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Impact of the Crisis on the Public Debt Management Behaviour: Evidence from France

Christophe Schalck*

Paris School of Business

Abstract:

The aim of the paper is to identify some shifts in public debt manager's behaviour in France. The behaviour is described through a reaction function and captured reactions of the share of short term debt to cost and risk considerations. Using a new monthly database and a Markov switching approach distinguishing normal times and crisis times, endogenous shifts in public debt behaviour are identified. Results show non-linearities in the French public debt management behaviour since estimated reactions are significantly different between the two regimes. Findings show larger responses to the changes in interest rates and to the liquidity of long term bond market in the crisis regime. The results have implications for monetary and fiscal policies.

Key words: Public debt, debt instruments, Markov switching model, crisis.

JEL codes: E63, H63, C24

* Paris School of Business, 59 Rue Nationale 75013 Paris, France. Email: c.schalck@psbedu.paris

1. Introduction

The onset of the financial crisis resulted in a sharp deterioration of fiscal positions in developed countries. For example, the public deficit in the euro area increased from 0.6% in 2007 to 6.1% in 2010, and public debt in the euro area increased from 65% in 2007 to 94.2% in 2014. At the same time, countries experienced very particularly monetary conditions. Interest rates strongly increase during the period 2005-2008 and then dropped to a very low, even negative, level in the recent period. The inflation rate followed the same pattern. In this context, the public debt management has become a key for macroeconomic policies.

Several studies showed interactions between public debt management and macroeconomic framework (Blommenstein and Turner, 2012; Das et al., 2010; Hoodguin et al., 2011; Togo, 2007). The way of how fiscal policy is conducted has an impact of public debt management. Tax and expenditure levels determine the level of debt that needs to be issued. A massive increase in the stock of debt leads to an increase in uncertainty about the size of future deficits and their financing. It results in an increase in sovereign risk and thus in interest rates of issuances. Public debt management also has implications on fiscal policy. Debt structure affects the fiscal costs of debt servicing and can jeopardize fiscal sustainability. In the same way, there are interactions between public debt management and monetary policy. Monetary policy can constrain debt manager's actions. Exchange rate and interest rate policies can limit the amount of foreign currency debt and floating debt rate that can be issued. Conversely, a poor debt structure can jeopardize the central bank's ability to tighten interest rate or to change currency value. Relationships between public finances and financial stability are based on various channels (Das et al, 2010). The first channel is the level of public debt. A higher public debt reduces sovereign credibility. It could result in higher volatility caused by difficulties in refinancing government debt, which in turn could trigger wider financial instability. A reduced sovereign credibility affects the prices of financial assets. Because government bonds are instruments that serve as a reference point for pricing other financial instruments, a reduced sovereign credibility would influence the soundness of the financial sector balance sheet. The second channel is the one of debt structure and composition. Inappropriate debt structures could become sources of vulnerability to the financial stability. In particular, the excessive use of foreign currency-denominated debt is subject to higher risk in the event of an expected shock (the Mexican case in the 90's is a clear example). Similarly, debt structures that rely heavily on short-term instruments to reach lower-cost ban be sources of financial vulnerability.

Public debt management can be defined as open market operations carried out by the government in order to change the composition of the outstanding stock of government-issued debt instruments (Paalzo, 1992). There are two perspectives from this definition. The first one is the macroeconomic perspective which focuses on all welfare implications of debt

management decisions. The objectives could be macroeconomic stabilization (Tobin, 1963), tax smoothing (Barro, 1999), or deficit stabilization (Missale, 2000). The second perspective of public debt management is the micro portfolio optimization perspective which focuses on debt servicing costs. This perspective examines public debt maturity and strategies related to the use of public debt instruments (Wolswijk and de Haan, 2005). Hoogduin et al. (2011) showed a change in debt management objectives from a macroeconomic perspective to a micro portfolio optimization perspective. Indeed, most of the debt management offices worldwide follow the revised guidelines for public debt management published by the IMF and the World Bank in 2014: "Public debt management is the process of establishing and executing a strategy for managing the government's debt in order to raise the required amount of funding at the lowest possible cost over the medium to long run, consistent with a prudent degree of risk". Owing to the particular current macroeconomic context, strategies of debt management offices have evolved.

Using descriptive statistics, international institutions described the impact of the financial crisis on the public debt composition in developed countries (e.g. Rawdanowicz and Wurzel, 2011). The stylised facts could be summarized as follows: the share of short-term debt constantly increased until 2010; the share of inflation-indexed debt decreased while the share of foreign currency-denominated debt increased; the share of floating debt rate broadly unchanged; debt managers increased flexibility in issuance calendar and in issuance techniques to improve the liquidity of sovereign markets. However, there are few academic studies that employed econometric methods to assess changes in public debt management during the crisis. De Broeck and Guscina (2011) analysed determinants of total issuance and auction share in a panel of 16 euro zone countries between 2007 and 2009. They found that the crisis and a business sentiment indicator had a significant effect while debt and macroeconomic variables were not statistically significant. Hoogduin et al. (2011) estimated a debt management reaction function on a panel of 11 euro zone countries between 1999 and 2009. They found that the share of short term debt responded to the yield curve and has gone up since the onset of the economic crisis. These studies are panel analysis and thus they do not take country characteristics into account. The effect of the crisis is only assessed through a dummy variable. Therefore, they are limited in reflecting changes in national public debt manager's behaviour.

The aim of the study is to fulfil those mentioned gaps. It empirically identifies some shifts in public debt manager's behaviour in France. The contribution of this study is threefold: first, a new database on monthly public debt management in France has been constructed; second, an extended specification of public debt management behaviour for France has been proposed by adding variables that better reflect country characteristics; and finally, a Markov switching approach has been used to endogenously identify some shifts in behaviour. The behaviour is described through a reaction function and captured reactions of the share of short term debt to

cost and risk considerations. Two regimes are considered: one reflected the normal times and the other crisis time. Results show non-linearities in the French public debt management behaviour since estimated reactions are significantly different between the two regimes. Findings show larger responses to the changes in interest rates and to the liquidity of long term bond market in the crisis regime. The study also highlights that the short term debt is a backup plan when there are problems within the French bond market. Consequently, the study may have policy implications, both for monetary policy and fiscal policy.

The paper is organised as follows: Section 2 presents an overview of the public debt in France, Section 3 describes the public debt management behaviour, Section 4 describes the used methodology, Section 5 presents and discusses the obtained results, and the final section provides a conclusion.

2. Overview of the public debt in France

Like most European countries, France managed a strong increase in net issuance from bn€ 101 in 2007 to bn€ 185 in 2011. Now, even though the up-trend is over, the level of net issuance remains high. In this context, one may wonder if the credibility of France was not affected. In other words, this is to ask whether this sharp increase in net issuance has not led to an increase in sovereign risk. Beyond managing the issuance amount, the public debt management focuses on the public debt composition. Figure 1 shows the annual changes in the main components of public debt in France since 2001.

Because the government debt maturity is a key parameter in debt management, the share of short-term debt to the total debt is crucial. Usually, issuing short-term debt is cheaper than issuing long-term debt. But, the refinancing risk is also higher for short term debt: frequent refinancing implies a higher risk of having to refinance debt at higher interest rates. This risk rises with the economic uncertainty. According to Holler (2013), if sovereign assets carry risk, the refinancing cost is not solely determined by the cyclical behaviour of interest rates but also the change of the country risk premiums. In France, the share of short term debt more than doubled from 7.5% in 2006 to 18.5% in 2009, and then it fell to 11.5% in 2014.

France is one of the few European countries that issues inflation indexed bonds. The advantage is to issue at a lower interest rate because investors do not need to be compensated for inflationary uncertainty. When the monetary policy is credible, the main motive for inflation indexed debt issuance is for diversifying the portfolio to attract a large investor base. The main disadvantage of issuing inflation indexed debt is the market risk, since the debt servicing costs react to price fluctuations. Debt ownership also answers to the motive to attract a large investor base. Foreign investors can reduce the cost of sovereign debt issuance

but a high concentration of foreign investors implies a high sensibility to demand shocks. Public debt managers are competing for the desires of foreign investors. In both cases, indicators rose during the financial crisis: the share of inflation indexed debt reached 14.9% in 2008 and the foreign ownership ratio reached 67.9% in 2009. Recent developments indicate a reduction of these indicators.

France used interest rate swaps since 2002. The debt manager receives the long-term interest rate from counterparty and pays the short-term interest rate. This allows said debt manager to fine tune the maturity of debt without running the refinancing risk. This also allows issuing long term debt and thus maintaining the liquidity of the market without increasing the duration of the portfolio. Swaps allow the cost advantages of short-term interest rates to be realised. Nevertheless, swaps have a counterparty risk which means that the other part to the contract might default on its obligations (Piga, 2001). With a default of the counterparty, the debt manager might be forced to renew its debt at higher rates. In France, interest rate swaps sharply dropped since 2005, from bn € 61 in 2004 to bn € 7 in 2014. Note that there are no floating debt rate and foreign currency denominated debt into the French debt.

Fig.1. Public debt composition in France (2001-2014).

Source: from data monthly reports of French public debt management agency (AFT).

3. Public debt management behaviour

Like Hoogduin et al. (2011), the behaviour of public debt manager is estimated through a debt management reaction function. Nevertheless, the chosen specification is expanded in order to fit at best to the French case. The public debt management behaviour captures reactions of share of short-term debt to the total debt to costs and risk considerations according to the IMF and the World Bank guide definition.

Cost considerations are reflected by the responses to the interest rates. Two specifications are considered. The first one is based on interest rates in nominal terms and distinguished short and long term interest rates. According to the micro portfolio optimization perspective, the debt management behaviour should minimise the debt serving cost. Consequently, a higher short term interest rates implies more expensive money market financing and may decrease the share of short term debt. Similarly, higher long term interest rates implies more expensive bonds market financing and may increase the share of short term debt. The second specification is based on real terms including the yield curve and inflation rate. Higher difference between the long and short term interest rates implies relatively more expansive bonds market financing compared to money market financing, and may increase the share of short term debt. Higher inflation rate reflects a more uncertainty environment which leads to an increase in the risk premium and thus an increase in long term interest rates. Moreover, higher inflation rate or expected inflation rate implies additional costs related to the use of indexed bonds. It results that higher inflation rate may increase the share of the short term debt.

Risk considerations are reflected by other variables. The first risk is related to the refinancing risk, that reflect changes in debt servicing cost due to changes in interest rates or unexpected changes in market conditions. This risk is captured via the lagged value of share of the short term debt. A high share of short term debt in the past implies a high short term refinancing. Since the average maturity of short term debt is between 90 and 120 days during the period 1998-2014, a lagged value of 4 months seems to be relevant. Debt management is also dependent on the record of the government as a reliable debtor. In other words, debt management behaviour includes a reputational risk. This risk could be reflected by net issuance of public debt. In the case where the government is not considered as a reliable debtor, higher net issuance could lead to more difficulties finding counterparty since the credit risk is significant. This effect is amplified with the debt level: Drudi and Giordano (2000) showed that at high debt levels the default risk premium become too large for governments to issue long term debt. It results that higher net issuance may imply increase in the share of short term debt. On the contrary, a low reputational risk allows the government to reduce refinancing risk by lengthening maturity and thus reduce the share of short term debt.

In the context of public debt management, bonds market liquidity is a key variable. It refers to the extent to which the bonds market allows assets to be bought and sold at stable prices. According to Holler (2013), the size of the debt market and the composition of the investor base are crucial elements in determining market liquidity. Trading volume of long term debt is a standard measure of market liquidity. A high trading volume reflects a high ease to exchange bonds and thus reflects a low liquidity risk. It facilitates issuance of long-term debt. Higher trading volume may decrease the share of short term debt. According to above French debt presentation, the liquidity risk could be influenced by interest rate swaps and debt ownership since they reflect the investor base. An increase in the counterparty risk leads to a decrease in interest rate swaps and may increase the share of short term debt. Similarly, a decrease in the foreign debt ownership ratio could reflect difficulties to attract investors on the sovereign bond market, which could imply an increase in the share of short term debt.

The public debt management reaction function is described by the two following specifications:

$$SD_t = \alpha_1 + \gamma_1 SD_{t-4} + \beta_1 SR_t + \beta_2 LR_t + \delta_1 NI_t + \omega_1 VOL_t + \theta_1 SWAP_t + \rho_1 FO_t + \varepsilon_t \quad (1)$$

$$SD_t = \alpha_2 + \gamma_2 SD_{t-4} + \beta_3 YIELD_t + \pi INF_t + \delta_2 NI_t + \omega_2 VOL_t + \theta_2 SWAP_t + \rho_2 FO_t + \mu_t \quad (2)$$

Where SD_t is the share of short term debt to the total public debt at time t, SR and LR are short and long term interest rates, NI is the net issuance of public debt, VOL is the trading volume of long term debt, $SWAP$ is the interest rate swaps, FO is the foreign ownership ratio, $YIELD$ is the yield curve, INF is the inflation rate, ε and μ are error terms.

4. The Markov switching methodology

Markov switching regression models the influence of explanatory variables to be state-dependent and has been popularised by Hamilton (1989). A growing number of empirical works have employed regime switching models in order to capture non-linearities and asymmetries which are present in many macroeconomic variables. Among the variables examined are the business cycle (Cologni and Manera, 2009), stock returns (Perez-Quiros and Timmermann, 2000), interest rates (Clarida et al., 2006), exchange rate (Frömmel et al., 2005), CDS spreads (Alexander and Kaeck, 2008), and fiscal policy (Ricci-Risquete et al., 2015). This approach is applied to model dependence of the cost and risk considerations on the share of short term debt in France.

A Markov switching model allows the economy to be in one of n different regime. It allows the regression parameters to take different values depending on the regime which prevails at time t, and denoted by s_t. Since regime switches may occur through structural changes in the

economy, two regimes were considered: one reflected normal times and the other crisis time. The transition from one regime to another is described by an unobservable first-order Markov chain. Public debt management reaction functions in the Markov chain are as follows:

$$SD_t = \alpha_{s,1} + \gamma_{s,1} SD_{s,t-4} + \beta_{s,1} SR_t + \beta_{s,2} LR_t + \delta_{s,1} NI_t + \omega_{s,1} VOL_t + \theta_{s,1} SWAP_t + \rho_{s,1} FO_t + \varepsilon_{s,t} \quad (3)$$

$$SD_t = \alpha_{s,2} + \gamma_{s,2} SD_{t-4} + \beta_{s,3} YIELD_t + \pi_s INF_{s,t} + \delta_{s,2} NI_t + \omega_{s,2} VOL_t + \theta_{s,2} SWAP_t + \rho_{s,2} FO_t + \mu_{s,t} \quad (4)$$

The probability of transition from regime *i* at time *t-1* to regime *j* at time *t* in only influenced by the regime at time *t-1*, and is denoted p_{ij}. For instance, p_{12} gives the probability to swift from regime *1* at time *t-1* to regime *2* at time *t*. In this case, p_{12} gives the probability that the share of short term debt (*SD*) fall into a crisis regime at time *t*. Transition probabilities are assumed to be time independent and summarized in the matrix *P*, thus:

$$p_{ij} = Pr(s_t = j | s_{t-1} = i)$$

The set of optimal parameters can be obtained by maximising the likelihood function, under the restriction that the sum of the probabilities is equal to one and standard deviations are greater than zero. Once the coefficients of the model and the transition matrix are estimated, smoothed probabilities of being in a particular regime, based on the knowledge of the complete series, can be calculated for each date (for details of the algorithm, see Kim and Nelson, 1999).

5. Data and estimation results

Available databases on public debt management are in yearly frequency or cover a short period. For instance, the ECB database starts in 2007. Because of this, they are limiting in identifying some shifts in behaviours over the time. This is the reason why a database about public debt management in France was constructed. From monthly reports of the French public debt agency (AFT), relevant information (short and long term debt, short and long term interest rates, net issuance, trading volume, interest rate swaps, debt ownership and inflation) was extracted. This database covers the period from January 1998 to June 2015 (210 observations). Seasonality of the series is adjusted using the X-11 ARIMA model. Descriptive statistics of the variables are reported in Table 1.

Table 1. Descriptive statistics

	Mean	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Obs.
SD	11.414	18.902	5.620	2.982	0.428	2.672	210
SR	2.361	5.280	-0.010	1.544	0.045	1.830	210
LR	3.721	5.746	0.484	1.160	-0.734	3.116	210
YIELD	1.360	2.899	-0.812	0.841	-0.520	2.521	210
INF	1.590	4.026	-0.791	0.892	-0.146	2.955	210
NI	10.702	20.613	-3.128	3.889	-0.151	3.240	210
VOL	24.097	39.834	10.112	4.269	0.161	4.018	210
SWAP	33.460	61.000	3.000	21.354	0.082	1.397	163
FO	49.836	70.472	12.424	17.223	-0.652	2.012	210

Table 2 provides estimation results for the first specification, i.e. based on nominal short and long term interest rates, with Markov switching coefficients. The first column presents parameter values that prevail in the normal regime (regime 1) and the second one presents parameter values that prevail in the crisis regime (regime 2). The crisis regime is characterised by a high share of short term debt since the intercept in the crisis regime is eighteen times as much as one in the normal regime. The autoregressive term of the share of short term is significantly positive in both regimes, that reflects a refinancing risk. As expected, an increase in the short term interest rate reduces the share of the short term debt while an increase of the long term interest rate raises it. The size of the short term interest rate effect remains about the same (-0.292 compared with -0.291), but the size of the long term interest rate is significantly higher in the crisis regime (1.813 compared with 0.361). In crisis time, the debt manager prefers minimize debt servicing cost than lengthening the debt maturity. The net issuance has not significant effect on the share of the short term debt, which reflects the French debt has no reputational issues. Note however that the French debt managers do not use its reliable picture for lengthening the debt maturity. The liquidity of the bond market appears to be a key issue in the crisis regime. The effect of the trading volume of the long term debt on the share of the short term debt is no significant in normal times while a decrease in trading volume leads to a significant and strong increase in the short term debt in the crisis regime (coefficient of 1.457 in absolute value). Similarly, the effect of the foreign ownership ratio on the share of the short term debt is no significant in normal times while it is negatively significant in the crisis regime. Interest rates swaps have a negative effect on the share of the short term debt. Using swaps the managers can reduce debt servicing costs by agreeing to pay short term rates and to receive long term rates. Thus, swaps are an alternative strategy of issuance of short term debt. Conversely, a decrease in the use of interest rate swaps may increase the share of short term debt. The swaps effect rises in the crisis regime (-0.114 compared with -0.013) which reflect a higher substitution effect. Swaps have a counterparty risk which means that the other part to the contract might default on its obligations. The counterparty risk is higher during recessions and when difference between long-term interest rates and swap rates become tiny. The

implication of the results related to the liquidity risk of the sovereign market is that the short term debt is often used when debt manager has difficulty attracting a large investor base.

Table 2. Markov switching regression results, Model 1.
(Dependent variable: share of short term debt, January 1998- June 2015).

	Regime 1	Regime 2
Constant	2.024***	28.503***
	(0.744)	(3.782)
Share of short term debt(-4)	0.854***	0.662***
	(0.034)	(0.062)
Short term interest rate	-0.292***	-0.291**
	(0.112)	(0.148)
Long term interest rate	0.361***	1.813***
	(0.114)	(0.370)
Net issuance	-0.260	-1.042*
	(0.349)	(0.568)
Trading volume of bonds	-0.054	-1.457***
	(0.340)	(0.490)
Interest rate swaps	-0.013***	-0.114***
	(0.004)	(0.023)
Foreign ownership ratio	-0.012	-0.141***
	(0.010)	(0.035)
Log Likelihood	-107.049	

Notes: standard errors in parentheses; * significant at the 10 percent level, ** significant at the 5 percent level, *** significant at the 1 percent level.

Table 3 provides results for the second specification based on the yield curve and the inflation rate. Results are consistent with the first specification based on the nominal terms. The crisis regime is characterised by a high share of short term debt compared to the normal times regime (intercept value of 12.646 compared with 2.801). A refinancing risk exists in both regimes. The share of the short term debt strongly reacts to the yield curve in the crisis regime: an increase in the yield curve increases the share of short term debt more than proportionally in the crisis regime (coefficient value of 1.832 compared with 0.255). The net issuance has still not significant effect on the share of the short term debt, which reflects the French debt has no reputational issues. The liquidity of the bond market has larger effect in the crisis regime and reflects difficulties in attracting a large investor base: effects of the trading volume of the long term debt, foreign ownership ratio, and interest rate swaps significantly increase in the crisis regime. The interesting point of this specification concerns the impact of the inflation rate. It is insignificant in normal times while it is significantly positive (+0.584) in the crisis regime. This finding reflects the rise of uncertainty and difficulties in attracting a large investor base via indexed debt during crisis time.

Table 3. Markov switching regression results, Model 2.
(Dependent variable: share of short term debt, January 1998- June 2015).

	Regime 1	Regime 2
Constant	2.801***	12.646***
	(0.848)	(2.132)
Share of short term debt(-4)	0.868***	0.301***
	(0.039)	(0.070)
Yield curve	0.255**	1.832***
	(0.129)	(0.187)
Inflation rate	-0.007	0.584***
	(0.085)	(0.101)
Net issuance	-0.595*	-0.372
	(0.346)	(0.638)
Trading volume of bonds	0.680**	2.207***
	(0.299)	(0.705)
Interest rate swaps	-0.020***	-0.139***
	(0.005)	(0.012)
Foreign ownership ratio	-0.032***	-0.054***
	(0.012)	(0.020)
Log Likelihood	-101.630	

Notes: standard errors in parentheses; * significant at the 10 percent level, ** significant at the 5 percent level, *** significant at the 1 percent level.

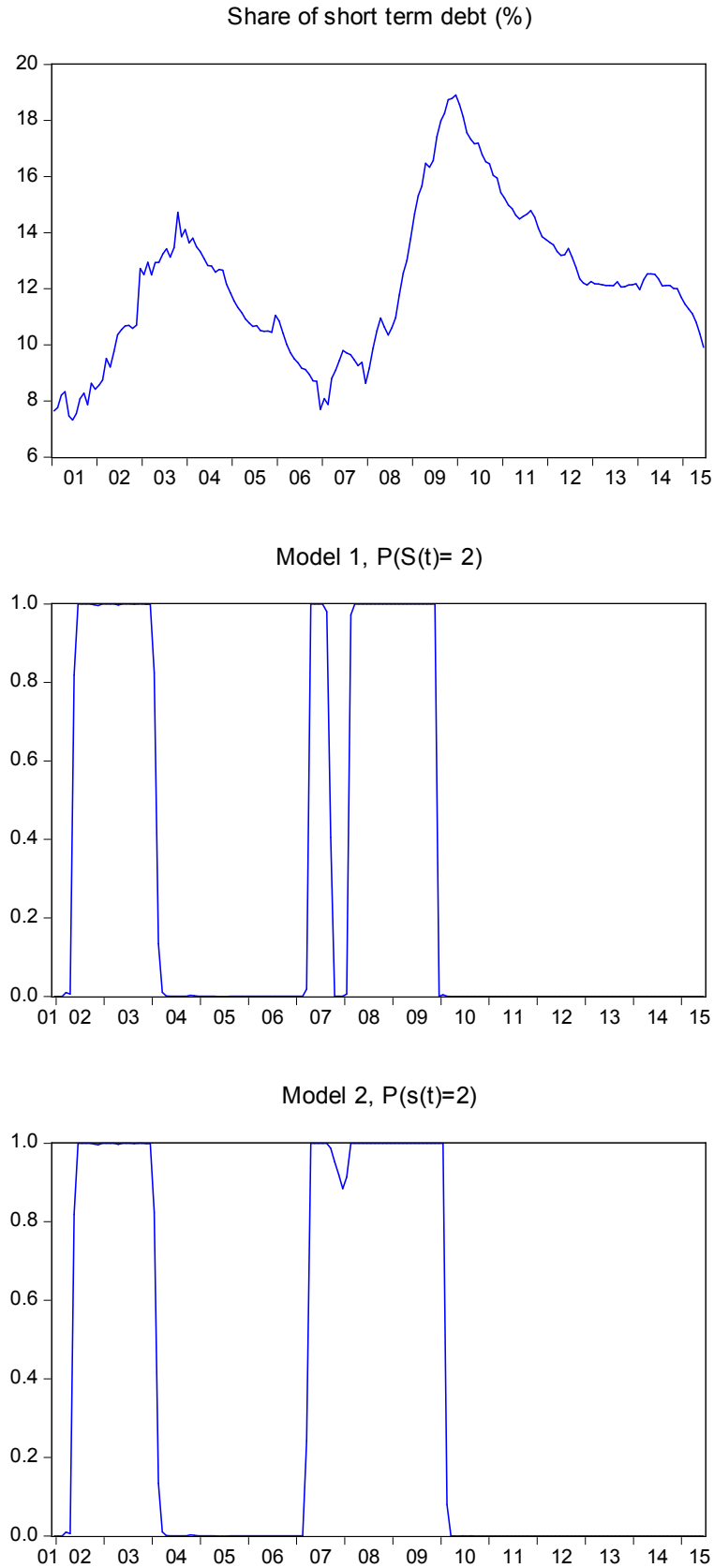
Wald tests on coefficients are performed in order to confirm significant changes between the two regimes. The null hypothesis is that each coefficient is identical in both regimes. Table 4 presents the results. These indicate very strong evidence of switching in public debt management behaviour. Most of coefficients have significant different values between the two regimes. Exceptions are net issuance, short term interest rate in the first specification, and interest rate swaps in the second specification.

Table 4. Wald test results for coefficients

	Model 1	Model 2
Constant	47.738***	18.291***
Share of short term debt(-4)	7.391***	51.318***
Short term interest rate	0.001	
Long term interest rate	5.620***	
Yield curve		46.356***
Inflation rate		19.562***
Net issuance	1.173	0.095
Trading volume of bonds	5.528**	3.986**
Interest rate swaps	13.166***	0.858
Foreign ownership ratio	18.638***	76.983***

Note: The null hypothesis is no switching in coefficient. * significant at the 10 percent level, ** significant at the 5 percent level, *** significant at the 1 percent level.

Fig.2. Smoothed probabilities and share of the short term debt



Note: share of short term debt (top subplot), smoothed probabilities of being in the crisis regime in the first specification (medium subplot), smoothed probabilities of being in the crisis regime in the second specification (medium subplot).

Fig. 2 shows the smoothed probabilities of being in the crisis regime for the two specifications together with the share of the short term debt. There are two main periods of crisis. The first one is the period from May 2002 to January 2004, and the second one is the period from March 2007 to December 2009. The figure indicates that the crisis regime corresponds to a quick and strong increase in the share of short term debt. The only difference between the two specifications is the period from September 2007 to January 2008. It is classified as normal times in the first specification but it is classified as crisis times in the second specification. This difference could be explained by the high inflation rate during this period, related to the oil shock. It is worth mentioning that the Markov switching model distinguishes regimes which are highly persistent. Table 5 presents transition probabilities and expected durations for each regime in each specification. The probability of remaining in the present state is always higher than 93%. The persistence of the regime is also described by expected durations. The normal regime is very persistent with an expected duration ranging from 36 to 41 months. The expected durations of the crisis regime is about 15 months.

Table 5. Regime transition results

	Model 1	Model 2
Transition probabilities		
P11	0.976	0.973
P22	0.932	0.939
Expected durations		
Regime 1	41.131	36.720
Regime 2	14.734	16.338

The results of the study may have policy implications, both for monetary policy and fiscal policy. A change in the yield curve induced by a central bank action may lead the debt manager to modify its issuance policy to take advantage of these new financing conditions. In this case, the public debt management becomes endogenous to monetary developments (Blommestein and Turner, 2012). The macroeconomic consequences of limited changes in debt composition would be small in normal times, but they could be significant in crisis time. Therefore, non linearities in public debt management could be taking into account in the monetary policy decision making in order to assure efficiency of the central bank action. From this point of view Goodhart (2010) argues that central bank should be encouraged to revert to their role of managing the national debt. Without going so far, our findings raise the issue of the institutional framework. An explicit coordination between monetary policy (including a financial stability dimension) and public debt management is needed.

A better understanding of public debt management behaviour also helps to anticipate changes in the debt servicing cost, which is a major public expenditure in France (around 2% of GDP). Policy makers can enable more robust fiscal forecasts when they take non-linear behaviour of

the debt manager into consideration. More accurate fiscal forecasts lead to a rise in fiscal authority's credibility that may lead to a reduce country risk premium. Non-linearities in public debt management also have some implications in a tax smoothing approach. Empirical results of the study confirm theoretical results of Angeletos (2002) and Buera and Nicolini (2004). They showed that the government can stabilise excess burden of taxation and so minimise the distortionary costs of taxation by exploiting variations in the yield curve across different maturities of risk free securities. Moreover, the study provides new insights to the conclusion of the Faraglia et al. (2008) study. They found little evidence to link variations in fiscal insurance to differences in debt structure. This is due to an observed period (before 2000) in which variations in yields curve and debt compositions are minors. According to our results, crisis times are characterized by significant changes in yield curve and debt composition, and thus may have a significant impact on fiscal insurance.

6. Conclusion

The aim of the paper was to empirically identify some shifts in public debt manager's behaviour in France. The behaviour was described through a reaction function and captured reactions of the share of short term debt to cost and risk considerations. Using a new monthly database and a Markov switching approach distinguishing normal times and crisis times, endogenous shifts in public debt behaviour were identified. Results showed non-linearities in the French public debt management behaviour since estimated reactions were significantly different between the two regimes. Findings showed larger responses to the changes in interest rates and to the liquidity of long term bond market in the crisis regime. The study also highlighted that the short term debt is a backup plan when there are problems within the French bond market. The results have implications for monetary policy and fiscal policy. The findings presented here could be extended to different international setting in order to gain new intercultural insights.

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