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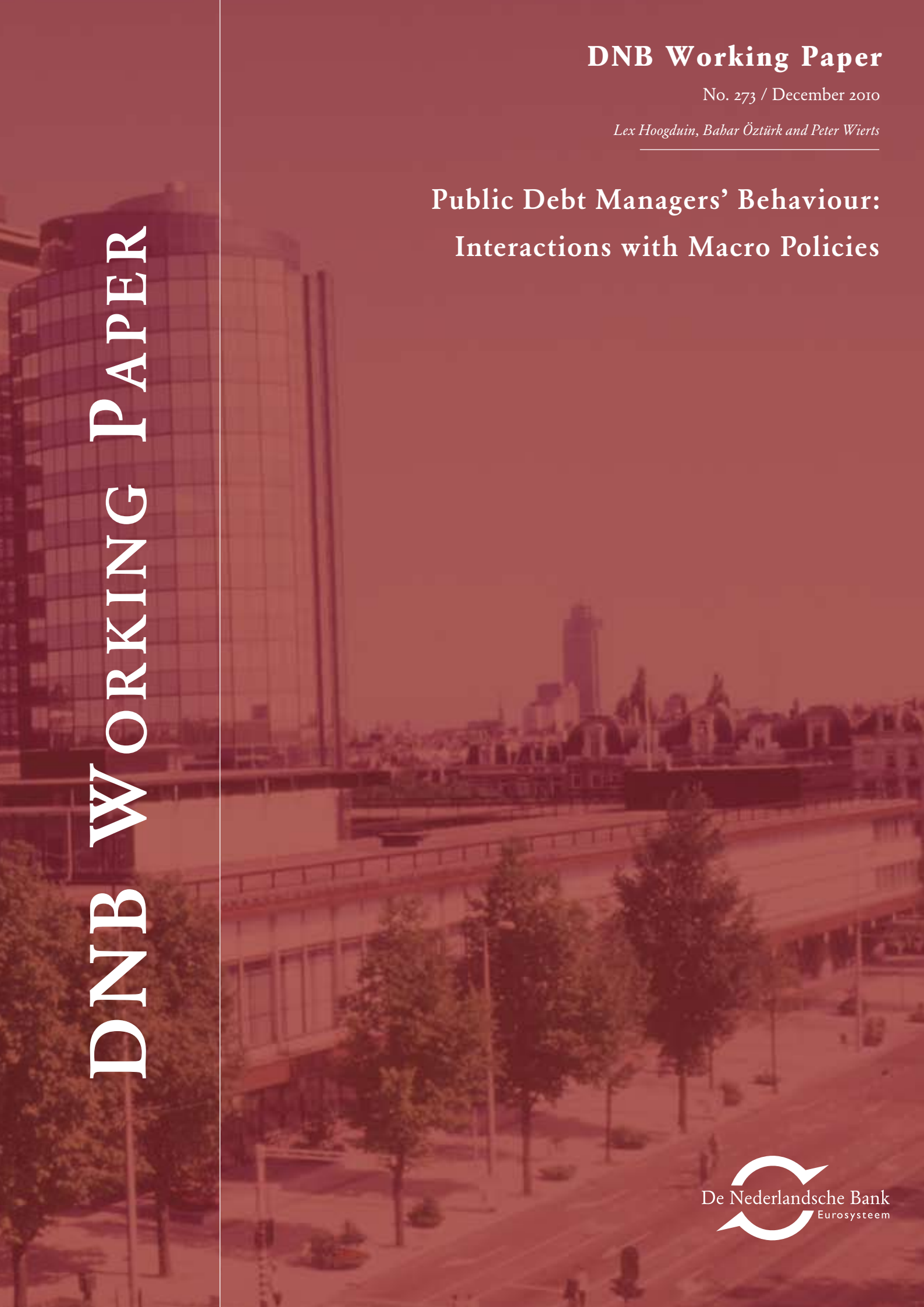

De Nederlandsche Bank
Eurosysteem

Public Debt Managers' Behaviour: Interactions with Macro Policies

Lex Hoogduin, Bahar Öztürk and Peter Wierts *

* Views expressed are those of the authors and do not necessarily reflect official positions of De Nederlandsche Bank.

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Abstract

We investigate the evolution of public debt management, the policy behaviour of debt managers, and the impact of debt management on financial stability and monetary policy. The focus is on the euro area. Empirical estimations of a debt management reaction function indicate that the share of short term debt (*i*) responds to the yield curve or the level of interest rates, in line with the objective of cost minimisation; and (*ii*) has been increasing especially since the onset of the economic crisis. The increase in short term debt brings about higher refinancing risks and strengthens the interaction of public debt management with financial stability and monetary policy. The sharp increase in cross border ownership of public debt since the adoption of the euro further amplifies potential spill-over effects. Policy recommendations focus on the need for transparency on the use of derivatives and prudent debt management that reflects broader macroeconomic considerations.

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[**] The opinions expressed in this article are those of the authors and do not necessarily reflect the views of De Nederlandsche Bank.

1. Introduction

Since the onset of the global financial crisis, fiscal positions in most of the euro area countries deteriorated significantly. Accordingly, public debt managers have been confronted with strong increases in government borrowing needs. These and subsequent increases in sovereign risks have accentuated the importance of prudent public debt management. The way a country's public debt is managed might have important implications for the macroeconomic framework.[1] This is, of course, not to say that by managing public debt in a prudent manner macroeconomic stability will necessarily be guaranteed. In fact, sound public debt management is not enough by itself and can not solve macroeconomic imbalances nor address structural financial sector problems. However, sound debt management can help reduce the risk that the government's own portfolio will become a source of instability both within and across borders. Besides, it will make countries less susceptible to contagion and financial risks (IMF and the World Bank, 2003).

Faced with unprecedented borrowing needs, a number of debt managers in the euro area have changed their borrowing strategies by shifting the composition of borrowing towards short term debt, introducing or increasing debt issuance in foreign currency and/or increasing the use of financial derivatives. While financing debt beyond prudent amounts in the short end of the market could offer cost advantages in the short term, it might also sow the seeds for larger costs in the longer term. Besides, almost all public debt managers focus on minimizing the costs of their national portfolios, independent of one another. Developments in Greece have shown that threats to one Member State's fiscal sustainability (and eventually financial stability) can entail serious contagion risks for a number of other Member States, and cast a shadow on the financial stability of the whole currency union.

The potential for interaction between public debt management and monetary policy has increased due to the increase in short term debt, but also as central banks have purchased government bonds in the secondary market as a part of unconventional monetary policies.[2] It is therefore highly relevant to improve our understanding of public debt managers' behaviour and its broader macroeconomic consequences. This paper addresses the following questions: How can debt management behaviour – in particular the drive towards short term debt – be

[1] In this paper, the macroeconomic framework is defined as to encompass monetary policy, fiscal policy and also financial stability.

[2] While both channels are highly relevant, this paper focuses more on the effect of short term debt. The effect of bond purchases on interest rates is discussed, for example, in Joyce et al. (2010).

explained? What are the main macroeconomic spillovers associated with public debt management and how can they be internalized?[1]

The remainder of this paper is structured as follows. Section 2 discusses the evolution of public debt management and its objectives. Section 3 investigates debt management practices (i.e. financing decisions) based on estimations of reaction functions for euro area debt managers, focusing on the share of short term debt in total issuance. Section 4 analyzes the potential implications of public debt management for financial stability and monetary policy. Section 5 summarizes the arguments and makes a number of policy suggestions.

2. Evolution of public debt management and its objectives

Until about two decades ago, public debt management was seen as an extension of monetary and/or fiscal policy (Togo, 2007). It was not considered a separate macroeconomic policy and was given the task of supporting the macroeconomic framework. During these years, the task of managing government debt was often in the hands of either fiscal or monetary authorities. Since the late 1980s and throughout the whole 1990s, however, the institutional setting for public debt management has undergone a strong transformation for a number of OECD countries. Although the pace and the timing of the transformation varied per country, its general direction showed large similarities across countries (Currie et al, 2003).

The transformation into "modern" public debt management partly resulted from the macroeconomic policies of the 1960s and 1970s. Expansionary fiscal policies in the run up to the 1980s in many OECD countries led to increased deficits and public debt. Eventually, this fuelled concerns about inflation and fiscal sustainability (Currie et al, 2003).[3] In those days, debt monetization was still seen as a feasible option available for the government to finance its debt. The pressure on monetary authorities would thus be even greater if they were also responsible for managing the public debt. Especially this latter concern triggered an influential discussion on the objectives of different macroeconomic policies and tradeoffs inherent among them. In the short run, the objectives of monetary policy, fiscal policy and public debt management involve tradeoffs (Cassard and Folkerts-Landau, 1997). The argument goes that if the monetary authority is responsible for both monetary policy and public debt management, it might be hesitant to raise interest rates to control inflationary pressures or be tempted to lower interest rates in order to constrain debt servicing costs. This

[3] For a detailed analysis of the evolution of public debt management and its instutional implications, please refer to Currie, Dethier and Togo (2003).

would obviously go at the expense of the price stability objective. Gradually, the acknowledgment of conflicts of interest and increased understanding that different policy objectives are best achieved by independent authorities paved the way for independent central banks, and public debt management offices were given a considerable degree of autonomy.

Parallel to this change in the way of thinking and institutional setting, developments in the financial markets throughout the 1980s and 1990s stimulated the emergence of modern public debt management. Financial market liberalization and deregulation increased the number of markets available to sovereign borrowers, assisted financial innovation and thus bolstered the development of new financial products. Increased emphasis on cost and risk analysis encouraged public debt management to mimic portfolio management and gradually turn into a more complex and sophisticated activity. Although their exact organization differs across euro area countries, debt management offices now have greater autonomy within or outside the Ministries of Finance (Wolswijk and de Haan, 2005).

Along with the institutional and operational transformation, the objectives of public debt management have undergone a remarkable shift from supporting macroeconomic policies to minimizing debt servicing costs. Traditionally, theories of sovereign debt management attached it broad macroeconomic objectives such as tax smoothing (Barro, 1999), macroeconomic stabilization (Tobin, 1963) and deficit stabilization (Missale, 2000). Currently, a great number of public debt managers adopt objectives that are akin to the one defined by the Guidelines for Public Debt Management (IMF and the World Bank, 2003): "*…to ensure that the government's financing needs and its payment obligations are met at the lowest possible cost over the medium to long run, consistent with a prudent degree of risk*".

Apart from costs and risks, this objective also refers to the planning horizon of debt management. However, not all debt managers refer to this planning horizon explicitly and instead, define the objective as to minimize debt servicing costs at acceptable risk levels. This seemingly minor difference can lead to considerable differences in the practices of debt managers. Minimizing costs at any point in time is different from minimizing costs over a longer time horizon. What might seem cost-efficient today may prove rather costly over a number of years. It is exactly the acknowledgment of this distinction that might help mitigate the alleged "dilemma" of minimizing costs while containing risks. As Piga (2001) states, expected cost minimization requires issuing short term debt. However, reducing the maturity

of debt implies higher interest rate- and refinancing risks. If these risks materialize, governments will be forced to bear considerable increases in debt servicing costs.

In some countries, the stated objectives of public debt management are extended to include the coordination of debt management activities with fiscal and monetary policies. It is also emphasized in the Guidelines for Public Debt Management that these policies should be coordinated. It remains unclear, however, under which circumstances macroeconomic considerations would outweigh cost considerations. It is fair to argue that a number of factors specific to the government distinguish it from a private portfolio manager. First of all, since the government has much wider objectives than simply to minimize debt servicing costs, it can not act as a private agent in the market. Second, compared to a portfolio manager, the amount of risk that a government can tolerate might be limited. According to Wheeler (1997), a government should follow the risk preferences of the median voter, who tends to be risk averse. Third, as will be discussed in Section 4, the way the public debt is financed might have important implications for the macroeconomic framework.

3 Explaining public debt management behaviour

3.1. Towards a debt management reaction function

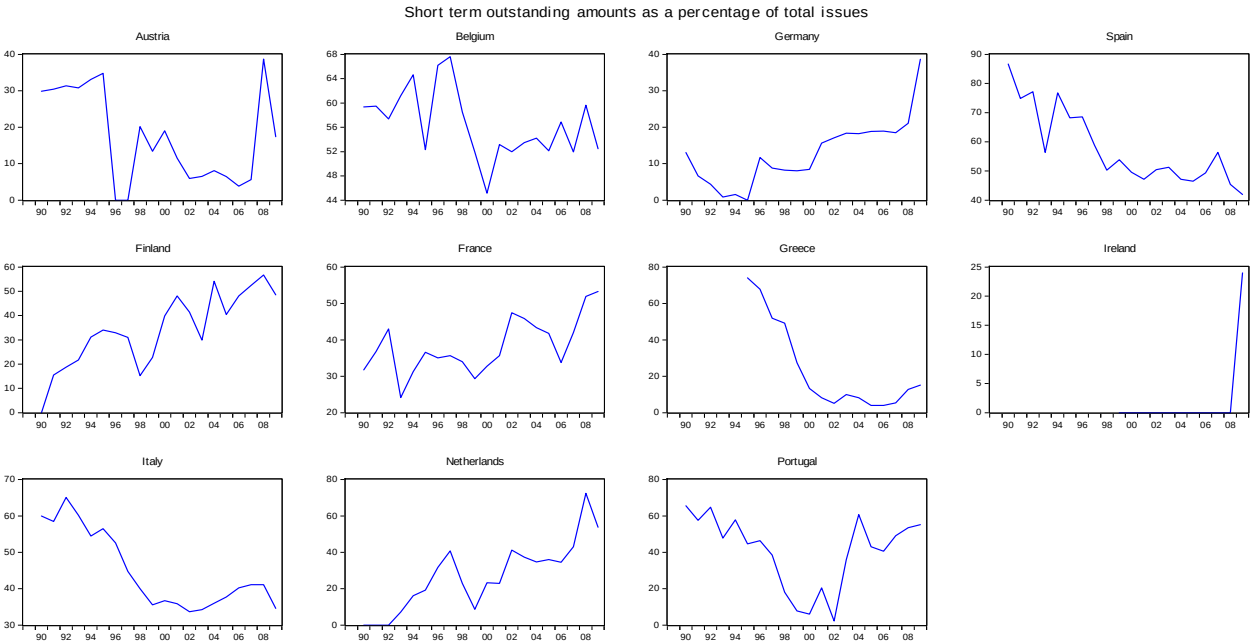
Several authors have already investigated how debt management responded to the unprecedented increases in borrowing requirements (e.g. Blommestein and Gok, 2009). One remarkable change has been the increase in the issuance of short term debt with an original maturity of up to one year. We aim to take the analysis further by studying the drivers of government debt managers' behaviour. Describing policy behaviour in terms of reaction functions is common to fiscal and monetary policy.[4] For debt management, we are not aware of such estimations; hence we make a first attempt towards a debt management reaction function. With our dependent variable, i.e. short term financing *relative* to total financing, we aim to capture the core policy decision of debt managers, namely deciding on the maturity. For a given level of financing needs, deciding on the maturity is a crucial (perhaps *the* crucial) decision for the debt manager to make.[5] Further, as mentioned already, the share of short term debt is relevant for the extent of interactions between debt management and central bank policies related to financial stability and monetary policy (see also Section 4).

[4] The literature is extensive. It is generally believed that the study by Bohn (1998) marks the beginning of the literature on fiscal reaction functions while the Taylor rule was first proposed in 1993.
[5] Other important policy decisions concern fixed versus floating interest rates, the currency denomination and issuance of nominal versus index linked bonds.

A priori, capturing debt management behaviour in an econometric model does not seem an easy task. Debt offices issue a wide array of instruments, for example index linked or nominal bonds, with fixed or floating rates, and/or denominated in national or foreign currency. Issuance decisions may reflect several demand and supply factors, which may potentially be difficult to disentangle. As a first approach, and given data limitations, we therefore simplify our approach as much as possible. More advanced specifications are left for future research.

An important caveat is that our estimations only capture issuance policy, which is highly observable to the market. The estimations do not capture how different countries subsequently influence the maturity profiles of their debt through the use of swaps, on which data availability is rather limited (see Box 1 for the use of financial derivatives in public debt management and the need for transparency).

Figure 1. Short term financing as a percentage of total debt issuance



Source: ECB SDW.

Data on our dependent variable – i.e. the *share* of short term debt in eleven euro area countries as displayed in Figure 1 - indicate a more diverse pattern across countries in comparison with the increase in the *level* of short term debt.[6] A first group of countries starts from a rather low share of short term debt at the beginning of our sample period, and subsequently increases it throughout this period (i.e. Germany, Finland, France, and The

[6] According to our data, short term outstanding amounts in the euro area more than doubled between 2006 and 2009, from EUR 322 billion to EUR 725 billion.

Netherlands).[7] One of the purposes of our empirical analysis is thus to explain the move towards short term debt in these countries. A second group of countries displays almost the opposite development. Having relatively high shares of short term debt at the start of our sample period, some countries in this group reduced their use of short term financing until the turn of the century (i.e. Belgium, Portugal), and some others opted for a trend decline in the share of short term debt throughout the sample period (i.e. Spain, Greece and Italy). These countries might have used the opportunity brought by a more stable macro-economic environment in the run-up to EMU to increase their calls in the capital market and thereby decrease their dependence on short term debt.

Box 1. The use of financial derivatives in public debt management

Financial derivatives such as interest rate and currency swaps have been widely used in government debt management since the 1980s. The interest rate swap was developed in 1981 and grew fast since then. In terms of notional principal amount, the size of the market had exceeded $500 billion already in 1987 (Fabozzi, 2010). Sovereign borrowers use interest rate swaps for two basic purposes. The first purpose is to hedge a given interest rate risk. A government paying a short term interest rate can agree to pay a long term rate in return for a short term rate. This allows debt managers to fine tune the maturity of debt and approach the benchmark portfolio, while preserving the predictability of issuance in the capital market. This is especially attractive when borrowing requirements rise significantly and unexpectedly, as they obviously did during 2008-2009. Such a strategy might also be cheaper than issuing debt directly in the capital market, depending on the difference between the yield on debt and the swap rate.

A second reason could be to increase risk-taking and reduce financing costs. Euro area debt managers are widely pursuing this strategy by entering into swap contracts to pay short term interest rates in return for long term rates. Some debt managers strive to enhance the liquidity of long term benchmark bonds in order to lower the liquidity premium. This allows debt managers to issue long term bonds and thus maintain liquidity while reducing the duration of portfolio by the use of interest rate swaps. By agreeing to pay short term rates, debt managers take on interest rate risks with the expectation of lowering debt servicing costs. Alternatively, the debt manager can issue short term debt directly in the money market and refrain from swapping. However, by choosing for the alternative strategy he or she would be limiting the amount of long-term debt that can be issued, and restrict the liquidity in the secondary market for long term bonds. Thus, interest rate swaps help solve this dilemma by letting debt managers to separate the funding decision from the portfolio decision (Piga, 2001).

7 In addition, Austria shows a somewhat mixed pattern while Ireland has resorted to short term debt only in recent years.

Financial derivatives are, however, not risk-free as they introduce counterparty risks. For example, whereas a Treasury bill also offers the advantage of low short term interest rates, swaps bring the risk that the other party to the contract might default on its obligations. With a default of the counterparty, the government might be forced to renew its debt probably at higher rates. Especially under current circumstances, counterparty risk is a factor one needs to consider seriously when entering into a swap contract. As Piga (2001) argues, counterparty risk is likely to be higher during recessions. One way to mitigate this risk would be to enter into swap contracts only with counterparties holding investment grade ratings. However, during a financial turmoil, even this might prove insufficient. For example until its fall on 15 September 2009, Lehman brothers held a rating of at least an A from all three major rating agencies, qualifying it as a creditworthy counterparty.[8] Credit ratings do not always reveal the true financial state of a company or an institution and tend to lag behind credit events. Another way of mitigating the counterparty risk is to demand collateral when entering into a swap contract. Still, this does not provide a hedge against the interest rate risk in case a counterparty defaults. During financial turmoil, the market value of the collateral might also shrink. Further, liquidation is usually a costly and time-consuming process. Government involvement can lead to reputation risk, which could then lead to a broader loss of confidence.

Interest rate swaps cover only one type of risk. Swapping short term interest rates for long term rates adjusts interest rate risk but not refinancing risk. Further, when used beyond the measure of prudence, swaps might hamper the transparency of debt management significantly. Most often, sovereign borrowers use only plain vanilla swaps. However, there are cases where more sophisticated interest rate swaps are used. The lack of available information on the details of swap arrangements makes it difficult for investors or interested institutions to judge financing decisions of debt managers. Overall, we conclude that swaps are useful tools as long as they are not employed excessively and not used for creative compliance with benchmarks.

3.2. Hypotheses on the behaviour of public debt managers

This section discusses the factors that can potentially affect debt managers' behaviour, as captured by our dependent variable (i.e. share of short term financing as of total). On the basis of the objectives of national debt managers, we expect yearly financing flows to be driven mainly by cost and risk considerations. Cost considerations are reflected by the response to interest rates. Debt managers may react to the level of interest rates and/or to the difference between long and short term interest rates (i.e. the yield curve). For example, a higher long term interest rate implies more expensive capital market financing and may increase the share

[8] Before its fall, Lehman Brothers' rating from S&P was A, from Moody's A2 and from Fitch A+.

of short term financing (positive effect). Similarly, a higher short term interest rate implies more expensive money market financing and may decrease the share of short term financing (negative effect). If both effects are equally strong, debt managers only react to the difference between the long and short term interest rates, that is to the yield curve, and do not respond to absolute levels *per se*. If this is the case, the coefficient of the yield curve should be positive, while the coefficient for the absolute level of the interest rate should be insignificantly different from zero.

Risk considerations are usually reflected by a benchmark for the maturity structure of government debt. We therefore expect the constant in our regression to be statistically significant, and between 0 and 100 per cent. In the hypothetical case where debt managers always finance a fixed amount of their financing needs in the money market, this would be the only variable that is statistically significant.[9] Variables capturing market circumstances may also play a role. The extent of ease with which the debt manager can tap a market increases with the liquidity of that market. Moreover, during periods of increased volatility in the market, it might be more difficult to issue long term bonds. Likewise, in an inflationary environment, investors might opt for short term positions, leading to a positive effect. Given that expected inflation is already included in nominal interest rates, we also run a separate regression with real interest rates and inflation.

The impact of fiscal policy on our dependent variable is reflected by the coefficient of net financing needs (i.e. excluding redemptions). High financing needs might be difficult to meet in the capital market, where the predictability of debt issuance is considered vital. In this case, the coefficient of net financing needs would be positive. Besides increasing financing needs, the outstanding stock of debt might also influence debt management behaviour. On the one hand, higher outstanding amounts could imply that a lower fraction should be financed in the money market in order to limit exposure to interest rate shocks. Alternatively, higher debt may also signal higher credit risk and limit access to the capital market. Thus, the expected sign is ambiguous. Moreover, the effects of special events that possibly influence financing decisions are captured by dummies. An EMU dummy (1999-2009) corresponds to the institutional change brought about by the euro. Given that it also roughly coincides with an increase in focus on costs by national debt managers, we expect a positive coefficient, if anything. Next to a crisis dummy (2008-2009), for which we expect a positive coefficient, we

[9] Note that a regression on a constant only gives the mean of the dependent variable.

also include a dummy for the conversion to the euro. At the time of conversion, debt managers were buying back bonds in their own currency and issuing bonds in euros in return. The coefficient for the conversion dummy is therefore expected to be negative.[10] Finally, we expect a statistically significant coefficient for the lagged dependent variable since a high outstanding short term debt by the end of a year implies that a large fraction of it will have to be refinanced in the following year.

3.3. Results

In explaining the behaviour of debt managers, we employ a general to specific approach, where we subsequently drop variables that are not statistically significant. As a first approach, we employ yearly data in order to maintain the link with the annual budgetary cycle. We restrict our approach to the euro area and the period 1990-2009 due to data availability. Our panel includes the larger euro area countries: Austria, Belgium, Germany, Spain, Finland, France, Greece, Ireland, Italy, The Netherlands and Portugal. More information on data sources and definitions can be found in Annex 1, while Annex 2 contains details on the estimated equation, the estimation technique and robustness checks.

We first look at the impact of the level of interest rates and the yield curve. These variables are instrumented with their own lags to correct for possible reverse causality. We include in our estimations the yield curve and the long term interest rate, which have a much lower correlation than the one between long term and short term interest rates. Alternatively, this specification can be rewritten into the separate effect of long term and short term interest rates:

$$\alpha * (Yield) + \beta * LR = \alpha * (LR - SR) + \beta * LR = (\alpha + \beta) * LR - \alpha * SR . \quad (1)$$

Where *LR* is the long term interest rate and *SR* is the short term interest rate. In other words, given that we control for the effect of the long term interest rate, the coefficient for the yield curve can also be interpreted as the response to the short term interest rate (but with a negative sign).

Table 1 reports the results that remain after statistically insignificant variables were dropped. Results in column (1) for all eleven countries in the sample are based on the restrictive assumption that debt management during the sample period behaved in a similar manner in all

[10] Many thanks to Niek Nahuis for his suggestion to include this effect.

countries. Results show a statistically significant positive response to the long term interest rate, a high degree of persistence (lagged dependent variable of 0.70), and expected signs for the dummy variables. Columns (2) and (3) loosen the restriction of a common behaviour in the whole euro area and show results for two different groups of countries. The division into two groups is motivated by differences in financing patterns as discussed already in Section 3.1, and robustness checks on the inclusion and exclusion of countries in each group.

Table 1. Estimations of debt management behaviour

	All countries (1)	DE, FI, FR, NL, IR, AT (2)	ES, EL, IT, PT, BE (3)
Yield curve		3.01 (3.89)***	
Nominal long term interest rate	1.18 (0.26)***		0.99 (0.30)***
D(Stock market volatility)		0.28 (0.15)*	
Total outstanding amounts / GDP, lagged		-0.36 (0.12)***	
Lagged dependent variable	0.70 (0.036)***	0.39 (0.12)***	0.61 (0.058)***
Constant	0.40 (1.68)	19.3 (3.89)***	10.3 (1.95)***
EMU dummy	4.6 (0.74)***	10.3 (1.90)***	
Crisis dummy	3.7 (0.73)***	8.0 (1.69)***	
Euro dummy		-6.4 (2.90)**	-4.7 (0.54)***
Estimation method	2S-EGLS[a]	2S-EGLS[a]	2S-EGLS[a]
Fixed effects	Yes	Yes	Yes
GLS weights	Cross-section	Cross-section	Cross-section
Adjusted R^2	0.90	0.85	0.91
Sample period	1991-2009	1991-2009	1991-2009
N	195	105	90

Notes: [a]The estimation method is two-stage estimated generalized least squares with cross-section weights. Heteroskedasticity and serial correlation consistent standard errors are in brackets below the point estimates, * = significance at the 10% level, ** = significance at the 5% level, *** = significance at the 1% level. The instruments for the nominal long and short term interest rates and the yield curve are the lagged long rates and short rates until the second lag. Further, N = number of observations. D stands for the first difference.

Results now show that more variables are statistically significant. Column 2 (i.e. for DE, FI, FR, NL, IR and AT) indicates that cost considerations show up in the response to the yield curve, with a steeper yield curve implying higher short term financing. Moreover, the share of short term financing decreases with increasing outstanding stock of debt. Hence, higher debt seems to lead to a more 'prudent' financing. An increase in market volatility implies more

short term financing in this group, possibly as a result of demand effects. A remarkable result is that the period since 1999 coincides with a level shift in the share of short term financing of 10% points (i.e. coefficient of EMU dummy). One possible explanation is the increasing focus on costs since the turn of the century. Moreover, the crisis period coincides with another highly significant increase in short term financing by 8% points (i.e. coefficient of crisis dummy). A frequently mentioned explanation is that capital market financing was not available when large spikes in financing needs occurred during periods of high uncertainty. Finally, the size of persistence (of 0.39) is much lower than in column (1) now that more variables appear statistically significant. Results in column 3 (i.e. for ES, EL, IT, PT and BE) suggest that in this group, the share of short term financing responds to the level of long term interest rates and not to the yield curve. In other words, decreases in long term interest rates – which were in part related to decreases in inflation rates over the sample period - may have led to longer term financing for this group. The EMU and crisis dummies are not statistically significant in this specification, while net financing needs turned out to be statistically insignificant for all three specifications.

We believe that in actual practice, debt managers focus more on market interest rates (i.e. nominal interest rates) instead of real rates. Nevertheless, by separating the nominal interest rate into a real interest rate and inflation component, we enrich the amount of explanatory variables so that we can gain additional insights. In column (1) of Table 2, the effect of inflation becomes highly statistically significant with the expected sign as higher inflation increases the share of short term financing. On the other hand, the real yield curve and the level of real long term interest rate turned out to be statistically insignificant[11]. Results in column (2) indicate that for countries with a relatively stable inflation, the share of short term financing is partly determined by the yield curve. This coincides with the effect to the short term interest rates (of opposite sign) according to equation (1). Column (3) indicates that for this group of countries (i.e. ES, EL, IT, PT, BE) inflation developments may have been a driving factor, given that the real long term interest rate is not statistically significant while inflation is highly significant with the expected positive sign. In comparison with table (1), our market volatility variable is now highly significant and shifts the debt manager towards less short term financing. Also the EMU and the crisis dummy are in this model highly

[11] Because the level of real long term interest rate was insignificant in all three specifications, we did not include this variable in Table 2.

significant. In this group of countries, EMU coincided with a decrease in the share of short term financing, which contrasts with the increase in the other group.

Table 2. Estimations of debt management behaviour, including inflation

	All countries (1)	DE, FI, FR, NL, IR, AT (2)	ES, EL, IT, PT, BE (3)
Real yield curve		3.22 (0.92)***	
Inflation	1.10 (0.38)***		2.39 (0.43)***
D(Stock market volatility)		0.30 (0.17)*	-0.32 (0.11)***
Total outstanding amounts / GDP, lagged		-0.38 (0.13)***	
Total net issues / GDP			-0.33 (0.17)**
Lagged dependent variable	0.72 (0.030)***	0.38 (0.11)***	0.58 (0.054)***
Constant	6.7 (1.32)***	19.8 (4.01)***	14.6 (3.71)***
EMU dummy		10.5 (1.94)***	-4.7 (2.26)**
Crisis dummy	4.2 (0.64)***	7.9 (1.79)***	6.1 (2.29)***
Euro dummy	-3.3 (0.93)***	-6.6 (2.89)**	-2.8 (1.09)**
Estimation method	2S-EGLS[a]	2S-EGLS[a]	2S-EGLS[a]
Fixed effects	Yes	Yes	Yes
GLS weights	Cross-section	Cross-section	Cross-section
Adjusted R^2	0.90	0.85	0.92
Sample period	1991-2009	1991-2009	1991-2009
N	195	105	90

Notes: [a]The estimation method is two-stage estimated generalized least squares with cross-section weights. Heteroskedasticity and serial correlation consistent standard errors are in brackets below the point estimates, * = significance at the 10% level, ** = significance at the 5% level, *** = significance at the 1% level. The instruments for the real yield curve and the real long and short term interest rates are the lagged real long rates and short rates until the second lag. Further, N = number of observations. D stands for the first difference.

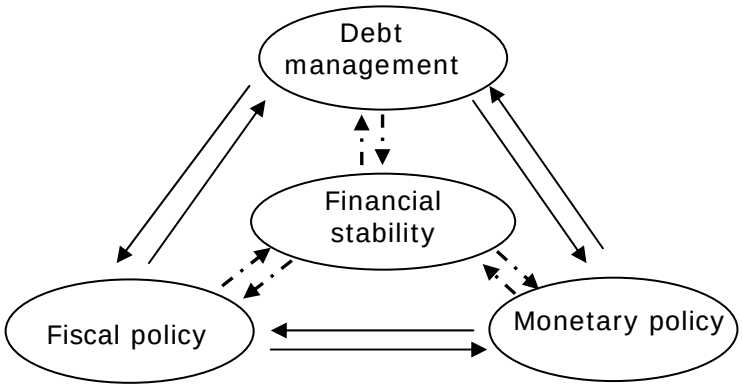
Overall, we conclude that we can explain the financing behaviour of debt managers relatively well with a few key variables: the yield curve, inflation, market volatility, outstanding amounts, persistence, and EMU, euro conversion and crisis dummies. To our knowledge, we are the first to describe the behaviour of debt managers in this manner. When comparing financing behaviour in the two groups of countries, it appears that the countries with higher creditworthiness (i.e. column 2) are more active in exploiting opportunities created by a steep yield curve. A possible explanation is that higher creditworthiness allows them to do so without causing adverse market reactions, while issuance behaviour in the other group of

countries is necessarily more cautious. As mentioned earlier, an important caveat is that while the issuance policy is highly visible to the market, this is not the case for the subsequent effect of derivatives on risk profiles. Increased transparency would allow further research on the effects of risk management beyond issuance policies.

4. Spill-overs from public debt management to the macroeconomic framework

Until recently, discussions concerning the coordination of macro policies were often confined to interactions between public debt management and monetary- and fiscal policies. Here, we add an explicit link between the former and financial stability by expanding the framework by Togo (2007) (see Figure 2). This section discusses the spill-overs from public debt management to financial stability and monetary policy.

Figure 2: Linkages between public debt management and the macroeconomic framework



4.1. Spill-overs from public debt management to financial stability

As Wheeler (2004) states, "*a government's debt portfolio is usually the largest financial portfolio in the country. It often contains complex exposures that create substantial risks for the government and the country's financial stability, particularly where large amounts of foreign currency debt and short-term debt are involved*."

High debt[12] and contingent liabilities[13] are important sources of sovereign risk. At the same time, debt financing policies play a role in the *transmission* of sovereign risk, but may also become a *source* of instability on their own in case financing structures become very risky.

[12] In the euro area, the debt ratio has risen from 69% of GDP in 2008 to 85% of GDP in 2010, and is expected to increase further to 89% of GDP in 2011 (source: European Commission, 2010 Spring Forecasts).
[13] According to the European Commission (2010, p 24), contingent liabilities related to government interventions in support of the financial sector amounted to 5½% of GDP in 2008 and 8½% of GDP in 2009 in the euro area.

With increasing shares of short term debt (in total), refinancing and rollover risks increase as well, which might trigger systemic risks as a result. In the following, we summarize channels through which sovereign risk is transmitted to financial markets both within and across countries. In practice, all channels at are work simultaneously.

Government securities markets transmit sovereign risks to the holders of government debt. In the euro area, monetary and other financial institutions hold roughly three quarters of sovereign debt held by residents. Accordingly, valuation changes of government securities can quickly spread to the balance sheets of financial institutions. In theory, when investors hold long term bonds to maturity, the effect of valuation changes will be limited in the short term. With a stable investor base, investors are less likely to pull out so that price effects are likely to be smaller. As a result, governments have more time to address the underlying fiscal problems. In practice, however, banks hold only very small portions of government bonds in their portfolios to maturity.[14] The opposite effects play with valuation at market value, more short term debt and a less stable investor base. In this case, the balance sheets of financial institutions will be more affected, refinancing will be higher, and investors will pull out more quickly. Moreover, increases in interest spreads will feed back quicker into government fiscal positions.[15] Therefore, a negative debt-deficit spiral and refinancing problems are more likely, which – in turn – amplify contagion of sovereign risk to the financial sector.

Table 3. Foreign ownership of general government debt

	Belgium	Finland	Portugal	Austria	Ireland	Greece	Netherlands	France	Germany	Spain	Italy
1998	20.4	57.4	37.9	36.3	:	29.3	19.5	:	33.8	24.2	26.9
2002	41.2	78.0	53.2	64.4	:	48.2	45.8	50.9	:	43.3	36.3
2003	46.1	81.8	56.6	68.7	:	54.2	49.0	:	:	38.8	39.4
2004	47.8	82.6	56.4	70.4	58.7	53.4	52.9	46.0	42.7	47.3	38.6
2005	48.7	79.6	72.7	70.6	61.5	:	55.9	52.8	45.0	48.1	42.7
2006	49.5	80.1	73.6	75.8	62.2	:	56.9	53.8	45.7	50.7	43.2
2007	54.3	80.8	75.0	80.3	63.1	:	56.9	53.0	48.5	47.1	42.3
2008	56.9	80.2	77.1	76.3	72.7	:	62.4	55.6	49.6	45.9	:

Notes: Data come from Eurostat, except for The Netherlands (CBS). Data for Germany include ex-GDR from 1991.

[14] Under the International Financial Reporting Standards there are three options: valuation at mark-to-market in the trading book, mark-to-market in the banking book (available-for-sale), and valuation at nominal value in the banking book (hold-to-maturity). The conditions for holding bonds in the hold-to-maturity book are strict: nothing can be sold, or otherwise the whole portfolio will no longer be hold-to-maturity. Banks generally hold very small portfolios in the hold-to-maturity book.

[15] With more short term debt, the sensitivity of government interest payments to changes in interest rates is larger. It could therefore be argued that an increase in short term debt facilitates market discipline. Experience however shows that the effects of market discipline often come in a non-linear fashion and rather late. For this reason, we emphasize in the main text the financial stability risks of short term debt.

In the euro area, financial integration due to the single market and the single currency has led to a sharp increase in foreign ownership of government debt (see Table 3). On the one hand, this has broadened the investor base and increased the efficiency of government financing. On the other hand, it also speeded up the transmission of shocks to owners of government debt in other countries, through the same channels as described above. The transmission of risk across borders can be further amplified by correlated price effects across countries. If a sovereign is perceived to be riskier, this will be reflected in increased yields on its debt, driving up its funding costs. Countries that have similar fiscal or economic fundamentals as the "risky" sovereign are likely to be affected more. Indeed, we have witnessed that concerns about Greek fiscal woes were extended shortly not only to balance sheets of Greek banks, but also to perceived risk profiles of Portugal and Spain. Further, sovereign debt markets are used as a pricing basis for other financial products, and often have strong correlations with other asset markets – e.g. (non-financial) corporate bonds and other debt instruments.

We conclude that the impact of debt management on financial stability largely depends on the level of debt, the maturity structure, ownership and its role as a benchmark. By individually and simultaneously increasing calls on the money market, euro area debt managers might have increased risks to financial stability, at a time when the financial sector is more vulnerable to shocks. Increased spillovers across countries have increased the need for co-ordination of debt management practices. Debt managers need to consider broader effects of their financing decisions when issuing debt.

4.2. Spillovers from public debt management to monetary policy

In describing the spill-overs from public debt management to monetary policy, a distinction should be made between the effect of high debt and debt management policies themselves. Obviously, high debt itself is not the responsibility of debt managers. Nevertheless, we include it here for completeness as the level of debt is rather relevant for the way it can be managed and crucial for the link to monetary policy.

The traditional argument is that high debt may lead to political pressure on monetary authorities to inflate away part of the debt. As a result, public perceptions of future inflation may change and exert an upward pressure on nominal interest rates. The empirical relevance of this argument is however questionable, as recent research does not find a link between high debt levels and inflation in advanced economies (Reinhart and Rogoff, 2010). A related

argument is that high debt, especially when financed at short maturities, may lead to political pressure to keep interest rates low.

Another influence of high debt on monetary policy is that market turmoil associated with increased sovereign risk may hamper the monetary transmission, as the Greek case has shown. In the euro area, this has led to the Securities Markets Program through which central banks directly bought government bonds in market segments that were dysfunctional.[16] A potential disruption of the monetary policy transmission mechanism also followed from the downgrades of Greek bonds. This would have hampered their eligibility as collateral in monetary policy operations, and disrupted monetary transmission. As a result, the Governing Council of the ECB decided to suspend the application of the minimum credit rating of Greek government securities, in light of the agreement on the Greek adjustment program. Thus, from the perspective of monetary policy, these arguments reinforce the need for credible consolidation and sustained fiscal discipline.[17]

Public debt management, on the other hand, might have implications for monetary policy through its effects on monetary policy operations. The ECB implements its monetary stance by steering the EONIA (the inter-bank overnight interest rate). Movements in the EONIA transmit to all interest rates in the whole sale money market as measured by the EURIBOR. With higher short term debt issuance, governments become larger players in the money market. Their influence on interest rates might then increase and complicate the steering of interest rates by monetary authorities. Such an effect may be larger if several debt offices – who individually may be relatively small players – tap the money market simultaneously without considering the joint effect of their actions. The relevance of this effect in practice is an empirical issue that could be addressed in future research.

Debt management policies can also affect long term interest rates. Under normal market circumstances, such effects are believed to be generally small. This applies especially to issuance, as most debt managers aim at predictability in the capital market. However, in case of increased sovereign risk and refinancing needs, market functioning may be less smooth, and debt management can have stronger effects on the yield curve and monetary conditions.

[16] Injected liquidity was however re-absorbed so that the monetary policy stance was not affected.
[17] Reducing debt ratios is also needed to build buffers for responding to new shocks and given that high debt levels (i.e. above 90% of GDP in their approach) are associated with lower real economic growth (Reinhart and Rogoff, 2010).

More generally, interaction between debt management and monetary policy has also increased at the long end of the market given that central banks have bought government bonds in the secondary market as part of their unconventional monetary policies. As with interactions at the short end of the market this calls for increased information exchange between debt managers and monetary authorities. In this context, Goodhart (2010, p. 26) argues that debt management is again becoming a critical element in the overall conduct of macro economic policy. In his view, central banks should be encouraged to revert to their role of managing the national debt.

Finally, public debt management might interact with monetary policy through its impact on monetary aggregates. The broad money stock in the euro area (i.e. M3) is defined by the short term liabilities on the consolidated balance sheet of the money creating sector (see Table 4).

Table 4. Consolidated balance sheet of euro area MFI's

Assets	Liabilities
Counterparts of M3:	**Components of M3:**
Credit to general government	Currency in circulation
o.w. loans	Overnight deposits
o.w. securities	Deposits with agreed maturity up to 2 years
Credit to other euro are residents	Deposits redeemable at notice up to 3 months
o.w. loans	Repurchase agreements
o.w. securities other than shares	Money market fund shares
o.w. shares and other equities	Debt securities issued by MFI's with a maturity up to 2 years
Het external assets	**Counterparts of M3:**
	Holdings against central government
	Longer term liabilities against other euro area residents

The money creating sector consists of Monetary Financial Institutions (MFI's) resident in the euro area. In this framework, short term refers to deposits and securities issued by MFI's with a maturity of up to two years. The counterparts of M3 make up the rest of the consolidated balance sheet of MFI's (e.g. long term liabilities and all assets on the balance sheet). It follows from the consolidated balance sheet that, ceteris paribus, any credit lent to the government with any maturity contributes to an increase in M3. However, actual growth of M3 depends on the net result of all the changes in balance sheet assets and changes in the maturity of funding in a given period. In practice, the contribution of the government to M3 growth has been relatively small since the introduction of the euro. However, the contribution increased with increasing debt levels and has never been as strong as in 2009 and 2010. This also calls for information exchange between monetary policy makers and debt managers.

5. Summary and policy implications

The increase in debt levels in the euro area has coincided with increases in both the level and the share of short term debt since 2007. This, in turn, has strengthened the inter-linkages of debt management with financial stability and monetary policy. Spill-over effects across borders have also increased strongly during the past decade due to capital market integration and increased cross border ownership of public debt.

As a response to market turmoil in government debt markets, several countries have stepped up fiscal consolidation, the EU fiscal rules are being revised, and a temporary crisis mechanism was established (i.e. the *European Financial Stability Facility*). As discussed in the previous section, unsustainable policies are at the root of the problem. Credible fiscal consolidation will therefore be a first necessary step towards decreasing the effects of debt management on macro policies. In addition, we believe that policy attention is needed for debt management policies themselves. On 2 July 2010, the IMF forum on debt management concluded that the combination of high debt and market volatility calls for a stronger focus on risk management and for enhanced communication between debt managers, fiscal authorities and central banks.[18] We agree.

We see a need for a greater focus on the effective risk profiles of public debt portfolios. Our proposals should be seen as a first contribution to the ongoing discussion, and would need to be specified further at a later stage. As is currently the case already in central banks' reserve management, broader macroeconomic effects could be a reason to override consideration of costs and risks only. Explicitly adopting a longer time horizon for the minimization of debt servicing costs in debt managers' mandates can also help to strengthen the focus on risks (for countries which have not yet done so). In addition, attention could focus more strongly on the translation of debt management mandates to actual policies. Caps on the level of short term debt or refinancing amounts are being used among national debt managers (Wolswijk and De Haan, 2005). The current situation calls for an international discussion on harmonised caps on short term debt and/or refinancing amounts for countries with high debt. Likewise, a discussion could take place on the use of derivatives in debt management. Swaps can be useful in strategically managing sovereign debt. However, large positions in derivatives complicate the risk profile of the debt portfolio and take away the transparency. In order to

[18] See https://www.imf.org/external/np/sec/pr/2010/pr10275.htm.

prevent this, limits to the use of swaps (for example, a limit to outstanding swap positions, exposure to currency swaps and/or a single counterparty etc.) can be introduced in countries where they are not in place.

When collecting data for the empirical part of this paper, we were struck by the fact that no cross country data were available on the use of swaps and the resulting maturity structures. In our view, national debt managers should co-operate to improve data availability and comparability across countries. Doing so would also assist the European Commission in including debt management as part of fiscal surveillance in the context of the EU fiscal framework. Moreover, aligning and pooling information would facilitate the exchange of information between debt managers in the euro area and the European Systemic Risk Board on financial stability and the ECB on monetary policies.

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ANNEX 1. Data sources, definitions and terminology

1.1 Data sources

Data were obtained from the following sources:

Stocks and flows of central government financing: ECB-Statistical Data Warehouse (securities issues other than shares, gross issues, net issues and outstanding amounts in millions of euro).

Short term interest rates: Ameco database, European Commission.

Long term interest rates: Ameco database, European Commission.

Inflation: HICP, or if not available in the past CPI, Ameco database, European Commission.

GDP: Gross domestic product at current market prices (millions of euro), Ameco database, European Commission.

1.2 Definitions and terminology

This paper focuses on money market versus capital market financing. Statistics on debt securities issues are broken down into short term securities and long term securities. In accordance with the European System of Accounts (ESA 95), short term securities generally have an original maturity of one year or less (in exceptional cases two years or less), even if they are issued under longer term facilities. All other issues, including those with optional or indefinite maturity dates, are classified as long term.

For short term issuance we can look either at short term gross issues (*STGI*) or short term outstanding amounts at year end (*STOA*). *STGI* contains all short term loans that are issued during the year, also those that expire within the same year. As a result, it also contains intra-year short term financing so that *STGI* is often much larger than *STOA*. *STOA* cancels out intra-year financing. It represents refinancing of last years' net money market financing plus net money market (new) issuance.

We are interested in short term financing relative to capital market financing. Hence, our dependent variable in the regressions is *STOA* as a percentage of total issues (*TI*). Total issues are the sum of money market financing (*STOA*) and capital market financing. Capital market financing is measured by long term gross issues (*LTGI*). It is the sum of capital market refinancing and net (new) issues in the capital market. Overall, we look at the yearly *flows* of money market financing and capital market financing. In addition, our dataset also contains data on the outstanding *stocks* of money market financing and capital market financing.

ANNEX 2. Estimated equation, diagnostics and robustness checks

2.1 The estimated equation

In the paper, we estimate the following debt management reaction function for the euro area:

$$\frac{STOA_{i,t}}{TI_{i,t}} = \alpha_1 Yield_{i,t} + \alpha_2 LR_{i,t} + \alpha_3 D(V)_t + \alpha_4 Liq_{i,t-1} + \alpha_5 (Debt/Y)_{i,t-1} + \alpha_6 (TNI/Y)_{i,t}$$
$$+ \alpha_7 \frac{STOA_{i,t-1}}{TI_{i,t-1}} + \alpha_8 EMU_t + \alpha_9 CRISIS_t + \alpha_{10} EURO + C + C_i + \varepsilon_{i,t}$$

As shown in formula (1) in the main text, this is equal to:

$$\frac{STOA_{i,t}}{TI_{i,t}} = (\alpha_1 + \alpha_2) LR - \alpha_1 SR + \alpha_2 LR_{i,t} + \alpha_3 D(V)_t + \alpha_4 Liq_{i,t-1} + \alpha_5 (Debt/Y)_{i,t-1} + \alpha_6 (TNI/Y)_{i,t}$$
$$+ \alpha_7 \frac{STOA_{i,t-1}}{TI_{i,t-1}} + \alpha_8 EMU_t + \alpha_9 CRISIS_t + \alpha_{10} EURO + C + C_i + \varepsilon_{i,t}$$

Where:

- Subscript *i* stands for country and *t* for year.
- *STOA* stands for short term outstanding amounts at year end (i.e. total money market issuance excluding intra-year financing).
- *TI* stands for total issues. By definition, *TI=STOA+LTGI*, where *LTGI* is long term gross issues or the gross yearly flow of debt issuance in the capital market.
- *Yield* stands for yield curve, defined as (*LR-SR*), where *LR* is the long term interest rate (10 year) and *SR* is the short term interest rate (3 months). We treat all interest rate variables as endogenous and instrument them since debt financing might affect interest rates.
- *V* stands for volatility in the market, which is a common factor as it does not vary across countries. It is measured as yearly averages of 65-days rolling standard deviations of daily differences in the euro area stock market price index (source: Datastream).
- *Liq* stands for liquidity either in the money market or the capital market. It is measured as the relative size of the money- or the capital market of country *i* (i.e. outstanding amounts of country *i* debt) relative to the respective euro area debt market (i.e. outstanding amounts of euro area debt).
- (*DEBT/Y*) stands for the stock of outstanding total marketable debt as a percentage of *GDP*.
- (*TNI/Y*) stands for total yearly net issues as a percentage of *GDP*. Note that we use *TNI* instead of total gross issues (*TGI*). *TGI* includes redemptions and is therefore strongly correlated with the lagged dependent variable in the regression. Note also that *TGI* is

endogenous, as higher past short term financing increases redemptions and thereby *TGI* (reverse causality).

- The lagged dependent variable contains the effect of refinancing of past years' outstanding money market volume.
- In addition to country fixed effects, we include separate dummies for the EMU period (1999-2009) , the crisis period (2008-2009) and the euro conversion period (1999-2000).[19]
- The dummy for the conversion to the euro intends to capture the conversion period during which debt managers were buying back bonds in their own currency and issuing bonds in euros in return. The coefficient for this dummy is expected to be negative.
- *C* is a constant. The coefficient is expected to be between 0 and 100 per cent (note that the individual country fixed effects sum up to zero by definition).
- Moreover, as an alternative specification in Table 2 we add inflation and include real nterest rates instead of nominal interest rates.

2.2 Diagnostics

Time series properties

The presence of a unit root characterises a non-stationary data generating processes that produces varying sample properties (i.e. mean, variance-covariance) and an infinitely long memory. However, such a non-stationary time series is not very plausible for our dependent variable since it is bounded between 1 and 100 per cent. Moreover, as time passes, the debt manager will rely less on his previous funding decisions regarding short term debt. Overall, for most of our series we reject the null hypothesis of a common or individual unit root. For the degree of market volatility, we clearly cannot reject the null hypothesis of a unit root. We include, therefore, the first difference of this variable in our regression. Moreover, the results of unit root tests are mixed for the stock of outstanding total marketable debt as a percentage of *GDP*. The literature on fiscal reaction functions shows that a positive response of the primary balance is sufficient for debt to be on a sustainable path (Bohn, 1998). Given that results for euro area countries generally find such a positive response, we also include debt as a percentage of GDP directly in the equation. This is in line with standard practice in the literature on fiscal reaction functions.

[19] At the time of conversion, debt managers were buying back bonds in their own currency and issuing bonds in euros in return. The coefficient for the euro conversion dummy is therefore expected to be negative.

Heteroskedasticity

An issue frequently encountered in panel data models is that the variance of the error term differs across sections. Tests for heteroscedasticity of the reported regressions indeed rejected the null hypothesis of no heteroscedasticity. This implies that we can increase the efficiency of our regressions by using Estimated Generalized Least Squares (EGLS) and cross section weights. This estimation method gives a lower weight to observations with a higher variance. In addition, we instrumented the yield curve and included fixed effects.

Endogeneity

As already mentioned, the share of short term debt issuance may influence interest rates. Since we are only interested in the one-way influence from the regressors on the short term financing, we use instrumental variables to incorporate this single link. Since interest rates are highly persistent, we approximate the endogenous interest rates by a linear combination of their (exogenous) lags. The Sargan null hypothesis on the validity of instruments can not be rejected for any of the models. Besides valid specification, the estimation results prove to remain robust to adjustments in instrumental variables.

2.3 Robustness checks

This section investigates the robustness of the estimation results in Section 3 to different estimation techniques. As it is well known, least squares estimates of dynamic panels are biased due to correlation between errors and regressors. In column (2) of Tables 5 and 6 we therefore use the correction proposed by Bruno (2005) for the two groups of countries (i.e. Least Squares Dummy Variables Corrected, or LSDVC). This method can only be used with exogenous variables. We therefore include the lagged interest rate, instead of instrumenting it. Comparison of results in column (2) with column (1) in Tables 5 and 6, which contain the same regression but without correction (i.e. Least Squares Dummy Variables, or LSDV), shows that the bias from making the model dynamic is very small.

Another issue frequently encountered in panel data models is that the variance of the error term differs across sections. In the main text (Tables 1 and 2), we therefore increased the efficiency of estimations by using Estimated Generalized Least Squares with cross section weights (2S-EGLS). In column (3) of Table 5 and column (1) of Table 6, we show the same regression, but this time without using these weights (i.e. Two-stage least squares,

Table 5. Robustness of results across estimation methods (DE, FI, FR, NL, IR, AT)

	(1) LSDV	(2) LSDVC	(3) 2SLS	(4) 2S - EGLS
Constant	17.1	n.a.	20.74	19.8
	(5.26)***		(5.51)***	(4.01)***
Real yield curve			2.77	3.22
			(1.15)**	(0.92)***
Real long term interest rate				
Real yield curve, lagged	1.08	1.28		
	(0.82)	(0.44)***		
Total outstanding amounts / GDP, lagged	-0.25	-0.21	-0.40	-0.38
	(0.14)*	(0.056)***	(0.16)***	(0.13)***
D(Stock market volatility)	0.28	0.32	0.55	0.30
	(0.13)**	(0.099)***	(0.18)***	(0.17)*
Lagged dependent variable	0.48	0.52	0.43	0.38
	(0.13)***	(0.059)***	(0.13)***	(0.11)***
EMU dummy	6.7	8.8	8.9	10.5
	(2.44)***	(1.42)***	(2.53)***	(1.94)***
Crisis dummy	9.0	9.4	5.1	7.9
	(2.96)***	(2.13)***	(2.60)*	(1.79)***
Euro dummy	-3.8	-4.7	-4.8	-6.6
	(2.90)	(1.46)***	(2.89)*	(2.89)**
Fixed effects	Yes	Yes	Yes	Yes
Standard errors	Robust	Bootsrapped	Robust	Robust
GLS weights	No	No	No	Cross-section
Adjusted R2	0.76	n.a.	0.76	0.85
Sample period	1991-2009	1991-2009	1991-2009	1991-2009
N	105	105	105	105

Notes: * = significance at the 10% level, ** = significance at the 5% level, *** = significance at the 1% level. The instruments for the real yield curve and the real long term and real short term interest rates are the lagged long and short rates (until the second lag). D stands for the first difference.

or 2SLS).[20] A comparison with the last column in Tables 5 and 6, which reproduce our baseline regression from Table 1, shows that this has some effect on some of the coefficients, even if overall results are still rather similar. The adjusted R-squares values however indicate that the fit is better with 2S-EGLS, which explains why we immediately used this estimation method in the main text. Overall, we conclude that different estimation techniques produce relatively small differences in results and that our preferred estimation technique is 2S-EGLS.

[20] For Table 6 the LSDV and 2SLS regressions are similar, since interest rates are not statistically significant and hence these variables do not need to be lagged or no instrumental variables are used.

Table 6. Robustness of results across estimation methods (ES, IL, IT, PT, BE)

	(1) LSDV	(2) LSDVC	(4) 2S - EGLS
Constant	14.6 (6.09)**	n.a.	14.6 (3.71)***
Inflation	1.54 (0.49)***	1.55 (0.33)***	2.39 (0.43)***
D(Stock market volatility)	-0.48 (0.15)***	-0.48 (0.094)***	-0.32 (0.11)***
Total net issues / GDP	-0.35 -0.21	-0.35 (0.14)**	-0.33 (0.17)**
Lagged dependent variable	0.62 (0.088)***	0.62 (0.057)***	0.58 (0.054)***
EMU dummy	-2.9 (3.40)	-3.0 (1.65)*	-4.7 (2.26)**
Crisis dummy	8.2 (3.80)**	8.1 (2.07)***	6.1 (2.29)***
Euro dummy	-5.5 (2.04)***	-5.5 (1.32)***	-2.8 (1.09)**
Fixed effects	Yes	Yes	Yes
Standard errors	Robust	Bootsrapped	Robust
GLS weights	No	No	Cross-section
Adjusted R^2	0.83	n.a.	0.90
Sample period	1991-2009	1991-2009	1991-2009
N	90	90	90

Notes: * = significance at the 10% level, ** = significance at the 5% level, *** = significance at the 1% level. The instruments for the real yield curve and the real long term and real short term interest rates are the lagged long and short rates (until the second lag). D stands for the first difference.

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