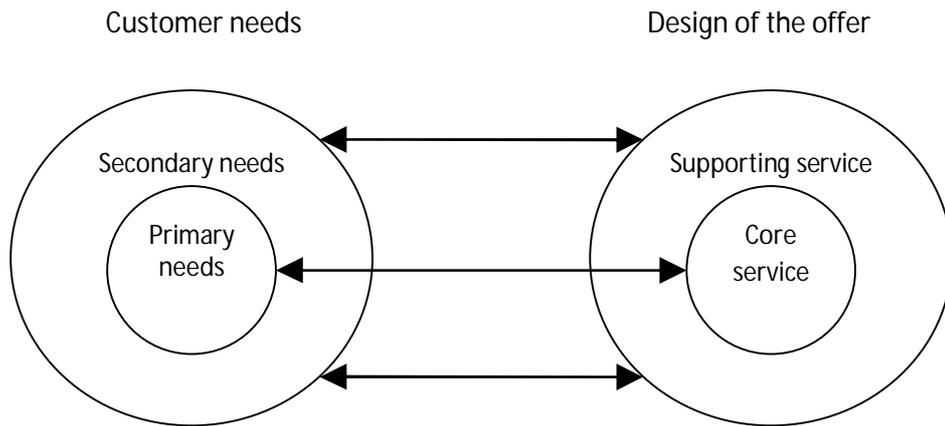


Figure 1. Model of the service concept.

Source: Edvardsson, Gustafsson, Johnson and Sanden, 2000, pp. 47.

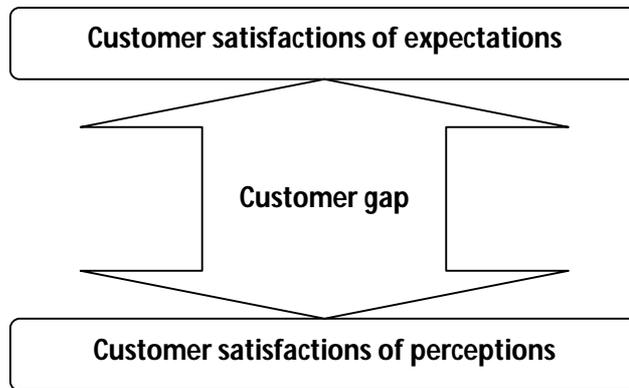


Figure 2. Service gap model.

Source: Zeithaml & Bitner, 2003, pp. 533.

"The Efficiency of the OPEC Oil Market - Evidence from Variance Ratio Tests"

Shahram Fattahi (Razi University, Iran)

Economists have been fascinated by the different issues in the oil market for years. Although different methods have been used to test the market efficiency in recent years, little attention has been paid to the efficiency of the OPEC oil market. In this paper, the random walk hypothesis and the efficiency of the OPEC oil market including its member countries were examined with the Lo & Mackinlay variance ratio test (LOMAC), Richardson & Smith variance ratio test, Belaire-Franch & Contreras variance ratio test, and Kim Bootstrap variance ratio test. The Random Walk Hypothesis states that prices are completely stochastic in nature so that they have 'no memory'. We employed weekly OPEC spot prices for the period of 3rd January 1997 to the first October 2010. The results indicated that the random walk hypothesis is rejected; implying the OPEC oil market is inefficient.

“Heavy lifting: Optimal hedging for the heavy oil industry”

Ivan Ourdev (JR Shaw School of Business, NAIT, Edmonton, Canada)

Crude oil is a volatile commodity and exposes oil producers to significant price risk. Risk management typically involves entering positions in the derivatives market that offset the amount of crude oil to sold in the future. One notable feature of the heavy oil industry is the significant amounts of gas needed to produce a barrel of crude oil. In this paper we argue that a proper risk management should incorporate the price risk of natural gas and demonstrate that failing to do so leads to a significant over-hedging from enterprise perspective. We also propose a consistent hedging computation technique that retains the portfolio point of view from the formulation stage to the solution stage. We demonstrate the correctness of both propositions on a hypothetical, though realistic, test case.

Introduction

Canada has vast deposits of unconventional fossil-based fuels in the form of oil sands. With estimated oil reserves of over 170 billion barrels it is second only to Saudi Arabia (ERCB 2009). It also has the most mature bitumen oil industry with a current production of over 1.3 billion bbl/day that is expected to double in the next five years.

Crude oil prices are determined by the interplay of the global demand and supply and beginning 2004 have seen extraordinary volatility. One of the most popular benchmarks for crude oil prices is the contract for domestic light sweet crude oil physically deliverable at Cushing, Oklahoma storage hub, traded on New York Mercantile Exchange (NYMEX) designated as West Texas Intermediate (WTI). The WTI price reached a daily high of US\$147.27/bbl at on July 11, 2008, closed at \$30.28 on Dec 23 the same year and was trading over the \$100 level by Mar, 2011 (see **Figure 1** below). Such large fluctuations in prices have enormous impact on the revenues of the companies in the energy industry.

This price risk is, typically, managed by entering offsetting trades, called hedges, in the financial derivatives markets.

Hedging allows the producer to lock in a particular value of the physical inventory in advance. It entails entering a derivatives position that is equal in size and opposite to the position in the risky physical asset. In the case of oil producers the position is called short, or seller's hedge, and the required amount of futures contracts is sold short.

Poorly designed hedging strategies cost companies billions of dollars every year. Companies suffer huge losses from both un-hedged exposures and from poorly designed hedges. Some prominent examples include the \$1.9 billion bailout in 1994 of an American subsidiary of Metallgesellschaft AG, formerly one of the largest German companies, as a result of a hedge with a poorly designed maturity structure (Pirrong 1997) and the 2006 Amaranth Advisors natural gas hedge fund disaster of \$6 billion lost in about ten days (Ziemba and Ziemba 2008).

For companies involved in heavy oil production the problem is further complicated by their production process, which uses oil sand. The term describes mixtures of sand, water and clay impregnated with extra-heavy crude oil known as bitumen.

The oil sand deposits vary in thickness and depth. Depending on these two parameters there are two major types of extraction approaches – mining and in-situ. For relatively shallow deposits (less than about 300 feet below the surface) the first method is given preference, while the second is used for deeper deposits.

There are several in situ methods for extraction, the most popular being the *steam-assisted gravity drainage* (SAGD) and *cyclic steam stimulation* (CSS), both of which involve injecting steam into the ground to separate the bitumen from the sand and decrease its viscosity. The first method utilizes two horizontal wells; one for steam injection, the other – for extraction. The second method relies on a single vertical well that is alternating between injection and extraction. Both methods are highly energy intensive, having steam-to-oil ratios of 2 to 4 barrels of heated water for every barrel of bitumen produced (Lacombe and Parsons 2007). Most of this energy comes from natural gas. Similar water requirements are cited for mining operations, 2 to 4.5 bbl water/bbl SCO (Toman et al. 2008).

Crude oil is characterized by its sulfur content and its weight relative to the weight of water measured by the American Petroleum Institute (API) gravity scale in degrees. WTI contains approximately 0.24% sulfur (making a "sweet" crude oil) and has API gravity of 39.6° (making it a "light" crude oil). The final product of the oil sand process is the *synthetic crude oil* (SCO, syncrude), which is obtained by upgrading the bitumen and is a mixture of naphtha, distillate, and gasoil streams with no residuum. The physical characteristics of the synthetic crude oil depend on the upgrading technology and the type of the target refinery, but are with a typical range of API gravity of 31-33° (making it a "heavy" crude oil) and sulfur content of less than 0.2% (Speight 2008). Since bitumen has a gravity of less than 12 degrees API, it is too heavy for normal pipeline transportation or processing in a refinery it is upgraded close to the mining location. The upgrading in Canadian oil-sand operations is, typically, a two-stage process. The primary upgrading consists of either thermal cracking via coking or a catalytic hydro-conversion. The secondary upgrading involves catalytic hydro-treating.

Upgrading uses large quantities natural gas for both heat and hydrogen production (Toman et al. 2008). This is added to the heat needed for the extraction phase. The total amount of natural gas is dependent on the technology. Lacombe and Parsons (Lacombe and Parsons 2007) estimate that for a SAGD plant with steam oil ratio of 2.5 bbl water/bbl bitumen, steam production would require natural gas of 0.42 Mcf/bbl water. Converting at 0.975 MMbtu/Mcf, each barrel of SCO would require 0.4095 MMbtu of natural gas. For companies with integrated mining/upgrading operations the same authors cite 0.7312 MMbtu/bbl SCO.

Thus, even though SCO can be equalized to the light crude deliverable under the standardized WTI futures contracts, the risk exposure of the producer is to both the price of crude oil and to that of the natural gas. The main point of this study is that the hedging of the heavy crude oil should take into account one of the main ingredients of the operating cost, the correlated natural gas.

There are several ways of reducing the use of natural in the production process. One is to use the coke, which is a byproduct of the primary upgrading, for heat and electricity generation in place of natural gas. The downside is elevated CO₂ emissions and the associated cost and pending regulatory restrictions. The other reduction method is to novel technologies with less reliance on gas, such as vaporized extraction (VAPEX) or combustion toe-to-heel air injection (THAI). These technologies are still under development and it is unlikely to become dominant in near future (Toman et al. 2008). This study is the first, to our knowledge, that addressed the issue of hedging price risk in the heavy oil industry by taking into account the multi-commodity nature of the price risk exposure. We develop a spread-type of a pricing model, similar to the known spark and crack spreads, that builds on the difference between the input commodity cost and the output final product, accounting for the correlation structure of the two and for the difference between the composition of the product and the available hedging instruments. We proposed a new technique of hedging that is consistent with the portfolio formulation and utilizes the strength of the mean-variance optimization approach to find the optimal hedge ratio and applied the new approach to the problem of futures hedging of heavy oil producers for a wide range of production technologies. We evaluate and compare the performance of different hedging strategies using historical prices.



Figure 1 Crude oil spot prices FOB (free on board) in dollars per barrel, West Texas Intermediate (WTI), Cushing, OK, from Jan 03, 2000 to Jan 31, 2011. (Source: www.eia.doe.gov)

The paper is organized as follows. In Section 2 we revisit the futures hedging problem and the two most often used hedging techniques, based on the minimum variance of the augmented portfolio, the analytical formulation and the ordinary least squares regression approach. We introduce the enterprise-wide risk management framework and the hedging technique based on the mean-variance portfolio. We compare and contrast the broader risk management approach to the conventional methodologies. In Section 3 we apply both approaches to a case study of futures hedging of a known quantity of heavy oil. We pay a particular attention of reproducing the same results whenever applicable and discussing the drawbacks of the conventional methods, particularly the dangers of over-hedging. In the final Section we draw the main conclusions from the study.

Futures hedging revisited

Hedging is a financial transaction designed to minimize some risk. It is a part of the overall risk management of the company and as such is influenced by many non-financial factors as business environment, strategic considerations, and the expected economic outlook. Most often, the decision to hedge or not to hedge and how much to hedge are taken in advance and the motivation for hedging is separated from the actual hedge implementation. This is consistent with the prevailing view of hedging as a form of insurance and risk transfer for price risk management (Pennings and Leuthold 2000). The idea behind hedging can be formulated quantitatively as follows. Given a set of risky assets that give rise to a "cash" position S_t of uncertain future value form an augmented portfolio by adding a set of appropriate instruments f_k , typically financial derivatives. The value of the resulting portfolio is

$$\Pi_t = S_t + \sum_k w_k f_k \quad (1)$$

Then, the hedging problem reduces to choosing the appropriate amounts (weights) that "minimize risk." In the case of only one hedging vehicle its weight is called hedge ratio (e.g. Chance and Brooks 2009).

The simplest approach, called "barrel for barrel" or "gallon for gallon" hedge, is to impose the requirement that the augmented portfolio does not change its value, i.e. $\Delta\Pi = 0$. The most widely used approach is to minimize the variance of

the portfolio instead. For the case of a single position in the cash market and a single hedging vehicle it yields a simple analytical formula for calculating of the optimal hedge ratio, h^* .

For the case of n_S barrels of oil to be hedged at a current spot price of S_t dollars per barrel and volatility σ_S one can use n_F number of futures contracts, each for S_F barrels of oil at a price F_t and volatility σ_F . The contract specification for light, sweet crude oil futures on NYMEX is for 1,000 US barrels (42,000 gallons).

With this notation the value of the augmented portfolio, Eq. 1, takes the form

$$\Pi_t = n_S S_t - n_F S_F F_t, \quad (2)$$

Dividing this expression by the number of barrels of oil we obtain the value of the portfolio *per barrel* of oil

$$\pi_t = 1 \cdot S_t - h F_t, \quad (3)$$

where the trade units of the cash position and the futures contract are combined in the hedge ratio

$$h = \frac{n_F S_F}{n_S}, \quad (4)$$

We will be using Eq. 5 below for a minimum variance optimization problem. We also need an expression that links the expected returns of the portfolio to the expected returns of its components. The derivation is straightforward. We start with the initial value of the portfolio

$$\Pi_0 = n_S S_0 - n_F S_F F_0, \quad (5)$$

Dividing both sides by Π_0 gives the constraint on the proportions (weights) of cash w_S and futures w_F in the portfolio

$$w_S + w_F = 1, \quad (6)$$

where $w_S = n_S S_0 / \Pi_0$, and $w_F = -n_F S_F F_0 / \Pi_0$. On the other side, if the proportions of the components stay the same, the value of the portfolio at later moment of time can be written as

$$\Pi_1 = n_S S_1 - n_F S_F F_1, \quad (7)$$

Dividing both sides by the initial value of the portfolio and subtracting one we get

$$\Pi_1 / \Pi_0 - 1 = n_S S_1 / \Pi_0 - n_F S_F F_1 / \Pi_0 - 1, \quad (8)$$

Taking into account the constraint, Eq. 6, and the definition for simple returns as the proportional change in value between two consecutive moments of time, $r_V = V_1 / V_0 - 1$, with some simple algebraic rearrangements we obtain the formula for the historical returns of the portfolio

$$r_{\Pi} = w_S r_S + w_F r_F, \quad (9)$$

which is typically written

$$r_{\Pi} = r_S - h r_F. \quad (10)$$

Using the linearity property of the expectation operator, the general expression for the portfolio expected returns takes the form

$$E(r_{\Pi}) = E\left[\sum_k w_k r_k\right] = \sum_k w_k E(r_k). \quad (11)$$

In order to find the optimal hedge ratio we calculate the variance of the portfolio returns, Eq. 10. The usual rules for applying the variance operator yield

$$\text{Var}(r_{11}) = \text{Var}(r_S) + h^2 \text{Var}(r_F) - 2h \text{Cov}(r_S, r_F) \quad (12)$$

Minimizing the portfolio variance given by Eq. 12 w.r.t. h yield the final expression for the optimal hedge ratio

$$h^* = \rho_{SF} \frac{\sigma_S}{\sigma_F} \quad (13)$$

where ρ_{SF} is the correlation coefficient of the spot and futures returns. In its simplest application the formula is applied as is to the historical time series of the spot and futures price changes, ΔS_t and ΔF_t . The most common approach is to use ordinary least-squares (OLS) and regress the spot price changes on the futures price changes.

$$\Delta S_t = \alpha + \beta \Delta F_t + \varepsilon_t \quad (14)$$

Comparing the definition for the slope of the regression with the analytical formula, Eq. 13, we conclude that the slope of the regression is the optimal hedge ratio

$$h^* = \beta \quad (15)$$

This offers a very convenient way of calculating the latter by regressing the crude oil returns on the returns of the futures contracts. At the same time it has significant drawbacks. First, it uses the historical volatilities and correlation, which are backward looking. Hedging is by definition a forward-looking quantity and it should incorporate expected values in its calculation. Second, the error term in the OLS regression equation, Eq. 14, is subject to restrictions in regards to expected values, autocorrelation and heteroscedasticity. Often the last two conditions are violated in the case of financial time series. The objective function in the optimization is the risk, defined as the standard deviation of the portfolio returns and this may not be the most appropriate one. The approach also ignores the required return, assuming that the hedging quantity is exogenous. Finally, the hedging horizon is also an exogenous parameter and the hedge ratio is constant over the period. There are many techniques that have been proposed to resolve this issues, such as conditional heteroscedastic (ARCH and GARCH) methods, the random coefficient method, and cointegration, to mention just a few (for a review of different hedging approaches refer to Chen et al. 2003).

Here, we are addressing a different drawback of the conventional hedging approach, the fact that it hedges only the output of production, ignoring the cost and the variability of the materials used to create this output. In order to resolve this problem we stress the portfolio formulation of the hedging problem. We further augment the expression for the hedging portfolio, Eq. 1, by adding to the value of "cash" position S_t of the final product the amounts of inputs I_t that go in producing S_t

$$\Pi_t = S_t - I_t + \sum_k w_k f_k \quad (16)$$

The quantity I_t can include energy, raw materials, labor, CO₂ emissions charges etc. The negative sign indicate expenditure. The only restriction is that the proportion if the inputs per unit of output is a known constant during the hedging horizon, which would be normally satisfied for a specified production process. The inputs also have to be risky assets with uncertain future values, otherwise their contribution to hedging would be a trivial calculation. Having augmented the hedging portfolio in this way, we keep the portfolio interpretation and solve the following minimization problem

$$\begin{aligned}
& \min_w \text{Var}(\Delta\Pi) \\
& \text{s.t. } w_k = \text{const}_k \\
& \quad w_k \geq w_k^*, \quad - \text{for the risky assets} \\
& \quad w_k \leq 0, \quad - \text{for the hedging instruments} \quad (17)
\end{aligned}$$

This formulation of the hedging problem is quite similar to the mean-variance analysis set by Markowitz. One popular version of the latter is solving for the portfolio weights that minimize the variance of the portfolio subject to a specified expected return and is written in matrix form as (see e.g. Prigent 2007)

$$\begin{aligned}
& \min_w \sigma_{\Pi}^2 = \mathbf{w}^T \mathbf{V} \mathbf{w} \\
& \text{s.t. } E(r_{\Pi}) = \text{const} \\
& \quad \mathbf{w}^T \mathbf{1} = 1 \quad (18)
\end{aligned}$$

Comparison between the two, Eq. 17 and Eq. 18, reveals the similarity. The only major difference is that in the mean-variance optimization there is a constraint on the expected return that is missing from our hedging formulation. It has to be noticed, though, that it is due only to our desire to keep the formulation simple and easy to explain, and to be able to draw a parallel between the conventional hedging techniques and the proposed approach. There is no restriction on the inclusion of the desired minimum return as part of the problem. This, presumably, could give a self-consistent way of determination of how much of the daily production output should be hedged.

The proposed hedging approach has the advantage of treating risk from enterprise point of view, incorporating not only the final product market risk, but also the exposure to product components taking into account correlations among them. Thus, it eliminates the danger of over-hedging. It is also able to capably hedge several risk exposures simultaneously with more than one hedging instrument. Below we illustrate the method and compare its performance with the conventional approaches on a simple, yet practical, case of hedging heavy oil exposure.

Case study

In order to illustrate the proposed hedging approach and contrast it with the popular techniques we consider the following hypothetical situation, where a heavy oil upgrading facility is facing the choice of hedging its output. Without loss of generality we take the amount of SCO to be 100,000 barrel. This can be thought of as finding the optimal hedging ratio *per* 100,000 barrels of output.

The source of data for the case study was the US Government Energy Information Administration, Department of Energy. We selected 52 weekly prices of WTI crude oil, natural gas and NYMEX four-month crude oil futures for the year 2010. The variation of the corresponding prices is shown in **Figure 2** and **Figure 3**. The calculation of the annualized volatility of the simple returns showed 23.35 percent for the cash crude oil, 21.32 percent for the futures, and 38.04 percent for the natural gas. The correlation coefficient of the crude oil spot returns and futures return was 0.958.

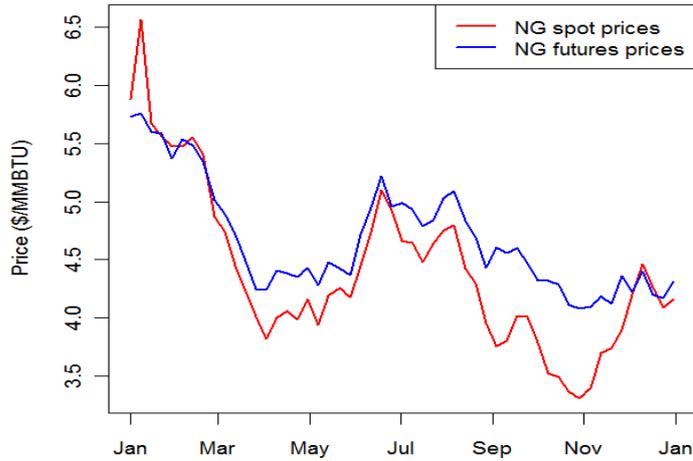


Figure 2 Weekly natural gas spot and futures prices in dollars per MMBtu, 2010. (source: www.eia.doe.gov)

Then the optimal hedge ratio was calculated using the analytical formula, Eq. 13,

$$h^* = \rho_{SF} \frac{\sigma_S}{\sigma_F} = 0.958 \frac{3.238}{2.956} = 1.0492 \quad (19)$$

Then, solving Eq. 4, for the number of futures contracts we find

$$u_F = hu_S / s_F = 105 \text{ futures contracts} \quad (20)$$

Thus, according to the standard minimum variance approach, a heavy oil produce, who wants to reduce the price risk of selling 100,000 barrels in the future has to take a short position in 105 futures contracts.

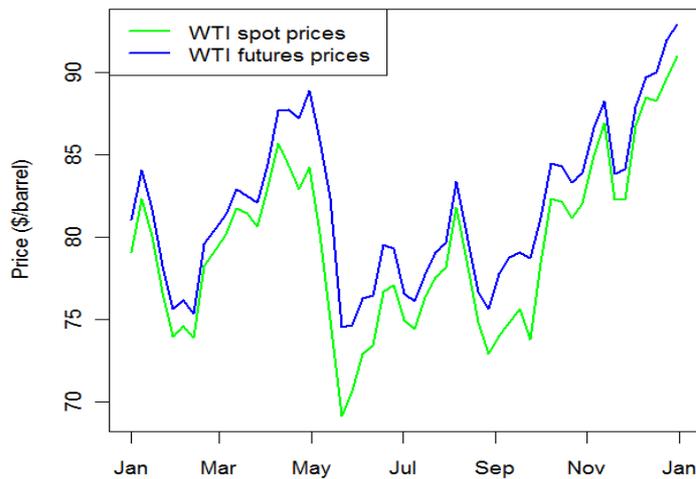


Figure 3 Weekly WTI crude oil spot and futures prices in dollars per barrel, 2010. (source: www.eia.doe.gov)

We can compare this result with the result obtained by using simple linear regression. To do so we calculate the percentage change of spot and future prices, $\Delta S_t = S_t / S_{t-1} - 1$ and $\Delta F_t = F_t / F_{t-1} - 1$, and apply the OLS regression, Eq. 14. The result of the regression is shown in **Figure 4**. The numerical values are given as

$$\Delta S_t = -0.0063 + 1.0492 \Delta F_t \quad (21)$$

(-0.05)
(23.66)

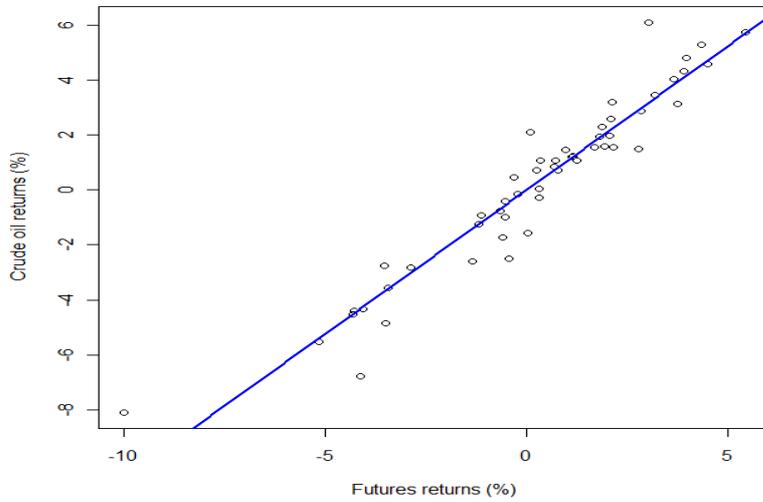


Figure 4 OLS regression of the weekly WTI crude oil spot return on the weekly futures returns for 2010.

Since the optimal hedge ratio is given by the slope of the regression, Eq. 15, we obtain the same number of 105 short futures contracts as in the case of the analytical formula. One additional advantage of this approach is the possibility to control the significance of estimated coefficients. The values in parentheses in the last equation, Eq. 21, are the t-ratios of the coefficients. The t-ratios are the test statistics of null hypothesis that the true values of the corresponding coefficients are zero against the two sided alternatives. The 1 percent critical value for a two-sided t-test on 52 degrees of freedom is 2.674. Comparing with the value of 23.66 for the t-ratio of the slope of the regression we can see that the number is highly significant. This is confirmed by the p-value, which is practically zero in this case.

The estimation the optimal hedge ratio when the expenditures on natural gas are taken into account amounts to solving the constrained quadratic problem, Eq. 17. In order to obtain a closed solution we needed to assume an amount of natural gas necessary to produce a barrel of SCO. We already pointed out that this amount depends on the technology used at a particular plant. For plants with integrated mining/upgrading operations the amount was 0.731 MMbtu/bbl SCO. For plants with SAGD heating required 0.4095 MMbtu of natural gas/bbl water. Multiplying the last figure by the number of bbl water/bbl SCO produced, by 2 and 4, we calculate the range of possible values for the most popular technologies as between 0.731 and 1.638 MMbtu/bbl SCO.

With these final assumptions the optimization problem can be written as

$$\begin{aligned} \min_{\mathbf{w}} \quad & \mathbf{w}^T \mathbf{V} \mathbf{w} \\ \text{s.t.} \quad & w_S = 1.0, \\ & w_G = -w_{FIX}. \end{aligned} \quad (22)$$

Here, $w_S = 100\%$ is the amount of cash crude oil output to be hedged, and $w_G = -w_{FIX}$ is the percentage of natural gas input per barrel of oil produce, corresponding to the low and high end of the range of technology dependent usage. Intuitively, we are solving for the number of futures contracts that are going to minimize the volatility of the returns of the augmented portfolio. Using the historical data, we estimated the mean weekly return of the cash crude oil to be $\mu_S = 0.27\%$, the return for the futures was $\mu_S = 0.27\%$, and the return of the natural gas $\mu_G = -0.67\%$. The variance-covariance matrix was calculated (in percentage form, for readability) as

$$\mathbf{V} = \begin{bmatrix} & r_S & r_F & r_G \\ r_S & 0.103 & 0.090 & 0.038 \\ r_F & & 0.086 & 0.036 \\ r_G & & & 0.237 \end{bmatrix} \quad (23)$$

The optimization problem, Eq. 22, can be solved with any of the available software packages. Given the simplicity of our illustrative example we used Excel's Solver.

Our first experiment was to solve Eq. 22 ignoring the natural gas component as it is done in a typical problem formulation, i.e. setting $w_G = 0$. The solution of this minimum variance portfolio problem is an optimal hedge ratio of

$h^* = w_F = -1.0492$, which is identical to the one obtained using the analytical. This confirms the correctness of the approach for the usual case of production output hedging.

Next, we "switch on" the gas input and set it to the usage ratio for plants with integrated mining/upgrading operations

$w_G = -0.731$. The optimal hedge ratio, calculated by the software was $h^* = w_F = -0.7404$, which results in 74 short futures contracts. Comparing this number with the hedge ratio, obtained by hedging the crude oil output only, 105 futures, we can conclude that the conventional approach results in a significant over-hedging of the overall risk exposure of the firm.

The difference is most striking for the case of a SAGD plant with high utilization of water, 4 bbl water/bbl SCO. Using the water utilization ratio, calculated above, $w_G = -1.638$, yields an optimal hedge ratio of only $h^* = w_F = -0.3575$. This is equivalent to 36 short futures contracts, a far cry from the estimate of 105 futures.

Thus, hedging the output of a plant only is likely to result in a significant over-hedging, with the degree of over-hedging being proportional to the amount of the production input, natural gas in our case, required per unit of output, barrel of SCO.

Since one of our purposes is to illustrate the feasibility of the proposed hedging approach and its reduction to the results from the conventional methods whenever applicable, we made one final step. The test case considered here is, in fact, a problem of the type of hedging the spread between the value of the crude oil and that of the natural gas. Thus, the results, obtained from the mean-variance optimization in this case should be identical to the usual regression analysis where the role of the dependent variable is the difference between the change in the price of crude oil and that of natural gas time the gas utilization ratio. The result from OLS regression for the case of the integrated production was

$$\Delta S_t - 0.731 \Delta G_t = \underset{(1.0)}{0.563} + \underset{(4.0)}{0.740} \Delta F_t \quad (24)$$

The regression output is presented in the **Figure 5** below. The comparison of the value of the slope, 0.74, with the value of the optimal hedge ratio, obtained by the mean-variance portfolio approach shows that the two are identical. The t-ratio also indicates that the slope is significant. This comparison confirms that the two approaches yield the same results for the types of problems where both are applicable. The portfolio approach has a much broader range of applicability.

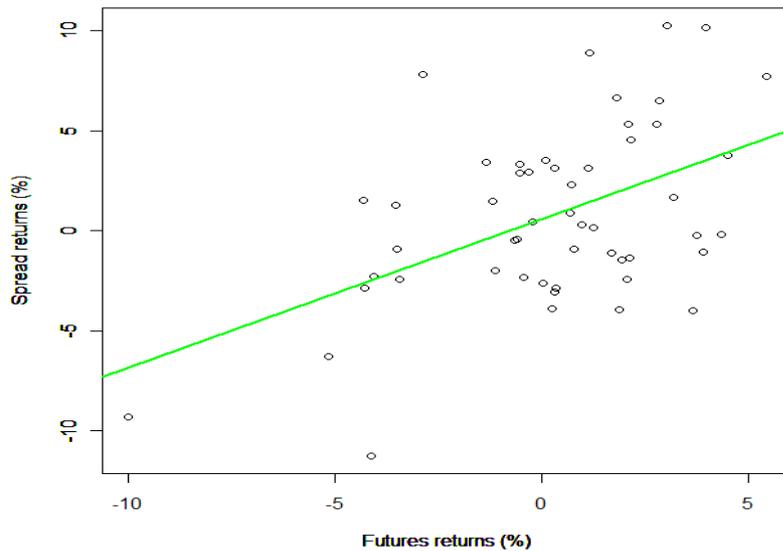


Figure 5 OLS regression of the weekly WTI crude oil spot return on the weekly futures returns for 2010.

Conclusions

The purpose of this study was twofold. On the one side we put forward a novel approach to hedging where the overall enterprise risk exposure is taken into account, not just the price risk of the final product. On the other side we proposed a new technique of hedging that is consistent with the portfolio formulation and utilizes the strength of the mean-variance optimization approach to find the optimal hedge ratio.

We applied the new approach to the problem of futures hedging of heavy oil producers for a wide range of production technologies. Our choice was guided not only by the practical utility of the problem, but also by the potential of the problem to clearly demonstrate the advantages of the portfolio approach to hedging. We compared the results obtained by our approach to those from the conventional minimum variance and OLS regression. This was done for two cases: the classical hedging of crude oil with futures and the case of hedging of the spread between the crude oil and natural gas. In both cases the numbers from portfolio approach were identical to those, obtained from the conventional calculations, which provides assurance for the correctness of the method.

We paid special attention to the effects of taking into account the process inputs, in this case the natural gas, on the optimal hedge ratio. We estimated the range of gas consumption ratios for the most popular heavy oil technologies and used them to find the corresponding optimal hedge ratios. The results showed that the conventional hedging approach leads to a significant over-hedging when viewed from a broader risk-management perspective. This is the case for even technologies that use relatively modest amounts of gas. Even though the method fixes the future selling price of crude oil it does not provide the optimal risk management sought. This is an argument in favor of our approach for enterprise level risk management.

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"Is a rising better educated labour force harmful?"

Cinthya G. Caamal-Olvera (Universidad Autonoma de Nuevo Leon, Mexico)

The aim of this paper is to explain a declining trend on the returns to education in Mexico which could be consistent with a rising better educated labour force. The paper will provide robust estimates of the returns to education across the conditional wage distribution. The empirical strategy is to apply quantile regression in order to make time comparisons inter-quantiles. The results do not promote an optimistic view of future educational spending. In fact, the rewards obtained from additional education do not depend only on the individual's decision to accumulate human capital since it is a result of a match in the labour market. Results reveal that a rising labour force is employed in jobs that may not suit their acquired knowledge.

Keywords: Returns to Education; Quantile Estimation; NAFTA; labour market; Mexico.

1 Introduction

The objective of the present study is to analyse trends of a growing better educated labour force and appraise how the returns to education have evolved during the last decades. The goal is to revise the effect of a rising pattern of education level and its effects on wages. The level of education chosen by individuals were affected by several structural changes such as reforms in the education system, the increase in compulsory education years, openness to trade and privatization of government-owned firms among other changes that had underlined the characteristics of the economy.

The database analysed is the Mexico's National Urban Employment Survey (ENEU) in the period of 1988-2004 and the National Survey of Occupation and Employment (ENOE) for the subsequent period of 2005-2008. In order to analyse how the labour force had evolved over the period of 1988-2008, it was defined two main classifications of several occupations. The association between education and type of jobs exposed surprising changes in the labour market. Since human capital theory establishes that education will increase wages; we can infer that highly educated workers will be allocated in jobs that pay a salary according to their qualifications. However, in 1988 around 14 percent of workers with college or more education were employed in jobs with low skill requirements and this percentage rose up to 34 percent in 2008. Therefore, it is important to quantify and compare how labour market is rewarding additional years of education to this rising better educated labour force over time.

A standard measure to estimate the effect of education on workers' income is to apply the structural model of the returns to schooling proposed by Mincer (1958). In this study a nonparametric technique is used to deal with the unobservable characteristics across individuals over time. In principle, instrumental variables technique could identify the unobserved ability that biases the estimated coefficients of the returns to education. Nevertheless, given the temporal comparison of the estimates, it is hard to find an instrument that identifies wage effects over time. In fact, the instrument could bias -even more- the coefficients. Consequently, even though the returns to education coefficients are biased, what matters to this study is the trend of the coefficients over time. The empirical strategy will consider quantile estimation to compare returns to education across quantiles over time. The reason to use quantile regression is to find out whether the effect of education differs within the conditional wage distribution. Results show that the estimated returns trend is declining particularly after 1997. It is important to evaluate the effectiveness of the labour market to accommodate workers according to their qualifications. Results imply that a rising labour force is employed in jobs that may not suit their acquired knowledge; nonetheless other factors could also play an important role in the evolution of this declining trend.

The paper is structured as follows: section 2 provides a brief literature review of the empirical evidence regarding to returns to education issues; section 3 presents a brief descriptive statistic summary of the sample used; section 4 provides detailed information of the workers' type of job given their level of education; section 5 summarises the main issues regarding the estimation of the returns to education; section 6 describes the empirical strategy of the study; section 7 presents the results for men workers; and finally, section 8 concludes.

2 Literature Review

In several papers the main topic studied is the estimation of returns to schooling, Mincer (1958), Schultz (1961), Becker (1962), Becker (1964), Ben-Porath (1967), and Mincer (1974). In these studies authors assert that productivity can be improved because schooling directly enhances wages. On the contrary, Spence (1973) proposed that schooling is related to higher wages through a signalling effect of ability. Weiss (1995) claimed the main distinction between the two approaches is that the first one assumes that education is the cause of the workers' productivity differences, and in the signalling approach workers' differences existed previously to the education choice. Regan, Oaxaca and Burghardt (2007) developed a neoclassical model of optimal schooling, they argue that not only the Mincerian schooling model overstates the returns to education due to the lack of an ability control variable but also in the context of a simple schooling model, with a linear schooling specification, returns to education have identification problems and cannot be considered as an internal rate of return.

The empirical evidence regarding the returns to schooling has grown in the last decades, cross-sectional studies have attempted to disentangle the endogeneity of education and wages, Card (1999) made a review of the literature where there are studies of Griliches (1977), Angrist and Krueger (1991), and Ashenfelter and Krueger (1994), among others, using instrumental variables to account for this endogeneity, although there are still issues regarding the choice of a convenient instrument, as Heckman and Vytlacil (2005) pointed out, different instruments define different parameters. Other studies have estimated returns to schooling by looking at the whole conditional earnings distribution, such as the quantile approach by Koenker and Bassett (1978). Its properties in the presence of heterogeneity make quantile regression a suitable technique.

Researchers are also concentrated on studying the evolution of the returns to education. Case country empirical evidence provides different patterns of the returns to schooling over time. Some studies reflect an increasing, stable or declining trend, the direction of the trend depends on the characteristics of each country, time horizon considered, structural reforms, change in their political system and the like. For example, Buchinsky (2001) estimated an increasing trend of the returns to schooling in the US between 1963 and 1980 and only after 1981 at all quantiles of wage. Also, his results showed that returns to education and experience are different for any quantile, even if the change over time follows the same pattern for all the quantiles.

Machado and Mata (2001) provided evidence of increasing returns to schooling over the period 1982-1994 for Portugal, he claimed that education is more valued for highly paid jobs, since the impact of education at the tails of the distribution was distinct, the return at the 90th quantile increased by 3 percent and the returns at the low quantiles decreased by 1.5 percent. Although returns to nine-year mandatory schooling decreased over the entire wage distribution, they argue this is because of the fall of the returns associated with the elementary education categories. Besides, the returns to have a college degree are on average increasing from 1982 to 1994 for the median and upper quantiles. They concluded that only after a certain degree, education pays off, and when this happens education is more valued for highly paid jobs. Also an

increasing trend of returns to education over time is estimated for transition economies, Flabbi et al. (2007) used comparable data for eight countries⁶⁴ from the early transition period up to 2002. They suggest that the cause of this tendency is the institutional and structural factors that were present over this period of time.

Some authors have compared different countries using similar controlled variables. Martins and Pereira (2004) presented quantile estimates for the returns to schooling for 16 European countries for the mid-1990s and compared trends over time across countries. They contrasted specific cross-country returns to schooling according to the accessibility of country data and accounted for differences in the data observations, diverse sources of information such as household, employee or employer survey, and different wage measures, gross or net. They found a robust stylised fact that returns to schooling are larger for more skilled individuals, thus returns to schooling increased across deciles for the set of countries analysed, although Greece shows a rather decreasing trend across deciles, they claimed this was because the available wage data was net of taxes which makes the comparison to other countries difficult. Italy and Austria also reported net wages and their trend across deciles was the opposite to Greece.

Returns to education estimates for Germany have shown stable returns to schooling, Fitzenberger and Kurz (2003) provided an empirical analysis of the structure of earnings in West Germany across skill groups and industries for the period 1984-1994. They used panel data with a block bootstrap procedure to account for heterogeneity and autocorrelation in the error term. They found a uniform trend over time as well as different effects of human capital and industry variables on earnings across quantiles.

Conversely, other studies have found declining trends over time. For Italy, Naticchioni et al. (2007) compared public and private sector workers and found deeper decline in the private sector, which was the result of institutional factors such as stronger unions, higher wage compression, and other labour market conditions that did not affect the public sector. Unlike other countries where the trend of Educational Wage Premia (EWP) has been stable or slightly increasing for some groups, Austria has shown a decrease of the EWP for all educational attainments at all quantiles. Fersterer and Winter-Ebmer (2003) estimated returns to education in Austria over the period 1981-1997 using cross-sectional data. They estimated that returns to secondary and tertiary education drop for all quantiles and the spread of returns is lower for females. In addition, they offered an explanation of this decline which is consistent with a rise in the number of highly educated workers over the last two decades. In general, they found higher estimated returns to education at higher quantiles, and all the coefficients are statistically different from each other. Furthermore, the fall in returns over time is relatively similar across quantiles, although women's returns to schooling fell disproportionately in the lowest decile.

According to some studies for the case of Mexico, the tendency of the returns to schooling has not followed a linear development over 1987-2002. Rodriguez-Oreggia (2005) found that the highest rates of returns to education were presented in 1991-1992 and the lowest, which coincide with the Mexican peso crisis, in 1994-1995. Moreover, the dispersion of the returns to education among regions increased, firstly because of the peso crisis, and secondly because of the effects of the North-American Free Trade Agreement (NAFTA). However, as he mentioned, it is striking to observe that returns to schooling have decreased in recent years. Lopez-Acevedo (2006) found that returns to schooling for upper secondary rose sharply in the late 1980s and early 1990s and then fell after 1993. However, returns to tertiary education continued to rise until 1996, before falling to levels that remained superior to those observed in the early 1990s. Moreover, she explained this drop as a cyclical fall in education premium in recession times, which was observed in other Latin-American countries.

⁶⁴ Bulgaria, Czech Republic, Hungary, Latvia, Poland, Russia, Slovak Republic and Slovenia.

3 Sample description

The database used in this study is a subset of the Mexico's National Urban Employment Survey (ENEU) for the period 1988-2004 and the National Survey of Occupation and Employment (ENOE) for the subsequent period 2005-2008. The two surveys are equivalent in terms of the questions addressed in this research, even though the questionnaire changed. Another important change is the sampling strategy; nonetheless it is possible to make comparable inferences.

Data is presented quarterly, ENEU-ENOE are five-quarter round panel, which means that one family is followed-up in five subsequent quarters. In order to avoid the overrepresentation of a single family in the objective sample only the third quarter of every year is considered.⁶⁵ Likewise the sample subject to study is formed by the heads of nuclear families, father and mother and it is considered nuclear families to avoid any household composition effect. Furthermore, people aged between 20 and 55 years are included in the objective sample. The upper limit is a conservative bound, since according to the Social Security Law⁶⁶ prevailing in Mexico during the studied period, workers could retire before they turned 60 years old if they have worked at least 1,250 weeks among other requirements,⁶⁷ for this reason, workers will probably be found retired at any age before 60. The sample excludes students so as to consider only those who can participate intensively in the labour market in the short term.

In the final dataset two main groups of people can be identified: 1) non-workers, individuals who reported neither working⁶⁸ nor studying, and 2) workers who worked at least one hour and are not students. To have a finer classification of workers, two other groups can be considered. The first group, Full-Time Full-Year (FTFY) are people who worked the whole year and in the previous week to the survey worked at least 20 hours and not more than 72 hours while the second group is Part-Time (PT) are those who worked less than or equal to 20 hours per week and not necessarily worked the entire year. Once again, these two groups can be split into two other groups: employees⁶⁹ and self-employed.

FTFY employees represent the largest group for men. Part-time employees represent around 14.3 percent of the total sample. Non-workers represent around 11.4 percent of the male sample. The group considered for the estimation is the FTFY men employees, not only because it depicts the formal sector but also it is a more stable group in comparison to self-employed and part-time workers, representing 64 percent of the total male sample.

Figure 1 shows how the stock of FTFY employees has evolved over time conditional to their educational levels. For this purpose, two main classifications for education were set up: basic and higher education, this category could be broken down into high school and college for a finer description. The proportion of workers with no level of education has been slightly reduced from 3.9 percent in 1998 to 2.68 percent. The first category is basic education that includes workers with years of schooling in the range of 1 and 9 years attained, those with higher education have at least 10 years of education; workers with high school attained between 10 and 12 years of schooling while, college educated workers studied more than 13 but less than 16 years of schooling.

⁶⁵ The third quarter men sample size is initially 1'953,971.

⁶⁶ Ley del Seguro Social, IMSS 1997.

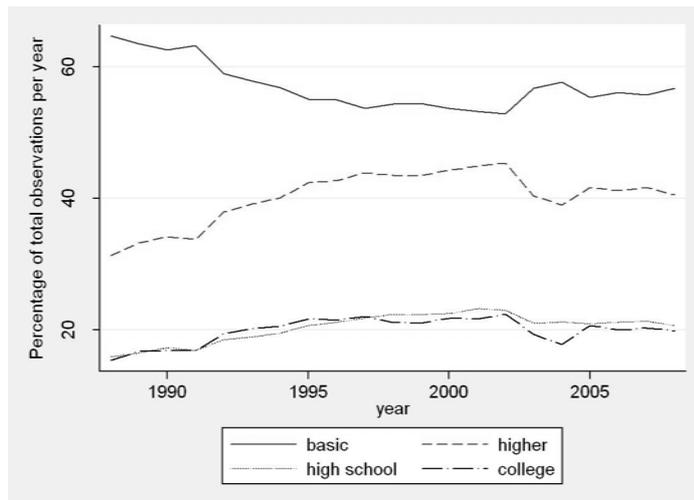
⁶⁷ For example, if a worker started his labour career at the age of 20, this person can retire even before turning 50 years old.

⁶⁸ Individuals out of the labour force and/or unemployed.

⁶⁹ Final sample size of FTFY men employees is 790,495.

On the one hand, share of workers with basic education follows a steady reduction. On the other hand, there is an increasing trend in the proportion of workers with higher education within the FTFY employees. This indicates that workers hold more schooling years when they entered in the labour market, in the men's graph the proportion of workers with basic education is still more than the proportion with higher education, a convergence is apparent though. The steady expansion of the average years of schooling throughout the period was also observed for women and was larger relative to men, holding on average 10 years of schooling at the end of period, for further details see Caamal-Olvera (2010). This trend is consistent with studies of the gender wage, Artecona and Cunningham (2002).

Figure 1. Evolution of worker's education



Source: Own calculations from ENEU 1988-2004 and ENOE 2005-2008.

Data reflect that around 20 percent of the FTFY men workers have college education. Since data is a repeated cross-section, the evolution provides evidence of the presence of more educate workers, which is relevant to quantify how the returns to education will be affected given this change in the composition of the labour force.

4 Job type and education

The hypothesis of skill-biased technological change was initially suggested by Bound and Johnson (1992) who proposed a theoretical model that incorporated the explanations of the observed relative wages changes of the 1980's in the US, which they summarised in four attributes: first, an increase in trade deficit that rose the demand of better educated workers; second, a reduction in the manufacturing employment and reduction in the power of unions; third, changes in technology mainly because of the computer revolution; and fourth, increase in relative wages of college educated since there was a drop size of the cohort entering in the labour market. They conclude that the main cause of the increase on relative wages of highly educated workers was a shift in the skill structure of labour demand brought about by biased technological change. Other authors have suggested testing the implications of technology directly using as a measure the computer development, Mincer (1991), Krueger (1993), and Autor, Katz and Krueger (1998). Acemoglu (2003) has considered the skill bias of technology as endogenous and driven by the relative success of developing different types of technology. He claimed that an increase in the quantity of skilled workers enlarges the market size for skill-complementary technologies and induces skill-biased technical change.

There are numerous theoretical versions of the Skill-biased Technological Change (SBTC) as Card and DiNardo (2002) mentioned which have ignored the pace of technological change across industries and have measurement issues. They examined the implications of SBTC for wage inequality and changes in wage differentials between groups but this hypothesis fails to explain the evolution of other dimensions of wage inequality, for example the age gradient in the return to education. Acemoglu (2003) pointed out that SBTC hypothesis cannot explain why the technical change is skill-biased in some periods but not in others. Similarly, Lemieux (2006) found little evidence of a pervasive increase in the demand for skill due to SBTC in order to explain the growth in residual wage inequality and he attributed these changes to composition effects linked to the secular increase in experience and education, which are associated with higher within-group wage dispersion.

For the United States there are a large number of papers that have recently studied the rising wage gap of college-high school graduates. Likewise, this phenomenon has occurred in the United Kingdom and Canada where the college-high school wage gap for younger men has risen while the gap for older men has been stable or declining. Card and Lemieux (2001) argued that the trends in returns to college is evidence of inter-cohort shifts in the relative supply of highly educated workers and that the driving force of these shifts is the slowdown in the rate of growth of educational attainment that began with cohorts born in the early 1950s. They incorporate imperfect substitutability between younger and older workers and thus obtain a prediction that a slowdown in the inter-cohort trend in educational attainment will lead to a rise in the college wage premium for younger workers.

In the Mexican empirical evidence of the early 1990s, there is a consensus that changes in the wage structure were driven mainly by demand side factors such as trade liberalisation and market-oriented reforms implemented in the beginning of the 1990s. Some papers have studied how the increase in the skilled-unskilled wage gap have associated with trade reforms, e.g. Hanson and Harrison (1995), who found that foreign investment and export orientation were the main causes. Others suggested that reductions in tariffs protection affected more the unskilled workers than the skilled workers since lower skilled workers were concentrated in industries that experienced larger reductions in tariffs protection, Revenga (1997), and Hanson and Harrison (1999).

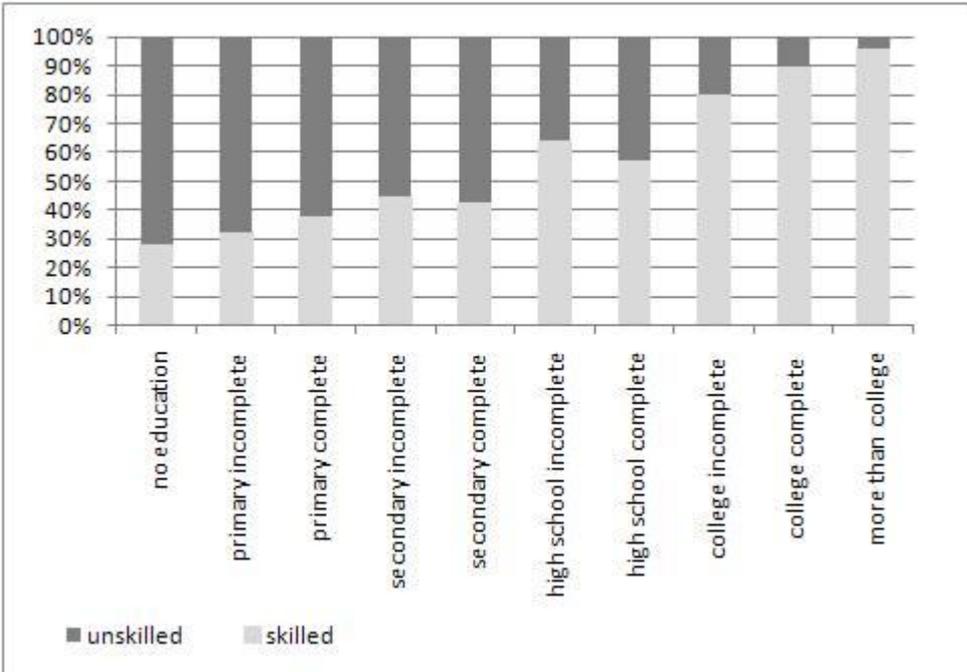
Others found evidence of the skill-biased technological change on the wage premium of skilled workers, Cragg and Epelbaum (1996) and Schady and Sanchez-Paramo (2003). Cragg and Epelbaum (1996) found that portable skills that are associated with a particular task can explain about half of the growth in the return and claimed that this provides evidence of catalysers of change are the ones receiving returns. Furthermore, they identify that the employment patterns reveal general skill intensification in the economy since the proportion of skilled workers increased in most of the industries consistent with major reforms implemented such as commercial opening to trade and foreign investment, privatisation of many state-owned firms, tax reforms, deregulation of industry, creation of an independent central bank, and accelerated infrastructure construction with private funding coincided with dramatic changes in the Mexican urban labour market. Schady and Sanchez-Paramo (2003) analysed the period between 1987 and 1999 and found increases in relative wages for skilled workers due to an increase in demand where the increases occurred within sectors, which were the same for the five countries analysed that they claimed is consistent with the SBTC.

In order to revise whether the SBTC theory was an important driving force of the returns to education trend, two main different types of workers are defined in this study according to the job they perform: skilled and unskilled. The skilled workers are those who require specific training to perform their jobs. In this group are classified: professionals, technicians, teachers, and directors in private and public sector. The unskilled workers are defined as those workers who do not require specific training to perform their tasks. The agriculture workers, craftsman, drivers, administrative assistants, in-store employees, travelling sales people, domestic and security workers are considered unskilled.

Figures 2 and 3 show the distribution of two points in time 1988 and 2008 respectively. The objective is to compare the percentage of the workers that given their level of education perform either skilled or unskilled jobs.

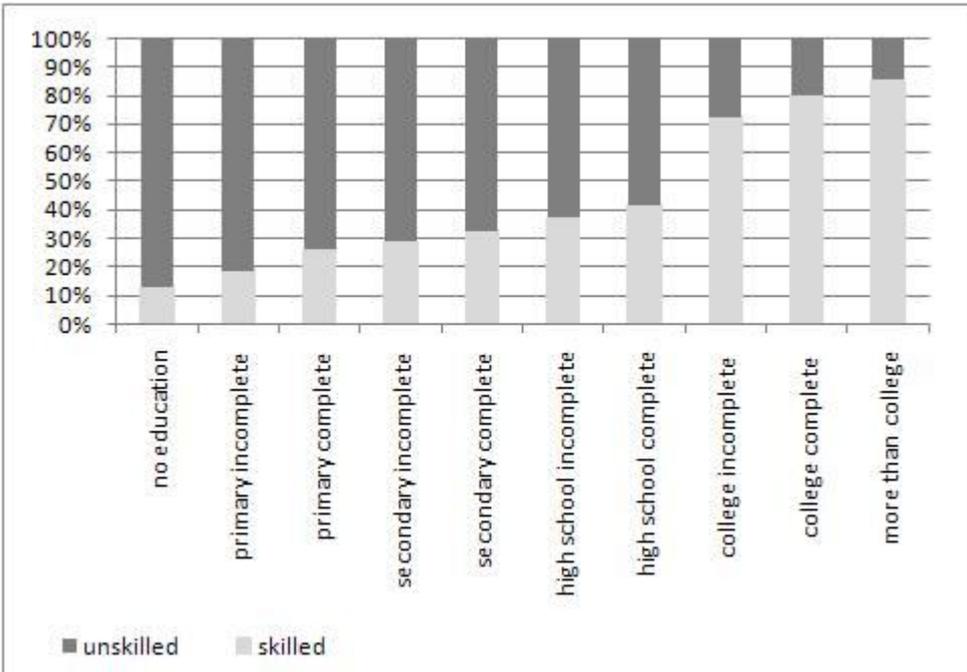
It is noticeable that in the year of 1988 which is shown in Figure 2, workers holding low levels of education are mainly employed in unskilled jobs, particularly between 71 percent and 67 percent of the workers who have no education or hold primary incomplete are employed in unskilled jobs. The contrary is shown for workers with higher education since at least 90 percent of the workers with college complete or more are employed in skilled jobs in the year 1988.

Figure 2. Distribution of skilled-unskilled jobs by level of education 1988



Source: Own calculations from ENEU 1988.

Figure 3. Distribution of skilled-unskilled jobs by level of education 2008



Source: Own calculations from ENOE 2008.

Figure 3 shows the distribution of education and type of jobs estimated for 2008; the allocation shows a stunning change. The upper bars, that represent unskilled jobs, are much bigger than they were in 1988, especially in the lower levels of education ranging from 70 percent to 87 percent. It is more interesting to see that the percentage of high-educated workers who are performing unskilled jobs rose approximately from 7 to 10 percentage points with respect to 1988. This is a surprising change since according to the projections that skill-biased technological change could make better-educated workers to have jobs suitable to their qualifications -since more skill-intensive vacancies would be created. However, it was evident that during the time that NAFTA took place the effect was not constantly in the same direction since the returns to education show a declining trend at the end of the period. It is not implausible to infer that labour market was not able to accommodate the rising labour force by the year of 2008.

Table 1 presents the change in the ratio of skilled-unskilled job type for every level of education. It is evident that ratios were larger in 1988 compared to 2008, thus percentage changes are negative. The largest reductions in the skilled-unskilled ratio are for workers with more than college education, high school incomplete and no education. The smallest reduction is observed for workers with secondary complete. In 1992 there was a change in the compulsory schooling years, from 6 to 9 years, which corresponds to secondary education.

Table 1. Skilled-unskilled job type ratio

	1988	2008	% change
No education	0.394	0.145	-63.3
Primary incomplete	0.478	0.230	-51.8
Primary complete	0.599	0.353	-41
Secondary incomplete	0.797	0.405	-49.1
Secondary complete	0.734	0.486	-33.8
High school incomplete	1.778	0.594	-66.6
High school complete	1.352	0.718	-46.9
College incomplete	4.074	2.635	-35.3
College complete	8.775	4.086	-53.4
More than college	26.027	5.812	-77.7

Source: Own calculations from ENEU 1988 and ENOE 2008.

Last column shows percentage changes in the ratio of workers that given their level of education are employed in skilled relative to unskilled jobs. The larger reduction is obtained for workers with more than college education, 77 percent, while for workers that completed college was lower, 53 percent. This trend confirms an increase in the education of the labour force although there is a rising percentage of high-educated workers that are not employed in jobs according to their instruction. Likewise large lessening in the proportion of unskilled in lower levels of education is consistent with the increasing worker's education level.

5 Estimation of returns to schooling

The human capital earnings function proposed by Mincer (1974) has commonly been used to estimate returns to schooling. This model focuses on the life-cycle dynamics of earnings, both observed and potential earning and human capital

investments. It relies on assumptions in the functional form such as linearity in schooling,⁷⁰ quadratic specification for experience and independence in schooling and experience. Mincers' model approximates an equation that can be estimated linearly, where returns to schooling estimates are the same for any level of education.

In general, the studies that estimate the returns to education have acknowledged the causal effect between earnings and education. Researchers have been cautious with the inferences of this causal effect. Since it could be complex to separate whether higher income is due to their higher education, or whether individuals with higher earnings have chosen to attain more schooling. The causality issue can be controlled using Instrumental variables; Card (1999) presents a review of papers that have tried to measure the causal effect of education and earnings by using instruments on the supply side of the education system as determinants of education outcomes. Other papers such as Griliches (1977), Angrist and Krueger (1991), Ashenfelter and Krueger (1994) have found that returns to schooling using instrumental variables were as big as or even greater than the corresponding OLS estimates and they claim this as evidence of a small ability bias in the OLS estimates. Arias et al. (2001) used an instrumental variables estimator for quantile regression using data on twins. Quantile estimation allowed them to estimate returns to schooling for individuals at different quantiles of the conditional distribution of earnings which can reflect the distribution of unobserved ability and, as they mentioned, they can account for the ability bias on the heterogeneous returns. Regan, Oaxaca and Burghardt (2007) integrated human capital investment into a model of wealth maximization incorporating ability and experience variables to identify returns to education coefficients. Their results show no evidence of the presence of endogeneity for the ability measure. The purpose of this paper, however, is to describe the trend of the returns to schooling over time and find out whether a rising labour supply with higher qualifications drove the resulting trend. For this reason the ability bias potentially present in the estimates is assumed to have the same distribution over time. In other words, only the long-run trend and not the level return values are relevant to this study. Furthermore, Quantile regression can estimate returns to schooling not only for the average but for every wage percentile in the conditional distribution, it is possible to compare the estimates over time without making any assumption regarding causality. Thus it can be argued that even if there is ability bias, instrumental variables are not the recommendable method since the average treatment effect may change over time and the estimates would still be biased and inconsistent. Heckman and Vytlačil (2005) pointed out that different instruments define different parameters, and then answer different economic questions. They also questioned the interpretation of Imbens and Angrist (1994) regarding Local Average Treatment Effect (LATE), which in this context is assumed as an average return to schooling, in other words, individuals are induced to go to school given changes in the values of the instrument, since it assumes that individuals respond to the instrument in the same direction, ruling out heterogeneity in the schooling choices to instruments. Therefore, the instrumental variable approach in this paper may not be convenient, since if it is used to correct endogeneity between wage and education, the groups affected by this instrument may change over time and in consequence can affect the dynamic comparison of the estimates at any point in the wage distribution.

6 Empirical Strategy

The ordinary least squares is the classical estimation method that provides the mean or average estimator of the effect that certain variables have upon a dependent variable, wages. Quantile regression employs information near to the specified section without reliance of any distributional assumptions. Therefore, quantile regression provides estimated coefficients

⁷⁰ See Regan, Oaxaca and Burghardt (2007) for a detailed discussion regarding the identification of the returns to education coefficient.

that correspond to particular sections of the distribution, thus it offers a more complete view of the relationship between the variables under study, wages and schooling.

The specification and interpretation of quantile regression is similar to that of ordinary least squares. On the one hand, quantile estimation minimizes the sum of absolute residuals, which can be seen as an optimal point estimator for asymmetric loss, in the symmetric case is the median; while OLS minimizes the squared sum of the residuals. On the other hand, the interpretation of each quantile coefficient of the effect of schooling upon wages depends on the particular section of the distribution considered while the OLS estimates represent the average effect. Unlike the minimisation problem of the ordinary least squares, quantile equation is not differentiable, thus quantile estimators cannot be obtained directly. Therefore, nonparametric techniques can be applied to obtain the variance-covariance matrix of the estimation, such as bootstrap to provide standard errors to make inferences regarding the significance of estimated quantile coefficients.

Koenker and Bassett (1978) exposed formally the quantile regression estimation. This approach will estimate the local effect that education has upon wages at any point of the distribution, thus accounting for unobserved heterogeneity existent but not affecting the temporal comparison of returns to schooling, Naticchioni et al. (2007). Unlike the standard approach, least squares method estimates the mean regression of the distribution, whilst quantile regression provides a more complete picture of the returns to schooling since it computes several regressions for different points within the wage distribution. For the case of quantile 50 or median, the symmetry implies that the minimization of the sum of absolute residuals must equate the number of positive and negative residuals, then assuring that the number of positive and negative residuals is the same as the number of observations above and below the median. Other quantiles are obtained by minimizing asymmetrically weighted absolute residuals.

An important issue largely ignored is the use of log transformation of the dependent variable, in the least squares regression, mainly for convenience of the interpretation and properties. Santos Silva and Tenreyro (2006) criticised the use of log-linearized models estimated by ordinary least squares as it leads to a biased parameter, compared to the true estimates without the transformation of the dependent variable.⁷¹ Another advantage of quantile regression is its equivariance properties, for example if the data is transformed; the quantile regression estimates also change in a way that leaves the interpretation of the results invariant. These can take a form of scale equivariance property, a shift or regression equivariance, and equivariance to reparameterization of design, Koenker and Bassett (1978).

More importantly, quantiles have a stronger equivariance property to monotonic transformations. Then, the quantiles of the transformed random variable, log of real hourly wages, is simply the transformed quantiles of the original real hourly wages. Transformations are more straightforward to interpret in the context of quantile regression than they are for mean regression, and represent appropriate estimates of the conditional median or any other quantile. Furthermore, another advantage of quantile regression is the robustness of the quantile estimations to outlying observations, since in the presence of large errors the performance of the median can be more robust than the mean.

In order to account for labour market conditions overtime, it was used repeated-cross section data, since it provides information of different workers in different points in time. The estimation will quantify the effect of education for men⁷² FTFY over the period of 1998 to 2008. Quantile estimation provides a closer look at the overall wage distribution; results are shown for the quantiles 10th, 25th, 50th, 75th, and 90th.

The estimated coefficients are considered robust measure of the location which is not sensitive to outlier observations. The quantile partitions of the wage distribution are applied to reduce bias of the estimation of the returns to education over

⁷¹ They proposed the gravity equation to account for the implications of Jensen's inequality.

⁷² See Caamal-Olvera (2010) for further model specifications.

time, because of the presence of heterogeneity and, more importantly, grouping unobserved heterogeneity among workers, such as ability.

The model to estimate follows a simple Mincer's specification of the earnings equation applying OLS and quantile regression consider the information of every men worker (i), at any time (t) during 1988-2008. The benchmark model is:

$$\ln(wage)_{it} = \delta_t + g(age)_{it} + \beta_t educ_{it} + \phi_t marital_{it} + \lambda_t ins_{it} + e_{it} \quad (1)$$

Where $\ln(wage)_{it}$ is the natural logarithm of the hourly real wage at current prices of 2002. From the dataset, tenure or any other variable that provide current experience⁷³ in the labour force are not available. Thus, to avoid specification error due to potential experience proposed by Mincer (1958), in this study, age will be used as a control variable, where $g(age)_{it}$ is an age fourth-order⁷⁴ polynomial:

$$g(age)_{it} = \alpha_{1t} age_{it} + \alpha_{2t} (age_{it})^2 + \alpha_{3t} (age_{it})^3 + \alpha_{4t} (age_{it})^4 \quad (2)$$

Regan and Oaxaca (2009) proposed a measure of experience based on the actual hours of work over several years.⁷⁵ Card (1999) mentioned that the estimates could be lower in comparison to those with the experience variable explicitly included. β_{it} is the estimated return to schooling at any year, $educ_{it}$ represents years of schooling, and e_{it} is the error term. Two dummy variables indicating marital status, $marital_{it}$, two dummy variables indicating whether they have medical insurance, ins_{it} , provided by IMSS,⁷⁶ which provides medical services to 49 percent of the FTFY workers in the sample; ISSSTE,⁷⁷ which provides medical service to 23 percent of FTFY government workers; or none of those. Variable ins_{it} could be seen as a proxy of the formal and informal sectors, those who hold medical service are likely to be employed in the formal sector.

7 Results

Quantile regression is a suitable approach to account for heterogeneity of the returns to education within the conditional distribution and it can reflect the distribution of unobserved ability and then represent proxies for ability, Arias et al. (2001). From equations (1) and (2) 126 estimated coefficients are obtained for the return to schooling: five coefficients for each quantile over the period 1988-2008 and OLS coefficients for each year during the same period of time. In order to summarise and observe the evolution of the returns to schooling for men workers the estimated coefficients are presented in Figure 4. The trend is evidently increasing during the first part of the period analysed, and declining at any quantile after 1997.

⁷³ It is a function of age, education and a constant.

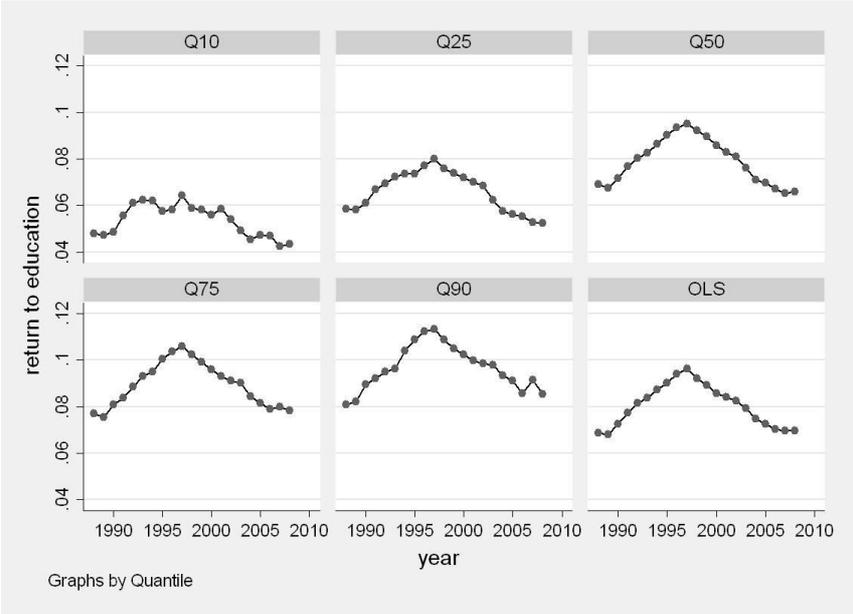
⁷⁴ Murphy and Welch (1992) argued that Mincer's estimation could be improved by adding a fourth-order polynomial.

⁷⁵ Unfortunately the data available is not a panel.

⁷⁶ IMSS, Instituto Mexicano del Seguro Social.

⁷⁷ ISSSTE, Instituto de Seguridad y Servicios Sociales para los trabajadores del Estado.

Figure 4. Evolution of the return to education



Source: Own calculations from ENEU 1988-2000, ENE 2000-2005 and ENOE 2005-2008.

The estimated coefficients are also shown in Table 2. Since quantile regression is a location measure of the effect of education on wages, it is possible to make comparison across the return to education at any part of the conditional wage distribution. The estimates⁷⁸ of the lowest quantile (Q10) are in the range of 4.8 percent estimated in 1988, 6.44 percent reached in 1997 and reduced to 4.34 percent in 2008. Currency crisis that happened at the end of 1994 reduced dramatically wages; however, this is not evident in the returns to education in the simple specification. Trade liberalisation could also play an important role to compensate the negative effect on wages as a result of the currency crisis.

⁷⁸ Mean (OLS) and quantile estimates are highly significant with at least 90 percent level of confidence.

Table 2. Estimated quantile coefficients of the returns to education

Year	OLS	Q10	Q25	Q50	Q75	Q90
1988	0.0685 (0.0011)	0.0480 (0.0025)	0.0584 (0.0014)	0.0693 (0.0013)	0.0770 (0.0016)	0.0809 (0.0019)
1989	0.0679 (0.0011)	0.0473 (0.0018)	0.0582 (0.0009)	0.0676 (0.0011)	0.0753 (0.0013)	0.0820 (0.0017)
1990	0.0725 (0.0011)	0.0486 (0.0017)	0.0611 (0.0019)	0.0718 (0.0017)	0.0809 (0.0016)	0.0894 (0.0015)
1991	0.0772 (0.0012)	0.0558 (0.0022)	0.0668 (0.0016)	0.0769 (0.0024)	0.0836 (0.0018)	0.0921 (0.0015)
1992	0.0813 (0.0008)	0.0611 (0.0016)	0.0695 (0.0013)	0.0803 (0.0011)	0.0885 (0.0012)	0.0948 (0.0014)
1993	0.0839 (0.0008)	0.0623 (0.0014)	0.0724 (0.0013)	0.0826 (0.0013)	0.0929 (0.0013)	0.0961 (0.0017)
1994	0.0871 (0.0008)	0.0621 (0.0012)	0.0736 (0.0013)	0.0865 (0.0012)	0.0949 (0.0010)	0.1039 (0.0013)
1995	0.0901 (0.0009)	0.0576 (0.0018)	0.0737 (0.0011)	0.0904 (0.0012)	0.1004 (0.0012)	0.1088 (0.0015)
1996	0.0938 (0.0008)	0.0582 (0.0012)	0.0770 (0.0012)	0.0934 (0.0012)	0.1037 (0.0008)	0.1123 (0.0015)
1997	0.0960 (0.0008)	0.0644 (0.0012)	0.0799 (0.0010)	0.0952 (0.0010)	0.1059 (0.0009)	0.1131 (0.0012)
1998	0.0919 (0.0008)	0.0588 (0.0014)	0.0757 (0.0010)	0.0922 (0.0008)	0.1021 (0.0011)	0.1087 (0.0011)
1999	0.0891 (0.0007)	0.0583 (0.0013)	0.0741 (0.0009)	0.0896 (0.0009)	0.0990 (0.0010)	0.1049 (0.0016)
2000	0.0855 (0.0007)	0.0561 (0.0014)	0.0721 (0.0011)	0.0857 (0.0010)	0.0959 (0.0006)	0.1022 (0.0012)
2001	0.0840 (0.0007)	0.0587 (0.0010)	0.0700 (0.0011)	0.0829 (0.0009)	0.0931 (0.0007)	0.0997 (0.0010)
2002	0.0825 (0.0007)	0.0542 (0.0012)	0.0685 (0.0009)	0.0810 (0.0009)	0.0912 (0.0010)	0.0986 (0.0012)
2003	0.0791 (0.0007)	0.0492 (0.0013)	0.0623 (0.0012)	0.0762 (0.0011)	0.0902 (0.0010)	0.0978 (0.0011)
2004	0.0746 (0.0008)	0.0453 (0.0015)	0.0575 (0.0010)	0.0711 (0.0013)	0.0844 (0.0014)	0.0932 (0.0012)
2005	0.0724 (0.0009)	0.0474 (0.0022)	0.0562 (0.0014)	0.0698 (0.0014)	0.0815 (0.0012)	0.0910 (0.0011)
2006	0.0701 (0.0009)	0.0469 (0.0017)	0.0553 (0.0007)	0.0672 (0.0010)	0.0790 (0.0013)	0.0855 (0.0015)
2007	0.0695 (0.0009)	0.0425 (0.0015)	0.0528 (0.0011)	0.0652 (0.0012)	0.0799 (0.0014)	0.0914 (0.0017)
2008	0.0695 (0.0009)	0.0434 (0.0018)	0.0523 (0.0014)	0.0658 (0.0011)	0.0782 (0.0013)	0.0854 (0.0019)

Source: Own calculations from ENEU 1988-2000, ENE 2000-2005 and ENOE 2005-2008. The returns to education coefficients are significant at the confidence level of 95%. OLS coefficients are significant at 90%. Standard errors are in parentheses.

The estimated coefficients of the lowest quantile, Q10, are smaller than any other quantile. From Figure 4, it was evident a change in the increasing evolution of the returns to education. Inter-quantile analysis reveals that the return to education is larger for upper quantiles. However, time comparison shows a clear declining trend on the returns to education. In the first year of the analysis, returns to education were 4.80 percent in the lowest quantile and 8.09 percent for the top quantile. In the years that follow, an increasing trend over time was estimated. Returns to education reached the largest magnitude in

1997, in the range of 6.44 to 11.31 percent. Afterwards a declining trend over time is observed, in 1998 returns to education coefficients reduced their magnitude, at any quantile, and were estimated to be around 5.88 percent and 10.87 percent. Lower estimates were estimated subsequently, and by, the year of 2008 returns to education were 4.34 percent to 8.54 percent, for the lowest and top quantile respectively.

Table 3. Inter-quantile marginal changes

Quantiles	1988	2008
Q25-Q10	21.59	20.68
Q50-Q25	18.62	25.71
Q75-Q50	11.13	18.83
Q90-Q75	5.08	9.19

Source: Own calculations. Numbers represent percentage changes from Table 2.

Table 3 presents evidence that education pays off for workers in upper quantiles. In fact, this means that positive investment on education enhances wages although looking at upper adjacent sections of the distribution the marginal changes are smaller. Larger inter-quantile increases in the return to education are calculated for lower quantiles. For example, workers in the lower 25th quantile obtain a return to education that is 21.6 percent more than workers in the lowest quantile in 1988. However, this percentage reduced to 20.7 percent in 2008. The contrary happened to upper quantiles, the marginal increase in the return to education from workers in the top 10 quantile relative to the top 25th quantile was only 5.08 percent; this was the lowest change across inter-quantile comparison. Nonetheless, this percentage increased at the end of the period, 9.19 percent.

8 Conclusion

This study examined the forces interacting in the labour market by analysing the relationship between wages and education, which is sturdily positive. Labour market coordinates the supply of workers that want to acquire education and the salary that employers are willing to pay them according to their qualifications; this is also determined by the number of similar workers available to a job position. Mexican labour market has been changing dramatically over time because of several structural reforms that took place during the last decades. It is relevant to analyse how the market had valued additional human capital investments made not only at different parts of the wage distribution but also at different points in time.

Results show a rise of a more qualified labour supply. In 1988, workers with higher education -high school and college or more- were around 31.3 percent and by the year 2008 this percentage increased to approximately 40.5 percent. To evaluate the effects of a skilled-biased technological change, it was analysed the changes in the distribution of workers over two job-type definitions according to the required training: skilled and unskilled. In 1988, workers holding low levels of education were mainly employed in unskilled jobs (around 67 and 71 percent) while those highly educated were mostly in skilled jobs (approximately 90 percent). The difficulty to find jobs suitable for workers' qualifications was noticeable by the end of the analysed period. Comparing 1988 and 2008, the ratio of highly educated workers employed in skilled jobs relative to unskilled obtained the largest decrease, 77 percent. In absolute terms, the increase of highly educated workers employed in unskilled type jobs rose from 3.7 percent to 14.7 percent.

This paper presents robust quantile estimated coefficients for five sections of the conditional wage distribution. Results also reveal a direct relationship between education and ability since upper quantiles obtained larger returns to education at any year considered. To summarise the findings, results show that there is a concave evolution of the returns to education peaking in the year of 1997 at any section of the conditional wage distribution. Also the return to schooling across quantiles improved as moving to upper quantiles, although the marginal increase across quantiles became smaller. The resulting effect of the currency crisis affected deeply in the reduction of wages, however, the effect on the returns to education depends on other factors. It is evident that for workers in the lowest quantiles the currency crisis had a larger negative effect relative to workers in upper quantiles. The estimated coefficients got smaller by the end of the period analysed. Thus, the results confirmed a declining trend of the returns to education which is robust across all quantiles. The results obtained do not promote an optimistic view of future educational investment. If returns to education are indicators of the efficiency of education to raise wages, then it can discourage individuals to invest in their own human capital even though it is an open question how people create their expectations about wages.

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Session H

“The Impact of the Global Financial Crisis on Thailand: Transmission Channels and Policy Responses”

Yuthana Sethapramote (National Institute of Development Administration, Thailand)

In this study, we focus on the effects of global financial crisis on Thailand's macroeconomy and separated the study into two main parts. First, we examine the transmission channels of global crisis to domestic economy. The results indicate that the international trade channel has significant impact to the economic activities, while the financial linkage provides only marginal effects. Most of the drop in export, investment and consumption could be explained by a shrink in world import value. Second, the effects of policy responses are investigated. The transmission mechanisms of fiscal and monetary policies are computed. The results show that the impacts from the monetary and fiscal policy responses are considerably smaller than those of the slump in global trading value.

1. Introduction

The recent Global Financial Crisis (GFC) began with the bursting of the United State housing bubble and high default rate in subprime mortgage loans in 2007. Later, the problems in housing and securitized-bonds markets spread to the financial institutions, followed by a declining in output. At the macroeconomic level, the stylized facts of this crisis are similar to previous crises, which were preceded by the boom and bust in asset prices. However, the recent developments of innovations in securitization and derivative securities market played the major roles in intensify the effects of loss in financial market, which consequently lead the biggest crisis in the US since the Great Depression in 1930s.

During the recent GFC, the emerging market economies (EMEs) also suffer from a sharp decline in domestic output in the second half of 2008. Unavoidably, Thailand also confronts with the economic slowdown. Similar to other emerging countries, the significant capital outflows lead to slump in stock market and the plummet in export value during the second half of 2008 results in recession since the fourth quarter of 2008 until the end of 2009. To cushion the recession and to achieve stability, several policies are announced; running the lowest policy interest rate since the 1997 Asian crisis and implementing the largest stimulus package called “Thai Kem-Kaeng”.

In this study, we focused on the effects of global financial turmoil to Thailand's macroeconomic condition and the effects of fiscal and monetary policy responses. In next section, we discuss the transmission channels of the GFC to the EMEs. The impacts of the international trade and financial linkage to Thai economy are estimated in Section 3. The policy responses in from of the stabilizing fiscal and monetary policies are addressed in Section 4 to assess their impacts in stimulating economy during the recession. Finally, Section 5 concludes the paper.

2. Transmission Channels of the Global Financial Crisis to the Emerging Market Economies

The global financial crisis creates the ripple effect from the US, European Union and Japan (G3) to EMEs. The transmission channels of the crisis have received attention in the literature. Some current studies have addressed the importance of the financial linkage as the transmission channel of current financial crisis. Danninger, et al. (2009) analyzed the channels of crisis spillover by focus on both international trade and financial linkage. They found that the capital movement, especially in the international loan's market, played the crucial role in transmitting the crisis from countries to countries during the current crisis. Devereux and Yetman (2009) investigated the importance of financial interdependence and financial vulnerabilities in transmitting shocks across countries. The results show that the financial linkage in term of the combination of portfolio interdependence and capital constraint could intensify the effect of global de-leveraging. The impact of shocks during the current crisis is examined by McKibben and Stoeckel (2009). Interestingly, they found that the shocks observed in financial markets can be used to generate the severe economic contraction in global trade and production currently being experienced in 2009. In particular the distinction between the production and trade of durable and non durable goods plays a key role in explaining the much larger contraction in trade than GDP experienced by most economies.

On the other hand, some studies have emphasized the role of the traditional international trade channel as an important route of spreading the crisis to the developing countries. IMF (2009) studied the financial linkage and found that it has a limiting role in transmitting crisis to developing countries. As can be seen, many low income countries were fairly unaffected from the financial crisis in the early stage. However, when the magnitude of crisis is amplified, the sudden decline in the global export demand together with the shortage of remittance and foreign direct investment escorted these countries into unavoidably suffer from the global crisis. In the study of Bank of Thailand (2009), the impacts of the global financial crisis on EMEs were investigated. Both financial and trade channels were mentioned as the transmitting instruments in varying magnitudes and timing. Using the Oxford Global Macroeconomic Model, the paper found that the financial channel plays the major role for the recession in the central and eastern European economies. However, the Asia economies have been affected mostly through trade contraction, which have also led domestic demand to slow down significantly. In addition, Berkmen, et al. (2009) found that during the current financial crisis, the EMEs with high leverage domestic financial systems and steady credit growth tend to be more severely suffered from the global financial crisis since the financial channel dominated the trade channel. However, for the other emerging countries, the trade channel is more matter. The countries that main export products are the advanced manufacturing goods, e.g., electronic equipments, suffer more than those countries that main exports are in agricultural products.

In summary, the study of the transmission mechanisms of the global crisis can be separated into financial and international trade linkages. In next section, we investigate the impact on these two major shocks on Thai economy.

3. Estimating the impacts of the Global Financial Crisis to Thai economy

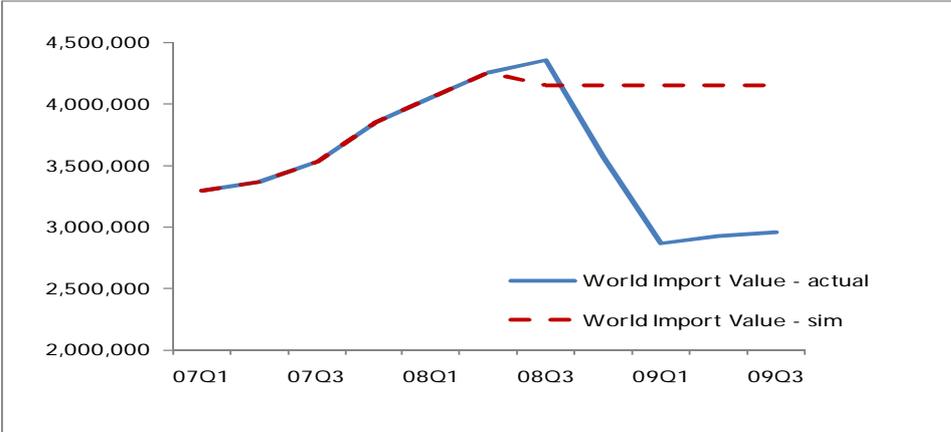
In this section, the NIDA's Quarterly Macroeconomic Model (NIDAQMM) is employed as the main model to measure the impact from each transmission channel to economic indicators. The model is based on the Keynesian's demand-based approach that covers the main economic activities, i.e., domestic consumption and investment, international trade, price

level and financial sector. (See Chintayarungsan, et al. (2003) for details on the NIDAQMM.) We quantify the magnitude of crisis transmission from both international trade and financial linkages using the simulation method conducted by the NIDAQMM. The observed declining pattern in asset prices, especially in the stock market is used to characterize the impacts from financial linkage while the value reduction in external demand (proxy by the global import value) is used to represent the international trade channel. The results are discussed as follows.

3.1 International Trade Channel

During the current crisis, international trade channel is the center of attention because of the big tumble in external sector. This channel is represented by a declining in the world import value which may affect the export, import, private consumption and investment. As can be seen in Figure 1, the world import value is dramatically fall since the second half of 2008. Hence, in the simulation exercise, we assume that the world import value after the second half of 2008 is constant at the same level of the average of quarterly world import value during the first half of 2008. The simulated results from this setting are applied to compare with the simulated data that we compute based on the actual world import value. The differences between these results imply the effects of a drop off in world import value to other key macroeconomic variables. In this study, four variables are considered - GDP growth, private consumption, investment and export.

Figure 1 World Import Value, 2000-2009



Source: International Financial Statistics Online Database

Table 1 The Simulation Results of the Effects from the International Trade and Financial Linkage Channel on the Key Economic Variables

	GDP	Consumption	Investment	Export
<u>Actual data</u>				
2008 Q3-Q4	- 0.68	2.22	0.65	- 0.27
2009 Q1-Q3	- 4.94	- 1.95	- 15.38	- 17.72
<u>Simulation data</u>				
<i>International trade channel</i>				
2008 Q3-Q4	2.09	- 0.31	-	7.57
2009 Q1-Q3	- 9.28	- 3.28	- 14.15	- 16.15
<i>Financial linkage channel</i>				
2008 Q3-Q4	0.02	- 0.04	-	-
2009 Q1-Q3	- 0.26	- 0.50	- 0.25	- 0.00

Source: Actual data are taken from NESDB. The simulation data are computed from the NIDAQMM.

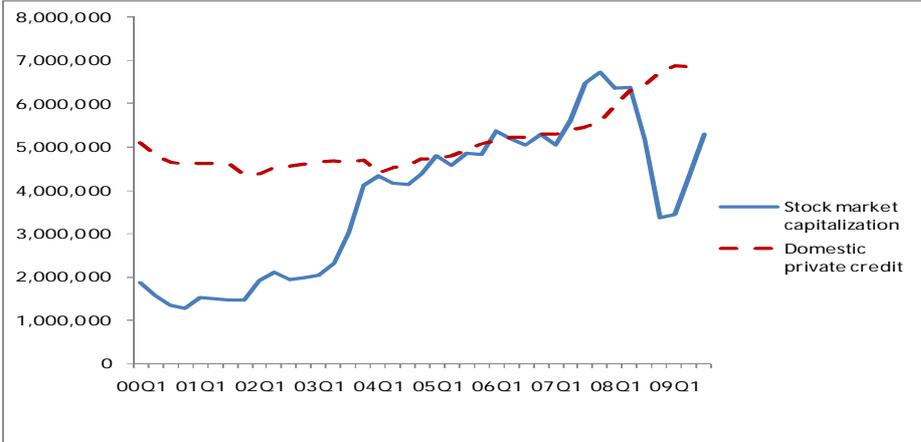
Table 1 shows the simulation results in which the change in world import value could describe most of the drop in export value in 2009 (-16.15 percent compare to -17.72 percent in the actual data). Moreover, the large portion of a decreasing in private investment and consumption is also explained by a cut off in world import. These results support to argument that the international trade is the significant transmitting channel of the global financial crisis to Thailand as the most of the deterioration in key economic variables could be accounted in this simulation setting. In addition, these findings also provide evidence of the closed relationship between export and investment in Thailand.

3.2 Financial Linkage Channel

In the literature of the current financial crisis, financial linkage channel has been discussed in several dimensions. However, in this study, we limit the scope of financial linkage in only two dimensions. The first is the adjustment of stock market in response to capital movement and the second is the change in private credit availability.

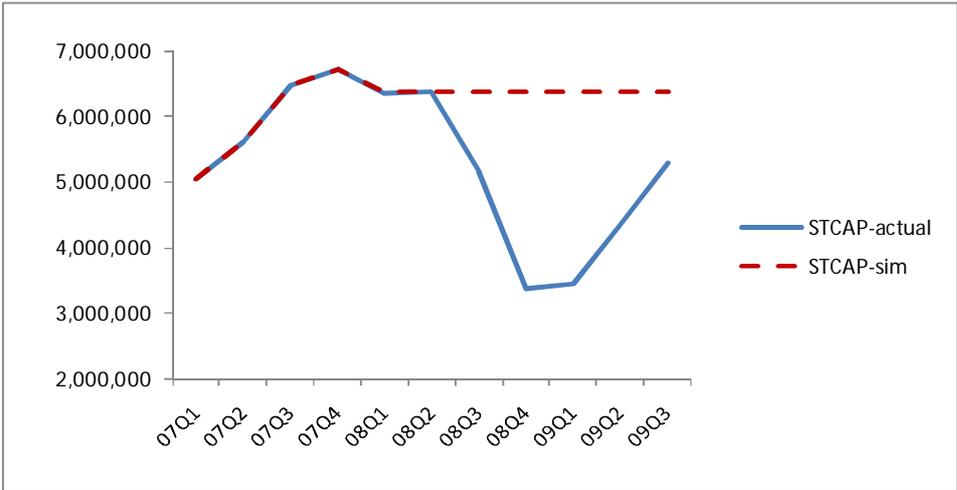
As can be seen in Figure 2, the market capitalization of Stock Exchange of Thailand (SET) is erratic movements during the development of financial crisis. The sharp decline in stock market happen in the second half of 2008 as the international financial market is in the peak of deleveraging in the aftermath of the collapse of Lehman Brother. The effects of domestic credit are also exhibited in Figure 2. The private credit market is in stable condition between 2007 and 2009. Only marginal decrease in private credit is found in 2009. The immunity in Thai credit market could be results of the domestic political problems. Risk factors contributed by the political instability affect business confidence and also create the uncertainty in government policies. Consequently, many Thai and foreign firms delay their investment plans. Moreover, the lesson learned from the Asian financial crisis in 1997 suspends Thai financial institutions from rapidly expand the credit market, especially for mortgage loan and complicated structured products. As a result, the domestic credit growth maintains approximately 5 percent annually during 2006 to 2007. In this section, we therefore focus only on the stock market as the key variable which is influenced by the financial linkage during the current global financial crisis.

Figure 2 Private Domestic Credit and Stock Market Capitalization of Thailand, 2000-2009



Source: Bank of Thailand (BOT) and Stock Exchange of Thailand (SET)

Figure 3 Stock Market Capitalization of Thailand, 2000-2009: Actual and Scenario Conditions



Source: The actual data is taken from SET and the simulated data is set as assumption

In the simulation, the stock market capitalization is set as constant from the third quarter of 2008 to the third quarter of 2009. The average level in the first half of 2008 is used as a benchmark. The result from actual stock market capitalization is also compared the results under the simulation. The differences imply the wealth effect from the stock market to private consumption and investment. The estimated results of this scenario are displayed in Table 1

From Table 1, the results show that the effects of a crash in stock market provide little explanation for the drop in consumption and investment. Only -0.50 percentage change in consumption during the first to third quarter of 2009 is described by the wealth effect from stock market (the actual decrease in consumption for 2009 is -1.95 percent). Moreover, a change in investment during 2009 can be explained by the effects of stock market capitalization for only -0.25 percent compare to the actual decrease at -15.4 percent. These results provide the evidence that the financial linkage in stock

market plays a minor role during this current crisis since the simulation results can explain only the small portion of decrease in either consumption or investment.

However, the above calculation results should be interpreted with caution because we only focus on stock market as a route of transmission mechanism. Although domestic credit market receives the minimal effects from the financial crisis, the international loan for investment projects could be significantly affected by the financial deleveraging process in global market. In addition, widen in the interest rate spread due to an increasing risk also discourages investment, especially from the foreign firms where sources of fund are from the international financial market. Nevertheless, there is the limitation of the model used in the study. Additionally, the NIDAQMM, which is the econometric-based model, focuses mainly on the aggregate demand factors. Therefore, the credit spread and external financing cannot take into account in the model. However, due to the facts that most of the drop in private consumption and investment can be explained by a shrink in world import value, only international trade channel provides sufficient explanation for the large decline in output. Hence, this evidence could imply that other financial linkages could provide only small portion of the effects during this crisis. The effects of the current financial crisis in Thailand are found to be dominated by the international trade linkage.

4. Effects of Monetary and Fiscal Policies Responses

In this section, we focus on analyzing the effects of government policies during the current crisis. For this purpose, the transmission mechanisms of monetary and fiscal policies are calculated. Once again, the NIDAQMM is employed as the main model in generating paths that key macroeconomic variables' response to changes in RP1 and real government expenditure. We apply the size of an interest rate cut off and the stimulus package during this current crisis to evaluate the effects of policies to key macroeconomic indicators.

4.1 Monetary Policy Response during the Current Crisis

Before, we evaluate the impacts of monetary policy; the transmission mechanism of monetary policy will be investigated. Using the NIDAQMM, the response of key macroeconomic variables is computed. We consider seven key macroeconomic variables, i.e., real GDP growth rate (YR), private consumption expenditure (CPRT), private investment (INPR), headline inflation (PCPIH), core inflation (PCPIC), real export (XTR) and real import (MTR). The results of the accumulate effects of the monetary policy are shown in Table 2. The paths of feedback of these variables are simulated based on a condition that the RP1 is set to decrease by 1 percent and stay at that level over 8 quarters periods.

The results from Table 2 provide the indicators of transmission mechanism in term of size and timing of the impacts of monetary policy. The response of GDP and the key domestic demand components, i.e. consumption, investment, import and export, takes 3-8 quarters after a change in RP1 to make significant impacts. The highest responses come at quarter 4 for consumption and investment. Among all GDP components, investment is the most response variable to a change in interest rate, followed by the private consumption. Increasing in export comes simultaneously with a rise in import. Therefore, the external demand is not considerably change from the effects of monetary policy.

The cumulative effects of monetary policy during 2008 and 2009 are shown in Table 3. The sizes of interest rate change during 2008 and 2009 are used to measure the effects of change in RP1. Our results show that monetary policy provides a support to economy in both 2009 and 2010. However, the impacts are not that large compared to the degree of decreasing in global demand which left economy in severe condition. The monetary policy is expected to stimulate growth at 1.024 and 0.681 percents in 2009 and 2010, respectively.

Table 2 Cumulative Effects of Monetary Policy in Thailand

	YR	PCPIH	PCPIC	CPRT	INPR
Q1	0.01	0.01	0.01	0.00	0.00
Q2	0.14	0.04	0.03	0.17	0.15
Q3	0.30	0.08	0.06	0.35	0.52
Q4	0.39	0.14	0.10	0.45	0.74
Q5	0.47	0.21	0.15	0.52	0.93
Q6	0.53	0.29	0.20	0.56	1.03
Q7	0.60	0.37	0.27	0.60	1.10
Q8	0.67	0.47	0.34	0.64	1.16

Source: Author's calculation using NIDAQMM

Table 3 Change in Monetary Policy Interest Rate in Thailand, 2009-2010, and the Estimated Impact

Monetary Policy Interest rate (RP1)	
Q3-2008	3.75
Q4-2008	2.75
Q1-2009	1.50
Q2-2009	1.25
Q3-2009	1.25
Change in GDP	
2009	1.024
2010	0.681

Source: Author's calculation using NIDAQMM

3.1 Fiscal Policy Response During the Current Crisis

In order to investigate the impacts of stimulus package, the multiplier effects of fiscal policy to key macroeconomic variables are computed. The NIDAQMM is then applied to compute the effects of an increasing in government spending. The accumulate effects of a 10 percent increase in real government spending to the other macroeconomic variables are shown in Table 4.

The estimated results show that the fiscal policy provides the quicker response in the real GDP growth and other domestic demand variables than those of the monetary policy. However, the effects will evaporate quickly after the end of stimulus package. The degree of multiplier effects in Thailand is not that high as the 10 percent increase in real government

spending follow by the 2.24 percent increase in the real GDP growth during the first year and the effects will decrease to 0.41 percent for the subsequent year. Using the size of the increasing in real government expenditure in Table 4, an increasing in fiscal budget during 2008 and 2009 provide only injection of GDP growth approximately at 1.0 and 0.70 percent in 2009 and 2010, respectively.

Table 4 Cumulative Effects of Fiscal Policy in Thailand

	YR	PCPIH	PCPIC	CPRT	INPR
Q1	1.85	0.00	0.00	0.29	0.00
Q2	1.96	0.01	0.01	0.50	2.97
Q3	2.11	0.02	0.02	0.70	3.47
Q4	2.24	0.03	0.03	0.88	4.98
Q5	2.62	0.04	0.04	1.10	5.62
Q6	2.61	0.05	0.05	1.26	7.01
Q7	2.65	0.07	0.06	1.42	7.47
Q8	2.65	0.08	0.07	1.54	8.22
Q9	1.12	0.09	0.08	1.39	8.55
Q10	1.18	0.10	0.09	1.31	6.66

Source: Author's calculation using NIDAQMM

Table 5 Estimated Impacts of Fiscal Policy in Thailand, 2009-2010

Real Government Spending Growth	
2009	4.67
2010	2.28
Change in GDP	
2009	1.043
2010	0.697

Source: Author's calculation using NIDAQMM

Finally, the impacts of monetary and fiscal policies responses in Thailand are compared. The results show that the effects of monetary policy present greater support to macroeconomy in either 2009 or 2010 than those of fiscal policy. However, the size of impacts of both policies is still inadequate to support Thai economy during the crisis in 2009. Particularly, the effects of the monetary and fiscal policy responses are considerably smaller than those of the slump in global trading value.

5. Conclusion and Policy Implication

In this paper, we mainly focus on the effects of global financial crisis to the macroeconomic situation in Thailand. Firstly, the estimation results of the transmission channels of the global crisis to domestic economy indicate that the international trade channel has significant negative impacts to the economic activities while the financial linkage has marginal effect to the domestic consumption and investment. In tackling with the effects of the global crisis, the fiscal and monetary policies are employed. The simulation results show that the fiscal policy provides most of its effects during 2009, while the monetary policy influences economy in second half of 2009 and first half of 2010. However, neither fiscal nor monetary policies can provide significant impacts to cushion the effect of the crisis.

The major policy implication of this study is that Thai economy is highly dependent on the export in order to drive the GDP growth. The importance of export is not only from the direct source of demand of production but also the indirect effect via the investment decision. The export-orientated investment projects and the role of multinational companies (MNCs) have the significant effects to private investment expenditure. In addition, the size of impacts from global trade slump is estimated to be too large for the fiscal and monetary policies to offset these adverse effects. Therefore, in the future, this issue should be addressed to prevent the spillover effects of the crisis in the advanced economies to Thailand.

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“Interdependence of Banking Sectors among three European Markets”

Apostolos Kiohos (University of Macedonia, Greece)

Athanasios Koulakiotis (University of Macedonia, Greece)

Nicholas Papasyriopoulos (University of Macedonia, Greece)

Constantinos Stathopoulos (University of the Aegean, Greece)

The basic purpose of this study is to estimate the interdependence of Greek banking stock market sector with banking stock markets for countries in the European Union which their economies are the largest in Euro-zone (France and Germany). For this purpose, we use two multivariate models (AR (1)-EGARCH and VAR-EGARCH).

This study provides new empirical evidence on the interdependencies of banking stock markets sectors in terms of the first and second moments for their stock price returns. Hence, we examine the transmission mechanisms of banking stock price returns and volatility among the countries mentioned above with a model that accounts for asymmetry.

The results show that there is interdependence among the banking stock market sectors and this would indeed seem to be asymmetric. Greece was found to play an important statistically lopsided or reciprocal role in France and Germany which are the two developed stock banking markets. The implications arising from these volatility interdependencies are that news is more negative than positive when arising from a bigger developed banking sector to a smaller developing banking sector.

Keywords: Asymmetry, Interdependencies, EGARCH, European Banking Sectors

GEL Classification: G15, C3, C61

1. Introduction

This paper examines empirically the interdependence of the two most developed Eurozone banking stock markets sectors compared with the Greek banking stock market sector.

The motivation of this study is to uncover whether the Greek banking sector is more interrelated with the French or the German banking sectors. The financial features which are expected to be captured have to do with the possibility whether the volatility of the Greek banking sector is influenced more regarding the French or the German banking sector.

For this purpose, we use two multivariate models. The first one is an AR (1)-EGARCH model which does not take into account the interdependence among countries and the second one is a VAR-EGARCH model which takes into account the interdependence among countries.

The extensive literature on price and volatility interdependence provides evidence for first and second moment interdependencies among stock markets. For instance, Koutmos (1996) provides evidence for ‘lead/lag’¹ interdependencies among the stock markets of the United Kingdom, France, Germany and Italy. Koch and Koch (1991) provide documentation for simultaneous ‘lead/lag’ interdependencies among eight national stock markets. Becker et al. (1990) show that the information within the American stock market could be used to earn profits from the Japanese stock market. Many other investigations provide evidence for interdependencies among stock markets as presented in detail in the literature review section of this study. Moreover, some researchers provide evidence of interdependencies of first and second moments (stock price returns and volatility) among stock price indexes within the same stock market, such as Harris and Pisedtasalai (2006) for the stock price indexes of small and large capitalization of the London Stock Exchange.

This study provides new empirical evidence on the interdependencies of banking stock markets sectors in terms of the first and second moments for their stock price returns. More specifically, we examine the transmission mechanisms of banking stock price returns and volatility among the countries mentioned above with a model that accounts for asymmetry².

2. Literature Review

The interdependence of stock markets has been examined empirically with an ARCH-type model (autoregressive conditional heteroscedasticity) by numerous researchers. Some of them used a single-variable model and others a multi-variable one, where the transmission of price and volatility among stock markets could be examined successfully. Researchers examined this interdependence of stock price returns and volatility worldwide and not only locally. For example, Hamao, Masulis and Ng (1990) examined the interdependence of short-term volatility for the stock price returns of three sovereign stock markets. They used daily opening and closing prices of stock price returns of the stock exchanges of New York, Tokyo and London for a period of three years, from April 1985 until March 1988. In their analysis they used a single-variable ARCH model to investigate the interdependence of stock price returns. The main consideration was whether the changes of stock price volatility in a stock market were positively associated with the changes of stock price volatility of other stock markets for a couple of days. They used daily stock price returns data, namely stock price returns of 'closing-opening' prices and stock price returns of 'opening-closing' prices. This helped them analyze the impact that the foreign stock market had on the domestic stock market for the opening and closing of stock trading. They found evidence that stock price volatility is transmitted from the stock market of New York to London and Tokyo, as well as from London to Tokyo. Furthermore, they did not observe different effects on the volatility of these stock markets before and after the crash period of 1987. In particular, the results showed that the effect on the Japanese stock market was significant while on the other stock markets it was not. These results were not affected by the different exchange rate. Also, they showed that the unexpected changes of the foreign stock market were associated with influences of the typical mean value of the domestic stock prices, for both the returns of closing-opening prices and the returns of opening-closing prices. One of the problems that the researchers were faced with was that their results were 'biased', as 'spillovers' were not real because they used a univariate model. Following, there are other examples with multi-variable ARCH-type models, where the results for the geographic regions of America, Europe and Japan were more representative.

Many researchers used asymmetric ARCH-type models in order to examine the interdependencies of stock price returns volatilities among different stock market exchanges in Europe. Suffice to refer to some researchers such as Booth et al. (1996) and Kanas (1998). The first study provides new evidence on the effect of stock price returns volatilities among the stock markets of Denmark, Norway, Sweden and Finland. The impact of 'good' and 'bad' news on stock price returns' volatility was analyzed with a multivariate EGARCH model. The transmission of news was asymmetric, since the effects were most pronounced for 'bad' news than for 'good' news with considerable stock price volatilities, being however short-intensive. The data referred to the stock markets of the above mentioned countries, for the period from May 2, 1988 to June 30, 1994. The dataset referred to the period after the crash of October 1987 because an increase was observed in the movement of stock price returns. They found that there was a common variation in all four stock markets. With the exception of Denmark, the stock price volatilities reacted stronger to 'bad' news than to 'good' news. Also, the results of the investigation showed that the effect could last for one week on these stock markets. In addition, there was transmission of stock price returns and volatilities from the Swedish to the Finnish stock market and vice versa. These effects are due to the long-term economic and cultural links between the two countries.

The second study examined the interdependencies of the European stock markets, in terms of variability of stock price returns, namely for the three major European stock markets, London, Paris and Frankfurt. An asymmetric EGARCH model was used to capture the possible influences of non-symmetrical variation of innovations during the period from 1984 to 1993. Mutual transmissions of information were found to exist between London-Paris and Paris-London, whereas equivalent effects were not observed from London to Frankfurt. In almost all cases, the effects were asymmetrical, in the sense that 'bad' news in a market had more influence on the stock price volatility of another market than 'good' news. Furthermore, the analysis for the period before the crash of October 1987 (1984-1987) and after the crash (1987-1993) showed that the effects during the second period were larger in magnitude. These findings suggest that the markets became more interdependent in the post-crash period.

Baele (2002) studied the degree to which efforts to expand the economy in Europe had changed the size of the influence of economic news from the USA and some European stock markets to 13 other specific European stock markets. His dataset consisted of weekly stock price returns of thirteen European stock markets and two regional stock markets for the period from 1980 to 2001. These European countries were Austria, Belgium, France, Germany, Ireland, Italy, Spain and the Netherlands which participated in the Euro-zone, and the United Kingdom, Denmark and Sweden which participated in the European Union but were not using the Euro as their currency, as well as Switzerland and Norway, which were not members of the European Union. In addition, Baele used a large sample of regional markets (those of the USA and of all the European countries), since he wanted to study and compare the interdependence of stock price return volatilities among different stock markets. He found that changes in the magnitude of the effects were statistically and economically significant. While in the European Union and in the United States the size of the influence of news had arisen throughout the twenty years of examination, the impact was more decisive on the European Union. Additionally, he showed that the USA continued to be the dominant market, which affected European stock markets; however, there was also important interdependence amongst European stock markets. This may be due to the improvement and development of stock markets, the low inflation and the increase (the release) of trade between the countries of the European Union.

Koutmos and Booth (1995) explored the mechanisms of interdependence for stock price returns and volatilities in the stock markets of New York, London and Tokyo. The asymmetrical influence of 'good' (advantages for the market) and 'bad' (threats to the market) news in the transmission mechanism of stock price volatility among these markets were described by an EGARCH model. Using daily 'opening-closing' stock price returns for the period of September 3, 1986 to December 1, 1993, they found strong evidence that the effect of the variance in a particular stock market when the news received was negative was much stronger than when it was positive. An analysis for the period before and after the crash of 1987 showed that the linkages and interdependencies among the three stock markets had risen in the post crash era. They found evidence of transmission of news from New York to Tokyo and London, and from Tokyo to London. Stronger interdependencies were found for the second moment (stock price volatility), with notable effects of stock price returns volatility from New York to Tokyo and from Tokyo to London and New York. In all cases, the transmission mechanism of stock price returns volatility was asymmetric. Negative innovations in a stock market increased the variance of the next stock market much more than positive innovations. These findings showed that stock markets were sensitive to news that originated from other stock markets, especially when the news received was negative. The analysis of this period before and after the crash showed that the stock markets in New York and London had been more sensitive to the innovations coming from Tokyo.

Ng (2000) examined the size and the changes of stock price returns volatilities in two of the most powerful industrial countries, as well as in six stock markets in the Pacific Ocean. Ng used weekly returns to avoid the problem of synchronization of the operation of stock markets. The stock markets were the United States and Japan (developed

industrial countries) and Korea, Malaysia, Singapore, Taiwan, Thailand and Hong Kong (countries of the Pacific Ocean). She found that, in addition to the influence of global factors, there were significant influences of peripheral factors (Japan) on the variation of the examined stock markets. Liberation measures for these stock markets appeared to affect the relative importance of global and regional factors which also affected the stock markets. In particular, she focused on how and to what extent volatility in these markets was affected by foreign stock markets and to what extent it was affected by other regional national stock markets. Ng made a distinction between regional stock markets (Japan) and world stock markets (USA), separating news into regional and global, respectively. She concluded that the regional and global factors were important for the volatility of the stock markets of the Pacific Ocean, although the global factor (USA) tended to exert more influence. The size of stock market volatility was caused either by regional factors or by world factors and it was generally very small. In four of those six countries, news from the USA and Japan affected other markets less than ten percent (10%), in terms of weekly stock price volatility returns. There were two possible explanations for this finding: firstly, the local information that was used in the empirical model may not be able to 'capture' the structural changes that occurred because of the regional and global news and, secondly, the variation of the performance of the Pacific markets may be led by specific factors not linked to the Japanese market.

3. Methodology

Based on Koutmos (1996) methodology we use the AR-EGARCH and the VAR-EGARCH multivariate models for the investigation of stock price returns and volatility interdependencies within the selected European banking sectors and among them. The AR-EGARCH model is included in the VAR-EGARCH model and is referred to the orthogonal coefficients of the VAR-EGARCH model. For this reason below we present only the VAR-EGARCH model. Thus, the VAR-EGARCH can be written as follows:

Average price:

$$R_{i,t} = \beta_{i0} + \sum_{j=1}^3 \beta_{ij} R_{j,t-1} + \varepsilon_{i,t} \quad |\Omega^{t-1} - N(0,H) \text{ for } i,j=1,2,3 \quad (1)$$

Stock price volatility:

$$\sigma_{i,t}^2 = \exp\left[\alpha_{i,0} + \sum_{j=1}^3 \alpha_{ij} f_j(z_{j,t-1}) + \gamma_i \ln(\sigma_{i,t-1}^2) \right] \quad \text{for } i,j=1,2,3 \quad (2)$$

$$f_j(z_{j,t-1}) = \left(|z_{j,t-1}| - E(|z_{j,t-1}|) + \delta_j z_{j,t-1} \right) \quad \text{for } i,j=1,2,3 \quad (3)$$

Covariance of stock prices:

$$\sigma_{ij,t} = \rho_{ij} \sigma_{i,t} \sigma_{j,t} \quad \text{for } i,j=1,2,3 \text{ and } i \neq j \quad (4)$$

where, $R_{i,t}$ is the rate of return at time t for the market i, e.g. i = 1, 2, 3 (1=France, 2=Germany, 3=Greece), Ω_{t-1} is the σ -

field that has been created from all the information available at time t-1, $\sigma_{i,t}^2$ is the conditional variance, $\sigma_{ij,t}$ is the conditional covariance between markets i and j, $\varepsilon_{i,t}$ is the noise at time t (e.g. $\varepsilon_{i,t} = R_{i,t} - \mu_{i,t}$) where $\mu_{i,t}$ is the conditional mean of stock prices, $z_{i,t}$ is the local error of the equation (e.g. $z_{i,t} = (\varepsilon_{i,t} - \mu_{i,t}) / \sigma_{i,t}$), while δ_j captures the asymmetry.

Equation (1) describes the stock price returns of banks for three countries as "vector autoregression" (VAR), where the conditional mean of stock price returns for each country is an equation of the previous days stock price returns. 'Lead/lag' relations between the stock price returns of banks in each country can be determined by the rates β_{ij} for $i \neq j$. A statistically significant coefficient β_{ij} means that country i is affected/led by country j , or that the stock price returns in country j can be used to predict future returns to country i .

Equation (2) describes the conditional volatility of stock price returns of banks in each country and it is an exponential function of previous stock price returns and standard errors for the countries under this study. The form of the residuals is given by equation (3) and is described by the $f_j(z_{j,t-1})$. This function is asymmetrical and for $z_{t-1} < 0$ the curve of $f(.)$ function is equal to $-1 + \delta_j$ while for $z_{t-1} > 0$ the curve takes the form $1 + \delta_j$. Therefore, equation (3) allows errors to affect the conditional volatility asymmetrically. The term $(|z_{j,t-1}| - E(|z_{j,t-1}|))$ gauges the extent of influence while the term $\delta_j z_{j,t-1}$ measures the quality of influence. Assuming that the coefficient α_{ij} is positive, the influence of the term $z_{j,t-1}$ in the $\sigma_{i,t}^2$ (conditional volatility) will be positive or negative if the size of the term $z_{j,t-1}$ is larger or smaller than the exponential value of the term $E(|z_{j,t-1}|)$. The quality of the influence of news could be strengthened or compensated by the extent of the influence. More specifically, if the coefficient δ_j is negative, the value of stock price returns starting from country j ($z_{j,t-1} < 0$) will result in asymmetric transmission of stock price volatility from country j to country i . Such an influence is in line with the impact of leverage effect which is measured by the proportion

$| -1 + \delta_j | / (1 + \delta_j)$. The effect of stock price volatility among the stock prices of banks is measured by the rate of α_{ij} for $i, j = 1, 2, 3$ and $i \neq j$.

The mechanism of asymmetric transmission of stock price volatility is explained as follows: a statistically significant rate of α_{ij} with a negative δ_j rate means that the negative innovations in stock prices in country j have greater influence on the stock prices of country i than positive innovations. The persistence of volatility is measured by the coefficient γ_i (equation 2). If the rate γ_i is lower than 1, the nonstandard volatility is finite, whereas if the rate for γ_i is 1, the nonstandard volatility follows a process of integration of grade 1 (Nelson, 1991).

The conditional volatility is described in detail in equation (2) and can simultaneously measure the relationship among the stock prices of banks for the three countries under study. This relationship means that the correlation of banking stock price returns of specific countries is under investigation and that the covariance is comparable to the standard deviation of the specific countries.

Assuming that there is normality, the log-likelihood for the multivariate model of AR-EGARCH and VAR-EGARCH can be written as:

$$L(\Theta) = -0.5(NT) \ln(2\pi) - 0.5 \sum_{t=1}^T (\ln |S_t| + \varepsilon_t' S_t^{-1} \varepsilon_t) \quad (5)$$

where, N is the number of equations, T is the number of observations, Θ is a vector of the parameters of the model that

can be estimated, ε_t is a vector of innovations at time t , S_t is the varying conditional variance-covariance matrix. The log-likelihood is a nonlinear equation for each numerous Θ maximization technique used. In particular, we use the difference of the VAR and AR models for both cases and if the value of $[L(\Theta_2) - L(\Theta_1)]$ is greater than the critical value of Chi-squared (18 degrees of freedom) that is 9.39 at the 5% significance level, we accept that the VAR model is better than the AR model.

4. Analysis of Results

4.1. Data Analysis

The data used in this study consist of daily stock price returns of banks for the stock exchanges of France, Germany and Greece. For each country the daily closing prices of stock prices of banks were taken. For each day we built a portfolio that consisted of all the stock prices of banks at the closing time of stock exchanges and divided these with all the number of observations. That is to say, we used the formula:

$$(P_1 + P_2 + \dots + P_n) / N$$

where, P^i the stock price of each bank and N is all banks that trade in the stock market in each country. The period considered here spans from 2-1-1990 to 21-12-2007. The data were obtained from the system of simultaneous transmission of the electronic flow of financial transactions (DataStream). After collecting the data, we calculated for each country the stock price returns for the sample of banks ultimately used in this study for every day of transaction. In particular, we used the formula:

$$R_t = \ln(P_t) - \ln(P_{t-1})$$

where P_t is the price level of banks stock index at time t , P^{t-1} is the price level of banks stock index at time $t-1$ and R^t is the logarithm of banks' stock price returns at time t .

More specifically, we used the logarithm of the difference between banks stock price returns of each day and the ones of the day before. We used twenty-six banks for France, twenty-one banks for Germany and eleven banks for Greece.

4.2. Preliminary Analysis

Table 1 presents the descriptive statistics for France, Germany and Greece regarding the stock price returns of banks of each country. We also present the results of tests for normality, asymmetry, kurtosis, interactivity and ARCH (Autoregressive conditional Heteroscedasticity) influence. The mean of stock price returns ranged from 0.0224 for Germany to 0.0737 for France and the standard deviation was ranged from 0.0120 for Germany to 0.0277 for Greece. The magnitude of asymmetry and kurtosis for each country shows that the stock price returns for all three countries are positive, asymmetric and leptokurtotic concerning normal distribution. The tests of Ljung-Box (12) for stock price returns and squared stock price returns examine the existence of linear and non-linear interdependencies among the stock price returns and squared stock price returns of banks, respectively. At the 1% level of significance, the results of these tests are statistically important, in particular for Germany and Greece. The test for ARCH effects suggests that the dataset of stock price returns for Germany and Greece can be split fairly well by a model of ARCH type, whereas for France not so much. Hence, ARCH effects for Germany and Greece may explain the non-linear interdependencies as mentioned in the research

of Nelson (1991) and Booth et al. (1992). The simple correlation coefficients range from 0.066 for France and Greece to 0.093 for Germany and Greece.

4.3. Determination of Stock Price Returns Volatility

Table 2 contains the tests for determining the variability of stock price returns as developed by Engle and Ng (1993). These tests control for the asymmetry of volatility for all the countries which are studied. These tests are:

- the sign bias test
- the negative size bias test
- the positive size bias test, and
- the joint test.

The first test examines the effect of positive and negative residuals to volatility not predicted by the model. Specifically, square residuals are regressed on a constant and the pseudo S^t . We examine the effect of 'good' and 'bad' news on the banks stock price returns volatility. The negative size bias test examines large and small negative impact of residuals on the volatility of banks stock price returns and it is based on a regression of residuals against a constant and the $S^t E^{t-1}$. The t-statistic which can be calculated for the $S^t E^{t-1}$ is used for this test. The positive size bias test looks for small or large positive impact of residuals on volatility of banks stock price returns and is based on regressing residuals against a constant and $(1-S^t)E^{t-1}$. The t-statistic is used to check for possible biases except for the $(1-S^t)E^{t-1}$. Finally, the joint test uses the F-statistic based on a regression that includes the three variables S^t , $S^t E^{t-1}$ and $(1-S^t)E^{t-1}$. The main characteristic derive from the results is that there is statistically importance for individual and join size tests for the majority of the studied countries. Therefore, the asymmetric tests the studied countries show that an asymmetric model (like the one used) may capture the trends in the dataset in order to identify successfully the banks stock price returns volatility in each country. For the three size tests, only the positive size bias test for France and the negative size bias test for Germany fail to comply with the asymmetrical distribution of data at the significance level of 10%. Therefore, the results of the model can be considered reliable and an asymmetric model could be introduced in order to study if there is a difference between negative and positive news.

The sign bias test for all countries fails to comply with the asymmetrical distribution of data at the significance level of 10%.

4.4. Results and Analysis of the AR(1)-EGARCH Model

Table 3 presents the results of the AR(1)-EGARCH model. We notice that the degree of asymmetry of banks stock price returns (coefficient δ_i) is higher in Germany (0.2633), in absolute terms and smaller in Greece (-0.0748), in absolute terms. Moreover, the persistence of volatility (coefficient γ_i) in all cases is very high and indeed very close to the unit. The estimates of dependent correlation coefficients are in all three countries less than the estimates of simple correlation coefficients given in Table 1. The correlation between the banks stock price returns of Germany and France declined from 0.060 to 0.057, the association between banks stock price returns of France and Greece declined from 0.066 to 0.058 and the association between banks stock price returns of Germany and Greece declined from 0.093 to 0.087.

Diagnostic tests based on residual returns show that the mean levels of return residuals were close to zero and the volatility of residuals very close to 1. The statistical tests of Ljung-Box (12) indicate that there is some degree of interdependence among the banks stock price returns of each country. The Kolmogorov-Smirnov³ statistic (D) shows that the hypothesis that the distribution of residuals is normal is strongly rejected.

4.5. Results and Analysis of the VAR-EGARCH Model

Table 4 presents the results of the VAR-EGARCH model. The parameters of β_{ij} of the model show the 'lead/lag'⁴ relationship between the three countries. For example, Table 4 indicates that the banks stock price returns in Greece are associated with previous banks stock price returns in France ($\beta_{31} = -0.1274$) and Germany ($\beta_{32} = 0.2810$) since the coefficient β_{31} and β_{32} are statistically significant as well. Furthermore, it appears that banks stock price returns in France are associated with past banks returns to Greece ($\beta_{13} = -0.0092$), while Germany seems to have no interlink with past banks returns either of France or of Greece. Thus, the results indicate that there is an interdependence of stock price returns on banks stock price returns between France and Greece and a lopsided effect from Germany to Greece, while there seems to be no correlation between banks stock price returns of Germany and France (0.0232, 0.0022). Therefore, Greece is the country where the banks stock price returns receive the greatest impact by the other two countries, meaning that Greece is the country that receives information. In particular, Germany and France give information to Greece [(0.2810, (-0.1274)], and France (-0.0092) gets some information from Greece. Also, the 'uncentered R-squared' for the three countries ranges from 0.0039 to 0.0098, which means that the rate of divergence in banks stock price returns is very small.

Continuing the analysis of the results in Table 4 it is observed that for the second moment there is mutual transmission of volatility for all banking stock markets. Most notably, France affects Germany ($\alpha_{21} = 0.0201$) and Greece ($\alpha_{31} = -0.0306$), Germany affects France ($\alpha_{12} = 0.7036$) and Greece ($\alpha_{32} = 0.1196$) and Greece affects Germany ($\alpha_{23} = 0.0141$) and France ($\alpha_{13} = 0.6203$). From the coefficient of δ_i it is observed that the transmission mechanism of volatility is asymmetric for all countries. Negative innovations stemming from Germany (-0.2554) and France (-0.6047) have more influence on volatility of banks stock price returns for these countries than positive innovations, while for Greece (0.3046) the opposite is observed. These results reinforce the belief that size and sign effect are important for the transmission mechanism characteristics of volatility between countries.

4.6. Impact of Innovations on Volatility from the full VAR-EGARCH Model

Following Yang and Doong (2004), Table 5 shows the volatility persistence and asymmetry of stock price returns for the French, German and Greek banking sectors portfolios (panel A1 and A2).

The volatility shocks for the panel A1 banking sectors portfolios lasted about 12.5 days in the case of Greece. In the other two cases of banking sectors portfolios, it was impossible to calculate the half-life of a shock with the equation $\ln(0.5)/\ln(\gamma_i)$ because the sign of volatility persistence, measured by γ , from the estimated VAR-EGARCH model was found to be negative.

In panel A2 the asymmetric impact of positive and negative innovations is shown. Since δ_j are negative and significant and α_{ij} are positive and significant for the banking sectors portfolios of France and Germany, there is a difference between negative and positive innovations for the respective banking sector portfolios indexes. For instance, a negative innovation

of the French banking sector portfolio, has an impact on conditional volatility 4 times larger than positive innovations as estimated by $|-1 + \delta_j| / (1 + \delta_j)$.

The Greek banking sectors portfolio of panel A2 is an exception, since it was found that positive innovations from the Greek stock banking sectors portfolio on conditional volatility have an impact 0.5 times larger than negative innovations, because

δ_j was found positive and significant and α_{ij} was positive and significant as well.

In a similar way, we can analyze the impact of negative and positive innovations on conditional volatility of banking sectors portfolios.

Similarly to Yang and Doong (2004), we performed a simulation on the different impact of good and bad news on cross-market volatility. Table 6 shows that the total impact of spillover effects from market j to market i is measured by

$\alpha_{ij}(1 + \delta_j)$ for a 1% positive innovation and by $\alpha_{ij}|-1 + \delta_j|$ for a 1% negative innovation.

For example, a 1% (-1%) innovation in French banking sectors portfolio increased volatilities by 0.2230 (0.9055) the following day within French banking sector.

If the innovations of France have a 1% decrease then volatility of Germany responds with 3.22% raise.

However, there is a decrease by 0.0121 (0.0491) in the Greek banking sector of stock prices. In a similar way, we can analyze the rest of the results of table 6.

4.7. Comparison of Results from the two EGARCH Models

Comparing the estimates of AR(1)-EGARCH model and the full VAR-EGARCH model it is observed that the persistence of volatility (volatility persistence, coefficient γ_i) is in all three countries higher for the first model than the second one. For the test of joint significance of interdependencies for the first and second moments of distribution among the three countries (France, Germany and Greece), we used the difference of two log likelihood measures taking the form: $LR=2*[L(\Theta_1)-L(\Theta_2)]$, where $L(\Theta_1)$ and $L(\Theta_2)$ are the maximum estimated likelihoods obtained by the full VAR-EGARCH model and the simple AR (1)-EGARCH model.

The estimated value for the likelihood of Table 4 is $2*[-5344.7671-(-5369.9998)] = 2*25.2327 = 50.4654$ which means that the distribution is χ^2 (asymptotic 'chi-squared') with equal degrees of freedom with the parameters used in the AR(1)-EGARCH model. This corresponds to 18 degrees of freedom, which means that the AR(1)-EGARCH model is rejected at about 5% of significance level.

5. General Conclusions

In this study, the interdependence of the Greek banking market in relation to other European Union banking markets is examined. We examined the interdependence among the Greek, French and German banking markets. Similar to the study of Koutmos (1996), there was a particular focus on the asymmetric impact of innovations on volatility for the banks stock price returns of these markets.

Specifically, there was a particular focus on examining the possibility that 'bad' news in a banking stock market has a bigger impact than 'good' news on volatility for banks stock price returns of a different country. There are signs of 'lead/lag' relationships (first moment) between Greece and France and between Greece and Germany. For France and Greece this

relationship is reciprocal⁵ whereas for Greece and Germany, the relationship is lopsided with Germany playing the role of lag and Greece the role of lead.

Similarly, there are remarkable volatility effects (second moment interdependence) from all markets to all markets. In conjunction with the volatility interdependencies, Greece receives more negative news than positive ones from the developed sectors and gives more positive news than negative ones to developed banking sectors. The implications arising from these volatility interdependencies are that news is more negative than positive when arising from a bigger developed banking sector to a smaller developing or emerging banking sector. News is more positive than negative from smaller developing banking sectors (i.e. Greece) to larger developed banking sectors (i.e. France and Germany), if the market receiving the information belongs to the old European zone (i.e. France and Germany) while in the opposite case the information is more negative than positive (i.e. from France and Germany to Greece).

The above results are in agreement with the results of the literature showing that negative news influences the banking sectors more than the positive news with the exception of the news coming from developing banking sectors (i.e. Greece) to developed banking sectors (i.e. the old European zone; France and Germany).

Finally, Greece was found to play an important statistically lopsided or reciprocal role in the two developed stock banking markets and. This means that the stock banking market sector integration of Greece is great with the developed countries.

Endnotes

¹ This means that the lag affects the lead for two different bank stock markets.

² Good news for a country has a greater influence on other countries than negative news whereas negative news for a country has a smaller influence on other countries than good news.

³ The Kolmogorov-Smirnov test can be applied to a small sample and usually has a much greater capacity for rejecting a case of 'mistaken' zero hypotheses. The greater the value of D, the smaller the possibility is to apply a zero hypothesis.

⁴ Here it is mainly indicated the fact that a first-grade information is conveyed by the 'lag' to the 'lead' on the stock markets. The 'former' has the role of 'lag' and the 'latter' the role of 'lead'.

⁵ The impact from Greece to France is minimal.

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Appendix

TABLE 1 Descriptive statistics and diagnostic tests

Descriptive statistics and diagnostic tests for France, Germany and Greece for the period from 2/1/90-21/12/07			
Statistics	France	Germany	Greece
μ	0.07377	0.022454	0.069126
σ	0.014347	0.012067	0.027738
S	14.60879	0.905939	0.428777
K	371.6257	41.97887	5.866085
D	0.210*	0.116*	0.084*
LB(12) for R_t	13.3735	40.3009*	190.6761*
LB(12) for R_t^2	0.2547	509.7451*	654.5613*
ARCH(4)	0.0181	6.4860*	70.5781*
Table of Correlations			
	France	Germany	Greece
France	1		
Germany	0.060	1	
Greece	0.066 *	0.093*	1

Note: (*), (**), (***) indicate the statistical significance level of 1%, 5%, 10% respectively, where μ is the mean of banks' stock price returns, σ is the standard deviation of banks' returns, S is the asymmetry, K is the kurtosis and D the result of Kolmogorov-Smirnov test. LB (12) is the Ljung-Box statistics for 12 lags.

TABLE 2 Tests for determining the volatility of banks stock price returns

Countries	Sign bias(t-test)	Negative size bias (t-test)	Positive size bias test (t-test)	Joint test (F-test)
Test for determining the volatility of banks' stock price returns for Greece, Germany and France for the period from 2/1/90 to 21/12/07				
France	1.0081	-4.4003*	0.0190	6.9647*
Germany	0.2358	-0.9785	2.0309**	2.2579***
Greece	-1.3791	-8.1185*	7.7831*	63.519*

Note: (*), (**), (***) present statistical significance in the significance level (1%), (5%), (10%). Z is residuals from an AR (p) filter using constant volatility. S_{t-1}^+ is a unit if E is negative, and zero if not.

The t-statistic for sign bias, negative size bias and positive size bias tests are the factors of b coefficients for the regressions (i), (ii) and (iii), respectively. The F-statistic is based on regression (iv).

TABLE 3 Maximum valued probabilities of the model AR(1)-EGARCHMean stock price returns: $R_{i,t} = \beta_{i0} + \beta_{i1}R_{i,t-1} + \varepsilon_{i,t}$ for $i = 1,2,3$ Volatility: $\sigma_{i,t}^2 = \exp(\alpha_{i0} + \alpha_{i1}f_i(z_{i,t-1}) + \gamma_i \ln(\sigma_{i,t-1}^2))$ for $i = 1,2,3$ Covariance: $\sigma_{ij,t} = \rho_{ij}\sigma_{i,t}\sigma_{j,t}$ for $i, j = 1,2,3$ and $i \neq j$.**Maximum valued probabilities of the model AR(1)-EGARCH: 02-01-90 to 21-12-07 for the countries of France, Greece and Germany**

	France (1)		Germany (2)		Greece (3)
β_{10}	0.0131 (0.0044)*	β_{20}	0.0119 (0.0093)	β_{30}	0.0098 (0.0226)
β_{11}	-0.0011 (0.0082)	β_{22}	0.0745 (0.0142)*	β_{33}	0.1602 (0.0139)*
α_{10}	0.1456 (0.0027)*	α_{20}	0.0077 (0.0007)*	α_{30}	0.0304 (0.0027)*
α_{11}	0.4017 (0.0041)*	α_{22}	0.1061 (0.0035)*	α_{33}	0.1850 (0.0091)*
δ_1	-0.7988 (0.0083)*	δ_2	0.2633 (0.0215)*	δ_3	-0.0748 (0.0242)*
γ_1	0.9603 (0.0013)*	γ_2	0.9883 (0.0008)*	γ_3	0.9820 (0.0021)*

Table of Correlations

	France	Germany	Greece
France	1	0.0579 (0.0161)*	0.0584 (0.0186)*
Germany		1	0.0877 (0.0145)*
Greece			1

Diagnostic tests

	France	Germany	Greece
$E(z_{i,t})$	0.0000	0.0000	0.0000
$E(z_{i,t}^2)$	0.9997	1.0000	0.9998
LB(12); $z_{i,t}$	7337.3830*	37410.6805*	33201.0712*
LB(12); $z_{i,t}^2$	1371.2030*	24138.5653*	15959.4042*
D	0.379*	0.178*	0.152*

Notes: Numbers in parentheses are the asymptotic errors. For banks stock price returns, the logarithm of these returns has been used. Period: January 2, 1990 until December 21, 2007. D = Result of the Kolmogorov-Smirnov test, which checks for normality (5% criticism value is 1.36 / where T is the number of observations); LB (n) is the Ljung-Box statistics for more than n lags (distributed as χ^2 with n degrees of freedom). $Z_{i,t}$ is the residuals in the market i. (*), (**), (***) indicate statistical significance at the significance level (1%), (5%), (10%).

TABLE 4 Maximum valued probabilities of the VAR-EGARCH model

Mean stock price returns: $R_{i,t} = \beta_{i0} + \sum_{j=1}^3 \beta_{ij} R_{j,t-1} + \varepsilon_{i,t}$ for $i, j = 1, 2, 3$

Volatility: $\sigma_{i,t}^2 = \exp\{\alpha_{i0} + \sum_{j=1}^3 \alpha_{ij} f_j(z_{j,t-1}) + \gamma_i \ln(\sigma_{i,t-1}^2)\}$ for $i, j = 1, 2, 3$

Covariance: $\sigma_{ij,t} = \rho_{ij} \sigma_{i,t} \sigma_{j,t}$ for $i, j = 1, 2, 3$ και $i \neq j$.

Maximum valued probabilities of the VAR-EGARCH model for the countries of France, Germany and Greece for the period from 02-01-90 to 21-12-07

	France (1)		Germany (2)		Greece (3)
β_{10}	0.0537 (0.0073)*	β_{20}	-0.0035 (0.0058)	β_{30}	-0.0668 (0.0140)*
β_{11}	-0.0022 (0.0074)	β_{21}	0.0022 (0.0066)	β_{31}	-0.1274 (0.0123)*
β_{12}	0.0232 (0.0153)	β_{22}	0.0850 (0.0080)*	β_{32}	0.2810 (0.0203)*
β_{13}	-0.0092 (0.0047)***	β_{23}	0.0061 (0.0037)	β_{33}	0.2580 (0.0110)*
α_{10}	-0.5610 (0.0178)*	α_{20}	-1.0939 (0.0138)*	α_{30}	0.0778 (0.0041)*
α_{11}	0.5643 (0.0135)*	α_{21}	0.0201 (0.0018)*	α_{31}	-0.0306 (0.0040)*
α_{12}	0.7036 (0.0173)*	α_{22}	0.1093 (0.0027)*	α_{32}	0.1196 (0.0078)*
α_{13}	0.6203 (0.0151)*	α_{23}	0.0141 (0.0019)*	α_{33}	0.2496 (0.0082)*
δ_1	-0.6047 (0.0160)*	δ_2	-0.2554 (0.0062)*	δ_3	0.3046 (0.0154)*
γ_1	-0.1197 (0.0077)*	γ_2	-0.9416 (0.0021)*	γ_3	0.9456 (0.0031)*
R^2	0.0098		0.0039		0.0043

Table of Correlations

	France	Germany	Greece
France	1	0.08900 (0.0171)*	0.0606 (0.0174)*
Germany		1	0.0830 (0.0154)*
Greece			1

Diagnostic tests

	France	Germany	Greece
$E(z_{i,t})$	0.0000	0.0032	0.0000
$E(z_{i,t}^2)$	0.9997	1.0001	0.9998
LB(12); $z_{i,t}$	4.4070e+03	24521.5090*	9890.3446*
LB(12); $z_{i,t}^2$	2.9348e+03	5156.7504*	1432.4214*
D	0.500*	0.097*	0.254*

LB(12) for the product of vectors of formal errors

LB($z_{12,t}$)= 5.6630e+03, LB($z_{13,t}$)=4.3037e+03 , LB($z_{23,t}$)=2714.5300*

Notes: Numbers in parentheses are the asymptotic errors. For banks stock price returns, the logarithm of these returns has been used. Period: January 2, 1990 until December 21, 2007. D = Result of the Kolmogorov-Smirnov test, which checks for normality (5% criticism value is 1.36 / where T is the number of observations); LB (n) is the Ljung-Box statistics for more than n lags (distributed as χ^2 with n degrees of freedom). $Z_{i,t}$ is the residuals in the market i. (*), (**), (***) indicate statistical significance at the significance level (1%), (5%), (10%).

TABLE 5 Impact of Innovations on Volatility from the multivariate full VAR-EGARCH model

Panel A1: Degree of volatility persistence	
	Volatility Persistence
France	N.A.
Germany	N.A.
Greece	12.3918
Panel A2: Degree of volatility asymmetric impact of Negative and Positive innovations	
	Volatility Asymmetry
France	4.0594
Germany	1.6860
Greece	0.5330

Notes: Entries in Panel A1 denotes the degree of volatility persistence, based on the half-life of a shock (defined as $\ln(0.5)/\ln(\gamma_i)$). N.A. means not available.

TABLE 6 Total impact of innovations on volatility from the full VAR-EGARCH model

Percentage change			
Innovation at t-1 from:	France at t	Germany at t	Greece at t
+1% France	0.2230	0.0079	-0.0121
-1% France	0.9055	0.0322	-0.0491
+1% Germany	0.5239	0.0813	0.0890
-1% Germany	0.8832	0.1372	0.1501
+1% Greece	0.8092	0.0183	0.3256
-1% Greece	0.4313	0.0098	0.1735

Notes: Entries represent the total impact of innovations of index j to index I, which is defined as $\alpha_{ij}(1 + \delta_j)$ for a positive 1% innovation and $\alpha_{ij} | -1 + \delta_j |$ for a negative 1% innovation.

“Bayesian regression models for misclassified binary data”

C. J. Pérez (University of Extremadura, Spain).

L. Naranjo (University of Extremadura, Spain).

J. Martín (University of Extremadura, Spain).

Abstract

Two Bayesian approaches for generalized linear models are proposed to describe the dependence of binary data on explanatory variables when the response is subject to misclassification. Two noise parameters are included in the model to correct the bias produced by the misclassified data. Full Bayesian approaches are considered to address the probit and the t-link regression models. The computational difficulties have been avoided by using data augmentation. Although the augmented models increase the dimensionality, the generation processes can be addressed because efficient Gibbs sampling algorithms to generate from the posterior distributions can be derived. An illustrative example related to a problem in the economic context is presented.

1. Introduction

When information is collected in the real world, the data often do not reflect the true status of the elements in the sample, leading to a noisy data-generation process. This fact can happen due to several causes that are especially relevant in economic contexts. For example, in consumer surveys for marketing research, consumers may not remember their previous behaviours accurately, may misunderstand survey questions or may intentionally misreport. In hidden economy, the involved persons are often reluctant to provide their true information. Miscoded information is also a cause of distortion.

The main consequence is that such distortions or noises can have an important effect on inferences because the effective amount of information obtained from the sample is considerably reduced. If the noise in a data-generating process is not appropriately modelled, the information may be perceived as being more accurate than it actually is, leading, in many cases, to a non-optimal decision making. Economists have devoted increasing attention to the magnitude and consequences of measurement error in their data.

The underlying statistical problem addressed in this paper is known as inference with misclassified data. Generalized linear models are presented to describe the dependence of binary data on explanatory variables when the binary outcome is subject to misclassification. The proposed models have been developed by using the Bayesian methodology, which has been extensively used for twenty years in many fields of knowledge (the growth of Bayesian methods in Statistics and Economics since 1970 was addressed by (Poirier 2006)). An advantage of this methodology is that it allows the incorporation of relevant initial information through the prior distribution. Besides, powerful simulation tools as Markov Chain Monte Carlo (MCMC) methods are available.

(Cowling et al. 2001) present a Bayesian method for logistic regression where the outcome is determined by an imperfect diagnostic test of unknown sensitivity and specificity. Later, (Achcar et al. 2004) proposed another model that used a Metropolis-Hasting algorithm in the generation process. (Paulino et al. 2005) presented a Bayesian analysis of misclassified binary data under a framework of a logistic regression model with random effects. Much effort has been paid for the logistic model. This is because the logistic regression has been used extensively in the biomedical context. However, probit and t-link regressions offer alternatives to logistic regression for modelling binary data subject to misclassifications, specially, when the underlying distribution is normal or t-Student, respectively.

This paper addresses both the probit and the t-link regressions for misclassified binary data under the Bayesian methodology. Note, also, that the logistic model can be approximated by using the t-link model with eight degrees of freedom. The proposed approaches are extensions of the error-free regression model proposed by (Albert and Chib 1993). At the same time, the probit model with normal prior distribution is an extension to two noise parameters of the model presented by (Rekaya et al. 2001). The computational difficulties have been avoided by using data augmentation. The proposed data augmentation scheme has allowed to derive efficient Gibbs sampling algorithms to generate from the posterior distributions.

The potential applicability of these approaches to financial and economical fields makes this proposal interesting. An example illustrates the performance of the proposed models.

2. The models

Suppose that n independent binary random variables are observed Y_1, \dots, Y_n , where Y_i is distributed as a Bernoulli with probability of success $p(Y_i=1) = \vartheta_i$. The parameters ϑ_i are related to a set of covariates $\mathbf{x}_i = (x_{i1}, \dots, x_{ik})^T$ through a binary regression model addressing misclassifications. They are defined as $\vartheta_i = \rho_i (1 - \lambda_{10}) + (1 - \rho_i) \lambda_{01}$, where ρ_i is the true positive probability for an observation with covariate pattern i , λ_{10} is the false negative probability, and λ_{01} is the false positive probability.

A binary response model with $p_i = \psi(\mathbf{x}_i^T \boldsymbol{\theta})$ is assumed, where ψ is a cumulative distribution function (cdf). The most common models used in practice are probit (standard Gaussian cdf) and logit (logistic cdf). The probit model and the t-link one (t-Student cdf) are presented to address misclassification. In both cases, the posterior distribution is intractable for direct generation. However, it is possible to generate from it by augmenting the model with latent variables. Although the model increases its dimensionality, the generation process becomes easier.

The first type of latent variables to introduce is related to misclassification. Binary latent variables c_{hk}^j , $h, k=0,1$, are defined, where h represents the index for the true value and k represents the index for the observed value. When the latent variable takes value one, it denotes the group where the observation i has been assigned: true positive ($c_{11}^j=1$), false negative ($c_{10}^j=1$), false positive ($c_{01}^j=1$), or true negative ($c_{00}^j=1$). Note that $c_{11}^j + c_{01}^j=1$ (when $y_i = 1$) or $c_{10}^j + c_{00}^j=1$ (when $y_i = 0$). Then, the latent vectors $\mathbf{c}^j = (c_{11}^j, c_{10}^j, c_{01}^j, c_{00}^j)^T$ and the latent matrix $\mathbf{c} = (\mathbf{c}^1, \dots, \mathbf{c}^n)^T$ are defined. The second type of latent variables are introduced based on the idea of data augmentation of (Albert and Chib 1993), i.e. n independent latent variables z_1, \dots, z_n

are considered, where z_i is distributed $\text{Normal}(\mathbf{x}_i^T \boldsymbol{\beta}, \gamma_i^{-1})$, and $c_{11}^i + c_{10}^i = 1$ if $z_i > 0$ and $c_{01}^i + c_{00}^i = 1$ if $z_i \leq 0$. If the t-link model is assumed, then γ_i is distributed $\text{Gamma}(\nu/2, 2/\nu)$, with pdf $p(\gamma_i) = c(\nu) \gamma_i^{\nu/2-1} \exp(-\nu\gamma_i/2)$, where $c(\nu) = (\Gamma(\nu/2)(2/\nu)^{\nu/2})^{-1}$. Then, the likelihood function is given by:

$$\begin{aligned}
& L(\boldsymbol{\beta}, \boldsymbol{\lambda}, \nu | \mathbf{D}) \\
& \propto \prod_{i=1}^n \left[\{p_i(1 - \lambda_{10}) + (1 - p_i)\lambda_{01}\}^{\gamma_i} \right. \\
& \quad \times \left. \{p_i \lambda_{10} + (1 - p_i)(1 - \lambda_{01})\}^{1 - \gamma_i} \right] \\
& \propto \prod_{i=1}^n \left[\int \int \int \left\{ \phi(z_i; \mathbf{x}_i^T \boldsymbol{\beta}, \gamma_i^{-1}) \right. \right. \\
& \quad \times (I[z_i > 0]I[c_{11}^i + c_{10}^i = 1] + I[z_i \leq 0]I[c_{01}^i + c_{00}^i = 1]) \\
& \quad \times (I[y_i = 1]I[c_{11}^i + c_{01}^i = 1] + I[y_i = 0]I[c_{10}^i + c_{00}^i = 1]) \\
& \quad \times (1 - \lambda_{10})^{c_{11}^i} \lambda_{10}^{c_{10}^i} \lambda_{01}^{c_{01}^i} (1 - \lambda_{01})^{c_{00}^i} \\
& \quad \times \left. \left. \frac{\gamma_i^{\nu/2-1} \exp(-\nu\gamma_i/2)}{\Gamma(\nu/2)(2/\nu)^{\nu/2}} \right\} d\gamma_i dz_i dc^i \right], \tag{1}
\end{aligned}$$

3. Illustrative example

The likelihood function for the probit model is obtained as a particular case when $\gamma_i = p(\gamma_i) = 1$ in equation (1). Then, the parameter ν (degrees of freedom) is omitted and the likelihood function only depends on the regression and the noise parameters.

The following step is to define the prior distributions. The prior distribution for the regression vector is a multivariate normal distribution, i.e. $\text{Normal}_k(\boldsymbol{\beta}_0, \mathbf{B}_0)$. This is the usual choice for generalized linear models. Beta distributions are assumed for the noise parameters because this is the natural choice for modelling the uncertainty about probabilities, i.e.: $\text{Beta}(a_{10}, b_{10})$ and $\text{Beta}(a_{01}, b_{01})$. Finally, a bounded discrete distribution is chosen for the degrees of freedom.

The full conditional distributions must be derived in order to generate from the posterior distribution, i.e:

$$\mathbf{c}^i | \boldsymbol{\beta}, \boldsymbol{\lambda}, \nu, \mathbf{D} \sim \text{Multinomial} \left(1, \pi_{c^i}(c_{11}^i, c_{10}^i, c_{01}^i, c_{00}^i) \right) \tag{2}$$

$$\begin{aligned}
\pi_{c^i}(1, 0, 0, 0) &= \frac{p_i(1 - \lambda_{10})}{\theta_i} I[y_i = 1], \\
\pi_{c^i}(0, 1, 0, 0) &= \frac{p_i \lambda_{10}}{(1 - \theta_i)} I[y_i = 0], \\
\pi_{c^i}(0, 0, 1, 0) &= \frac{(1 - p_i)\lambda_{01}}{\theta_i} I[y_i = 1], \\
\pi_{c^i}(0, 0, 0, 1) &= \frac{(1 - p_i)(1 - \lambda_{01})}{(1 - \theta_i)} I[y_i = 0],
\end{aligned}$$

$$\begin{aligned}
\lambda_{10} | \mathbf{c}, \boldsymbol{\beta}, \nu, \mathbf{D} &\sim \text{Be} \left(a_{10} + \sum_{i=1}^n c_{10}^i, b_{10} + \sum_{i=1}^n c_{11}^i \right) \\
\lambda_{01} | \mathbf{c}, \boldsymbol{\beta}, \nu, \mathbf{D} &\sim \text{Be} \left(a_{01} + \sum_{i=1}^n c_{01}^i, b_{01} + \sum_{i=1}^n c_{00}^i \right)
\end{aligned} \tag{3}$$

Generating from these two conditional distributions is trivial, however it is not direct to generate from the other two full conditional distributions. A Gibbs-within-Gibbs algorithm is derived by using the introduction of the second type of latent variables z_i , i.e.:

$$(4) \quad z_i | \boldsymbol{\beta}, \mathbf{c}, \boldsymbol{\lambda}, \gamma, \nu, \mathbf{D} \sim \begin{cases} \text{N}(\mathbf{x}_i^T \boldsymbol{\beta}, \gamma_i^{-1}) I[z_i > 0] & \text{if } c_{11}^i + c_{10}^i = 1 \\ \text{N}(\mathbf{x}_i^T \boldsymbol{\beta}, \gamma_i^{-1}) I[z_i \leq 0] & \text{if } c_{01}^i + c_{00}^i = 1 \end{cases}$$

$$(5) \quad \boldsymbol{\beta} | \mathbf{z}, \mathbf{c}, \boldsymbol{\lambda}, \gamma, \nu, \mathbf{D} \sim \text{N}_k(\mathbf{b}_k, \mathbf{B}_k)$$

$$\mathbf{b}_k = \mathbf{B}_k(\mathbf{x}^T \mathbf{W} \mathbf{z} + \mathbf{B}_0^{-1} \boldsymbol{\beta}_0), \text{ and } \mathbf{B}_k = (\mathbf{x}^T \mathbf{W} \mathbf{x} + \mathbf{B}_0^{-1})^{-1}$$

$$(6) \quad \gamma_i | \mathbf{z}, \boldsymbol{\beta}, \mathbf{c}, \boldsymbol{\lambda}, \nu, \mathbf{D} \sim \text{Ga}\left(\frac{\nu+1}{2}, \frac{2}{\nu + (z_i - \mathbf{x}_i^T \boldsymbol{\beta})^2}\right)$$

$$(7) \quad \nu | \mathbf{z}, \boldsymbol{\beta}, \gamma, \mathbf{c}, \boldsymbol{\lambda}, \mathbf{D} \sim p(\nu) \propto \pi(\nu) \prod_{i=1}^n \left(c(\nu) \gamma_i^{\nu/2-1} e^{-\nu \gamma_i / 2} \right)$$

The final algorithm consists of choosing initial values for the parameters and generate iteratively from the full conditional distributions, e.g. in the following order: (4), (5), (2), (3), (6) and (7). When the probit model is considered, the generation process is simplified since γ_i is a fixed value and ν is omitted (steps (6) and (7) are avoided).

Next section shows an illustrative example in the field of Economy.

3. Illustrative example

A dataset for 46 companies recorded in a particular year is considered (Johnson and Wichern 2002), where the variable of interest is the default of the company. Four financial ratio variables are used as predictors for the probability of default, i.e.: cash flow/total debt (x_1), net income/total assets (x_2), current assets/current liabilities (x_3), and current assets/net sales (x_4). These covariates are observed for each of the 46 companies in the sample. The two categories of the binary dependent variable, y , are coded as 1 “default” and 0 “non default”.

Firstly, the probit model is used to investigate the relationship between the explanatory variables and the probability of default and to predict the probability, p_i , that a company i with a given set of financial ratios, x_{i1} , x_{i2} , x_{i3} and x_{i4} , will default. The following general model is considered:

$$\Psi^{-1}(p_i) = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3} + \beta_4 x_{i4}$$

for $i=1, \dots, 46$, where $\boldsymbol{\beta} = (5.31, -7.06, 3.50, -3.41, 2.98)^T$.

We have generated the true binary dependent variable y^{true} from (8) where $y_i^{\text{true}}=1$ if $p_i > 0.5$ and $y_i^{\text{true}}=0$ if $p_i \leq 0.5$. Figure 1 shows the data.

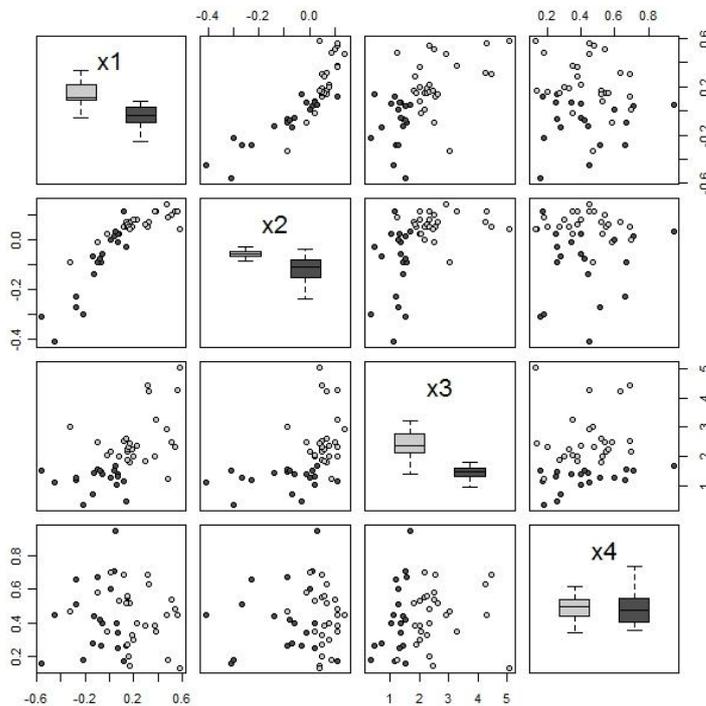


Figure 1. Financial ratio variables. The points drawn with light gray color correspond to the companies with “non default” ($y=0$), and the points drawn with dark gray color correspond to the companies with “default” ($y=1$).

In order to show the usefulness of the proposed method, the values of y have been considered by misclassifying y_i^{true} by a known proportion according to the following three scenarios:

1. Randomly misclassified data (elements 5, 25, 35, 37, 40).
2. Misclassified data close to the border, i.e. p_i in (0.4, 0.9) (7, 17, 20, 23, 25).
3. Misclassified data far from the border, i.e. p_i approx. 0 or p_i approx. 1 (1, 11, 21, 42, 46).

The known proportion of misclassification for the three cases is given by:

	$y = 0$	$y = 1$
$y^{true} = 0$	25	2
$y^{true} = 1$	3	16

Table 1. Relationship between the true and the observed responses.

Then, $\lambda_{10} = p(\text{false negative}) = 1 - \text{Sensitivity} = 3/19 = 0.157$ and $\lambda_{01} = p(\text{false positive}) = 1 - \text{Specificity} = 2/27 = 0.074$.

Table 2 presents the generated responses for the three cases. Also, the covariates and the true response are presented.

y^{true}	Case 1	Case 2	Case 3	x_1	x_2	x_3	x_4
1	1	1	0	-0.45	-0.41	1.09	0.45
0	0	0	0	0.51	0.10	2.49	0.54
1	1	1	1	-0.56	-0.31	1.51	0.16
0	0	0	0	0.08	0.02	2.01	0.53
1	0	1	1	0.06	0.02	1.01	0.40
0	0	0	0	0.38	0.11	3.27	0.35
1	1	0	1	-0.07	-0.09	1.45	0.26
0	0	0	0	0.19	0.05	2.25	0.33
1	1	1	1	-0.10	-0.09	1.56	0.67
0	0	0	0	0.32	0.07	4.24	0.63
1	1	1	0	-0.14	-0.07	0.71	0.28
0	0	0	0	0.31	0.05	4.45	0.69
1	1	1	1	0.04	0.01	1.50	0.71
0	0	0	0	0.12	0.05	2.52	0.69
1	1	1	1	-0.06	-0.06	1.37	0.40
0	0	0	0	-0.02	0.02	2.05	0.35
1	1	0	1	0.07	-0.01	1.37	0.34
0	0	0	0	0.22	0.08	2.35	0.40
1	1	1	1	-0.13	-0.14	1.42	0.44
0	0	1	0	0.17	0.07	1.80	0.52
1	1	1	0	-0.22	-0.30	0.33	0.18
0	0	0	0	0.15	0.05	2.17	0.55
1	1	0	1	0.07	0.02	1.31	0.25
0	0	0	0	-0.10	-0.01	2.50	0.58
0	1	1	0	0.01	0.00	2.15	0.70
1	1	1	1	0.14	-0.03	0.46	0.26
1	1	1	1	-0.28	-0.23	1.19	0.66
0	0	0	0	0.14	0.07	2.61	0.52
0	0	0	0	0.15	0.05	1.88	0.27
0	0	0	0	0.15	0.06	2.23	0.56
0	0	0	0	0.37	0.11	1.99	0.38
0	0	0	0	0.16	0.05	2.31	0.20
1	1	1	1	-0.08	-0.08	1.51	0.42
0	0	0	0	0.29	0.06	1.84	0.38
1	0	1	1	0.05	0.03	1.68	0.95
0	0	0	0	0.54	0.11	2.33	0.48
1	0	1	1	0.01	0.00	1.26	0.60
0	0	0	0	-0.33	-0.09	3.01	0.47
1	1	1	1	0.12	0.11	1.14	0.17
0	1	0	0	0.48	0.09	1.24	0.18
1	1	1	1	-0.28	-0.27	1.27	0.51
0	0	0	1	0.56	0.11	4.29	0.45
0	0	0	0	0.20	0.08	1.99	0.30
0	0	0	0	0.47	0.14	2.92	0.45
0	0	0	0	0.17	0.04	2.45	0.14
0	0	0	1	0.58	0.04	5.06	0.13

Table 2. Responses and covariates.

Probit models with and without misclassifications are considered for a comparison purpose. An informative prior distribution for θ is used, i.e. a multivariate normal distribution with parameters $b=(5,-7,4,-3,3)^T$ and $B=\text{diag}(10,10,10,10,10)$. For the probit model with error parameters, i.e. considering misclassification, λ_{10} -Beta(3,16) and λ_{01} -Beta(2,25).

A total of 110,000 iterations of MCMC are generated by using a Gibbs sampling algorithm. Then, it is considered a burn-in of 10,000 and one out of 10 values is stored. With this specification the chains seem to have converged. Figure 2 shows the posterior distributions with the 90% and 95% highest density regions for the noise parameters.

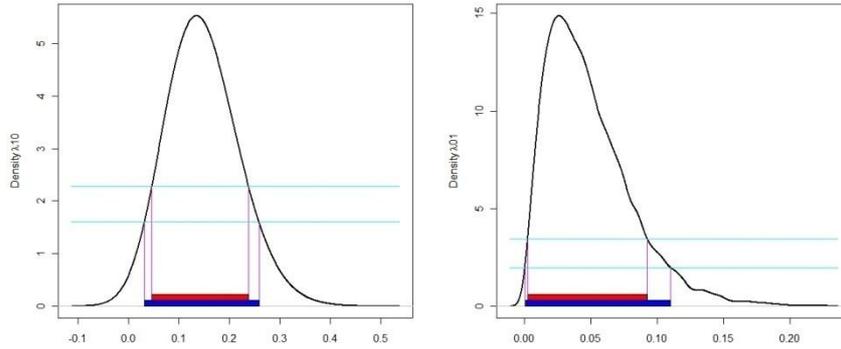


Figure 2. Posterior distributions for the error parameters (probit model).

Table 3 displays the summary of the predictions compared to the true values. Note that in all cases, the predictions of the models with error parameters are better than the standard models. This means that the proposed model is able to relocate the intentionally misclassified data.

Model		$y^{true} = 0$	$y^{true} = 0$	$y^{true} = 1$	$y^{true} = 1$
		$y^{pred} = 0$	$y^{pred} = 1$	$y^{pred} = 0$	$y^{pred} = 1$
Case 1	Probit	27	0	1	18
	Probit with error	27	0	0	19
Case 2	Probit	26	1	0	19
	Probit with error	27	0	0	19
Case 3	Probit	26	1	5	14
	Probit with error	27	0	0	19

Table 3. Predictions for the three cases.

Now, a similar study is presented for the t-link model. The scenarios are the same as in the probit one. For each case a t-link with $\nu=7$ and ν being a random variable are used as error-free models and a t-link model with error parameters with $\nu=7$ and ν being a random variable are considered.

The prior specification is the same for the regression and the noise parameters. In this model, a prior distribution for the degrees of freedom must be specified. The prior distribution considered is a discrete one with support $\{4, \dots, 10\}$ and probabilities given by $(0.05, 0.1, 0.2, 0.3, 0.2, 0.1, 0.05)$.

Also, the chains seem to have converged when a total of 110,000 iterations of MCMC are generated, a burn-in of 10,000 is considered and one out of 10 values is saved. The posterior distributions with the 90% and 95% highest density regions for the noise parameters are presented in Figure 4.

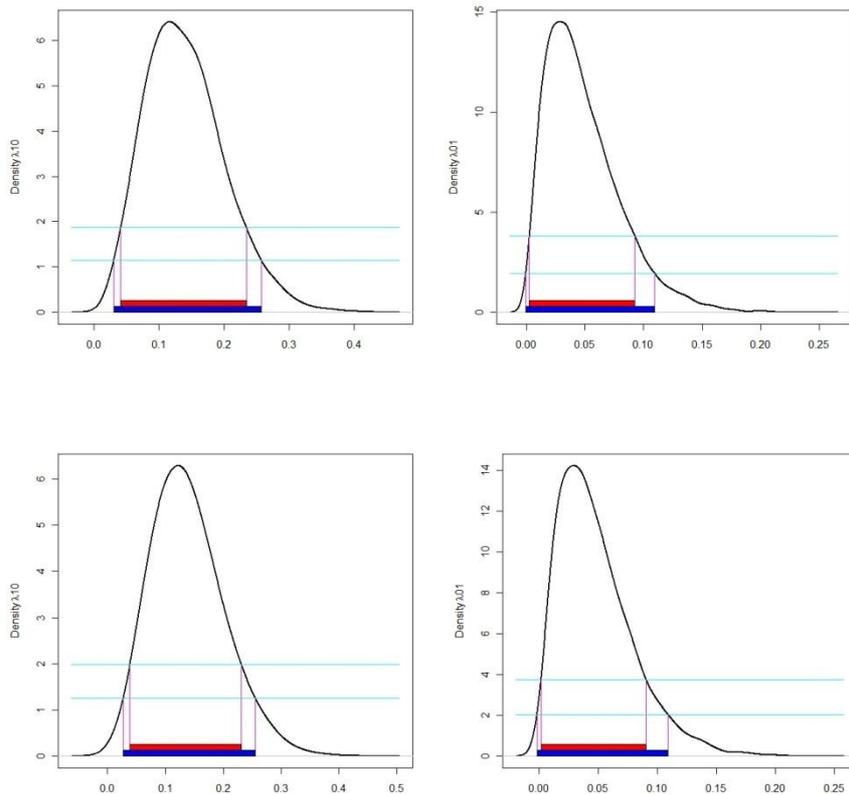


Figure 4. Posterior distribution for the error parameters with the t-link models (top: fixed degrees of freedom and bottom: degrees of freedom as random variable)

Table 4 displays the predictions compared with the true values. The predictions of the models with error parameters are better than the models that do not consider misclassification (except in the case 2 where the predictions are the same).

		$y^{true} = 0$ $y^{pred} = 0$	$y^{true} = 0$ $y^{pred} = 1$	$y^{true} = 1$ $y^{pred} = 0$	$y^{true} = 1$ $y^{pred} = 1$
Case 1	T	27	0	1	18
	T ν rv	27	0	1	18
	T with error	27	0	0	19
	T with error ν rv	27	0	0	19
Case 2	T	27	0	0	19
	T ν rv	27	0	0	19
	T with error	27	0	0	19
	T with error ν rv	27	0	0	19
Case 3	T	27	0	2	17
	T ν rv	27	0	2	17
	T with error	27	0	0	19
	T with error ν rv	27	0	0	19

Table 4. Predictions for the three cases.

We have presented one of the multiple experiments that have been performed. It is shown that the proposed models can produce better predictions than the standard ones.

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