

# **Government Debt Issuance in the Euro Area: The Impact of the Financial Crisis**

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## **Abstract**

This paper documents and analyzes crisis-related changes in government debt issuance practices in the euro zone countries and Denmark. Using a newly constructed database on primary market debt issuance during 2007–11, we find evidence of a shift away from pre-crisis standards of best funding practices—competitive auctions of debt instruments with a fixed coupon, long maturity and local currency denomination (DLTF). Exploiting the cross-country panel data dimension of the data, we conclude that the crisis as such and changes in the macroeconomic environment and investor sentiment can account for a significant proportion of the deviation. The negative effect of the crisis on DLTF debt issuance was especially pronounced in high debt euro area countries, and has forced governments to assume additional risk.

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## I. INTRODUCTION

**The global financial crisis has had a major impact on government debt issuance practices in the euro zone countries and Denmark.** These practices had broadly converged to a common standard prior to the crisis: placement via competitive auctions of long-term, fixed rate debt denominated in national currency. The standard was intended to achieve low borrowing costs while minimizing rollover and currency risks. However, in tandem with the unfolding global financial crisis, starting in mid-2008, the increase in sovereign funding needs and sharp reduction in investor risk appetite have forced sovereigns in the euro zone to move away from the previous standard and, as risk premiums have risen, so has the risk borne by the sovereign borrower.

**While the pressures and direction of change have been similar across countries, their impact has varied considerably.** The differentiation is in part related to the size of gross financing needs before the crisis. Countries such as Ireland which had a budget surplus and small government debt prior to the crisis were confronted with a surge in gross funding needs from low pre-crisis levels, and they had to re-introduce issuance procedures and instruments to meet these needs. Other countries, Belgium and Italy for instance, entered the crisis with a deficit and already high debt and hence substantial gross financing needs. In these countries, additional issuance due to the crisis-related widening of the deficit resulted in a relatively small increase in gross financing needs, which could be absorbed through limited adjustments in well-established mechanisms and instruments.

**This paper studies changes in euro zone and Danish issuance practices and their consequences from three perspectives.** First, it explores the determinants of the burgeoning gross debt issuance during the crisis. Next, the paper examines changes in issuance procedures, with a particular focus on the diminishing role of auctions in particular, reflecting challenging market conditions. Finally, it turns to shifts in instrument choice and their implications for the allocation of risks between sovereigns and investors.

**The analysis is based on a newly constructed database.** The dataset includes detailed information on the more than 6,000 debt issuances by central governments in the euro zone and Denmark during 2007–11. It contains data on the issuance and maturity dates, the nature of the instrument, its currency denomination and coupon structure, the placement technique, and the issuance yield and/or price. For the purpose of the paper's econometric analysis, the data are divided into a pre-crisis and a crisis period. The database's panel structure facilitates a focus on cross-country differences.

**The paper complements the expanding literature on euro zone sovereign spreads following the onset of the crisis.** This literature has focused on secondary market and CDS spreads.<sup>2</sup> Our paper focuses on the primary market and is the first systematic study of issuance information to analyze the impact of the crisis on euro zone sovereign issuing procedures and instruments in response to changed market conditions, and the resulting shifts in the allocation of risks between sovereigns and investors.<sup>3</sup> These changes in risk allocation cannot be identified by an analysis of movements in spreads. In future work, we intend to further explore the links between issuances and primary and secondary market spreads.

**The paper first documents the trends in gross government debt issuance and its composition.** Reflecting automatic stabilizers and fiscal stimulus packages, central government deficits in the euro zone widened from 1 percent of GDP in 2007 to 5 percent of GDP in 2009. The sharp increase in deficits and support to the financial sector raised central government debt in the zone (relative to GDP) from 54 percent to 65 percent over the same time span. The surge in deficits and debt was accompanied by shifts towards international/external debt, rising spreads, increased use of syndicates, and a spike in foreign currency denominated issuance. Deficit-to-GDP ratios narrowed in most euro zone countries in 2010–11, but debt-to-GDP ratios generally continued to increase.

**Next, a panel econometric analysis of the factors influencing the level and composition of government debt issuance is carried out.** A dynamic specification with random country effects links the level of issuance to a crisis dummy (defined as 0 during January 2007–June 2008, and 1 during July 2008–December 2011), the debt stock, key macroeconomic variables and a business confidence indicator. To relate the composition of issuance to the same set of explanatory variables, an estimation technique is employed which takes into account that the dependent variable (a share) is bounded between zero and one and that unobserved country heterogeneity may be present. To further explore this heterogeneity, the two sets of regressions were run for different country groupings based on combinations of debt and deficit thresholds: high debt (Belgium, Greece, Italy); high deficit (Belgium, Greece, France, Ireland, Portugal and Spain); and moderate deficit (countries other than the high deficit ones).

**The main results from the econometric analysis for the sample as a whole are broadly in line with theoretical priors.** Notably, the crisis shifted the composition of issuance away from domestic currency, fixed interest rate instruments with long maturity (DLTF debt) toward shorter maturities, a foreign currency denomination, or a floating rate. But,

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<sup>2</sup> For a recent summary of this literature, see Barbosa and Costa (2010).

<sup>3</sup> Biais et al. (2004) is an earlier paper studying the determinants of primary issuance in the euro zone Treasury Bill markets. Hoogduin et al. (2010) use aggregate issuance information from the ECB to estimate a government debt management reaction function for the euro area.

controlling for the crisis effects, lower inflation and higher growth supported the issuance of instruments with long maturity, domestic currency denomination, and a fixed coupon. Stronger investor sentiment was associated with a lower level of issuance (smaller deficits) and facilitated the use of auctions.

**The econometric results for country groupings confirm considerable cross-country heterogeneity.** In particular, in high debt countries, the negative effect of the crisis on the share of DLTF debt is highly significant. In high deficit countries, the debt stock, growth and inflation are significant with the expected sign in explaining the share of DLTF issuance, but the crisis dummy is not. In moderate deficit/moderate debt countries, the crisis dummy is again significant, and investor sentiment and spreads are also significant, but with a sign different from the expected one.

**The paper is organized as follows:** Section II describes the new database and its construction, and presents stylized facts and evidence on shifts in the composition of government debt issuance just before and during the crisis. Section III presents the econometric methodology and estimation results. Section IV concludes and identifies possible fiscal policy implications.

## II. DATABASE AND STYLIZED FACTS

### A. Database

**The government debt issuance data employed in this paper are taken from a newly constructed database.** The database includes information on individual gross debt issuances by the central governments of the 17 euro zone member countries<sup>4</sup> and Denmark (the currency of which is tightly pegged to the euro) during 2007–11.<sup>5</sup> In principle, all issuances on which public information is available are covered, with the exception of commercial paper program transactions and instruments tailored to retail investors. In total, more than 6,000 issuances are included. The database also covers pre-announced but subsequently cancelled auctions. The information is organized by country and, within each country, by the date of the transaction. The database includes information on the issuance and maturity dates of the instrument, its currency denomination and coupon structure, the placement technique, and the issuance yield and/or price. In case auctions are used for the issuance, data on the auction results, such as the share of non-competitive bids and the bid-to-cover ratio, are added.

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<sup>4</sup> One of the 17 member countries, Estonia, did not issue sovereign debt in the period under consideration.

<sup>5</sup> Data on general government components other than central government are not included in view of data availability and cross-country comparability issues.

**The database draws from various sources, the mutual consistency of which was checked:**

- Announcements of debt issuances and their results on the website of national debt agencies/national central banks, and on dedicated web pages of Bloomberg and Reuters.<sup>6</sup>
- Longer series on auction results and syndicated issuances posted on the website of national debt agencies/ national central banks; and longer series on Treasury bill and government bond issuances made available by Bloomberg.
- Information on debt issuances and stocks provided by trading platforms (MTS, domestic stock exchanges).

## **B. Stylized Facts**

### **1. Larger bond issuance**

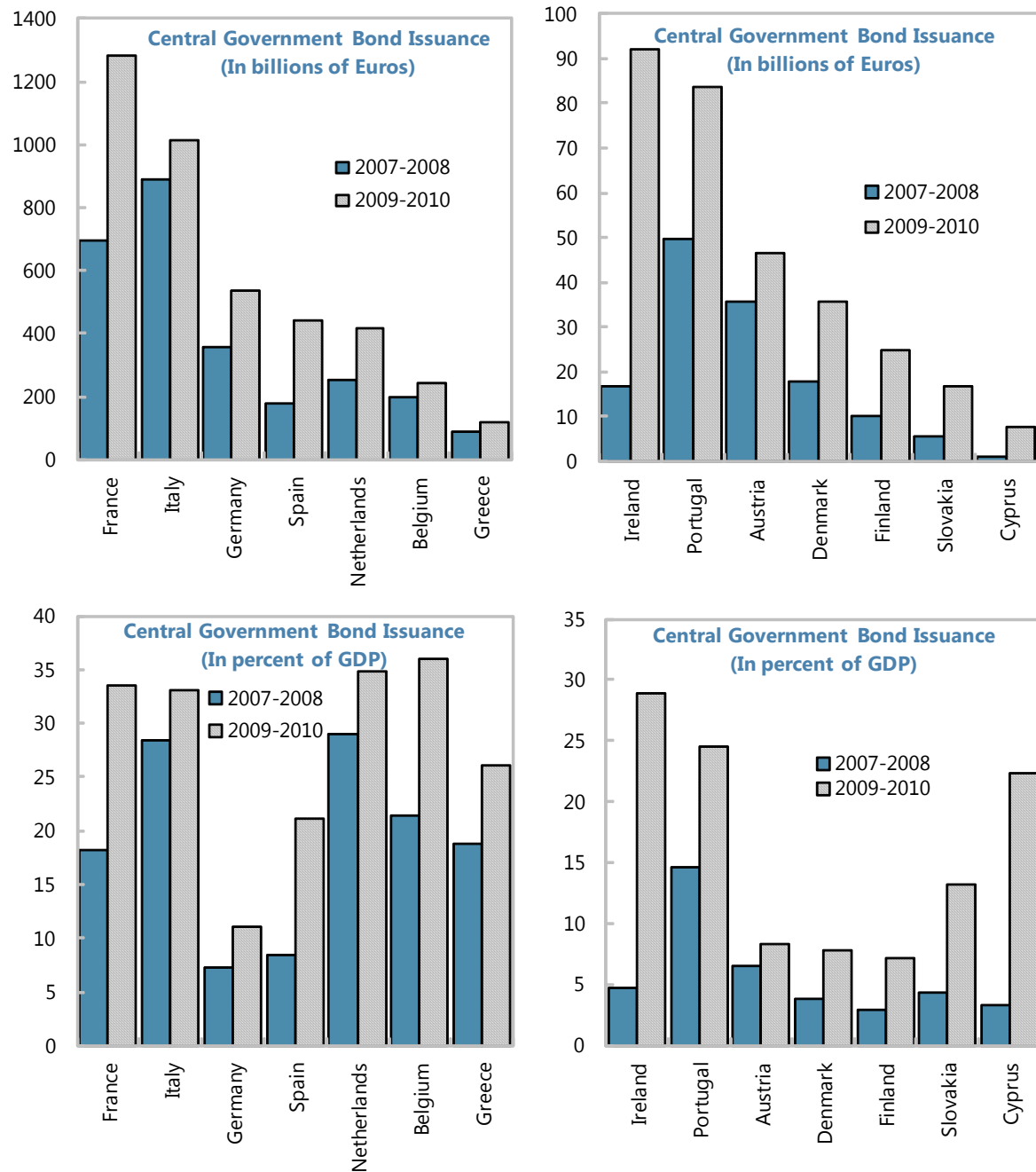
**Gross debt issuance increased in all euro zone countries as the crisis unfolded.** For illustrative purposes only we split the sample into a two-year pre-crisis period (January 2007—December 2008) and a two-year crisis period (January 2009—December 2010)<sup>7</sup>. During the crisis period gross issuance in the euro zone as a share of GDP almost doubled. A large increase was observed in France, Ireland, the Netherlands, and Spain in particular. Among the smaller euro zone countries, Cyprus and Malta stand out. Italy already before the crisis issued a lot of debt, and gross issuance further rose during the crisis.

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<sup>6</sup> Bloomberg and Reuters also provide market comments on important auctions and syndicated issuances.

<sup>7</sup> In the econometric exercise in part III, we also consider the 2011 data and we refine the timing and associate a crisis dummy with all observations after June 2008, as the crisis began significantly to affect government debt issuance in the second half of 2008.

Figure 1. Central Government Gross Bond Issuance 1/

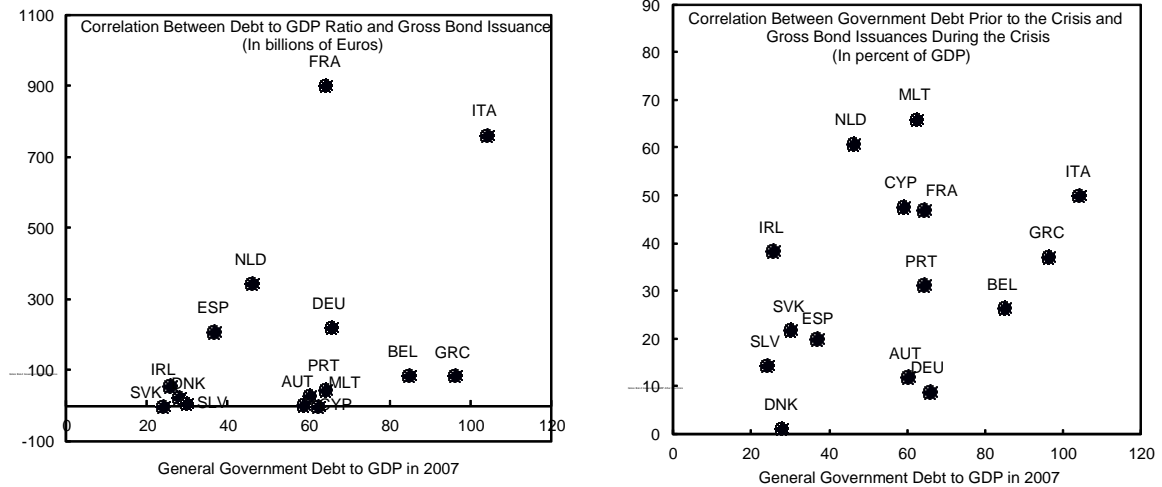


Sources: DeBroeck-Guscina Debt Issuance Database, WEO, and Haver Analytics.

1/For cross-country consistency includes only gross issuances that are captured in the database. We exclude internationally issued TBills and commercial paper, buybacks, taps, IMF loans, cancelled or failed auctions.

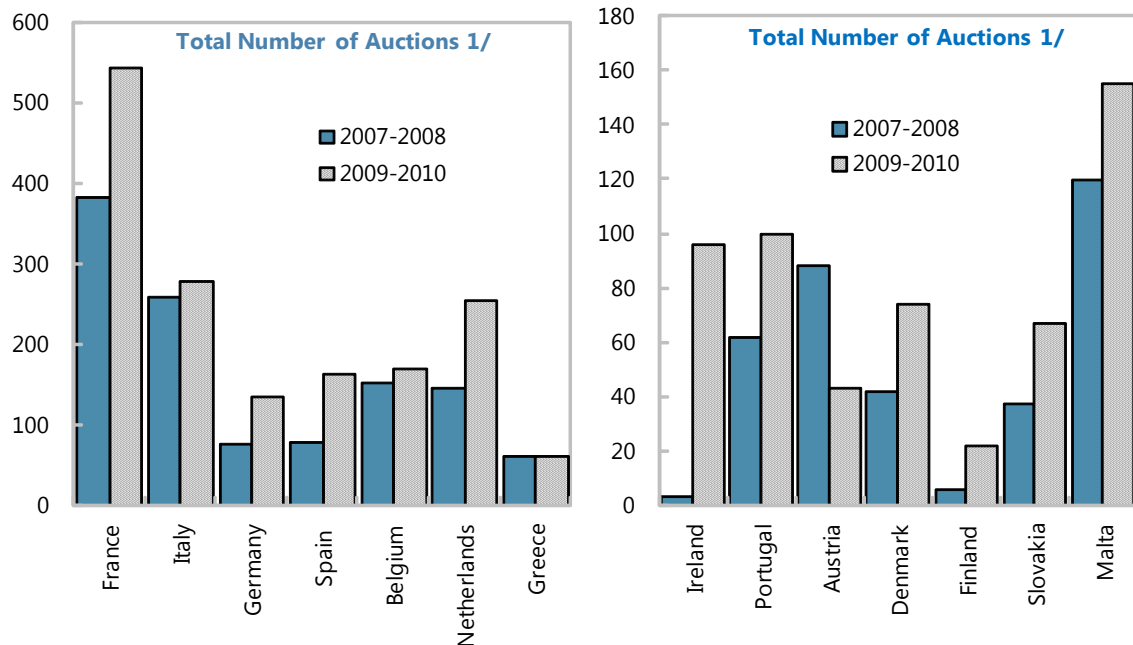
**Different combinations of roll-over and net issuance underlie cross-country differences in gross issuance.** For example, and as indicated in the introduction, in Ireland, the pre-crisis debt was low, and gross issuance during the crisis mainly reflected the sharp widening of the

deficit. In Belgium and Italy, on the other hand, countries with already high debt before the crisis, most of the gross issuance continued to be due to roll-over of maturing debt.



## 2. More Frequent and Larger Auctions

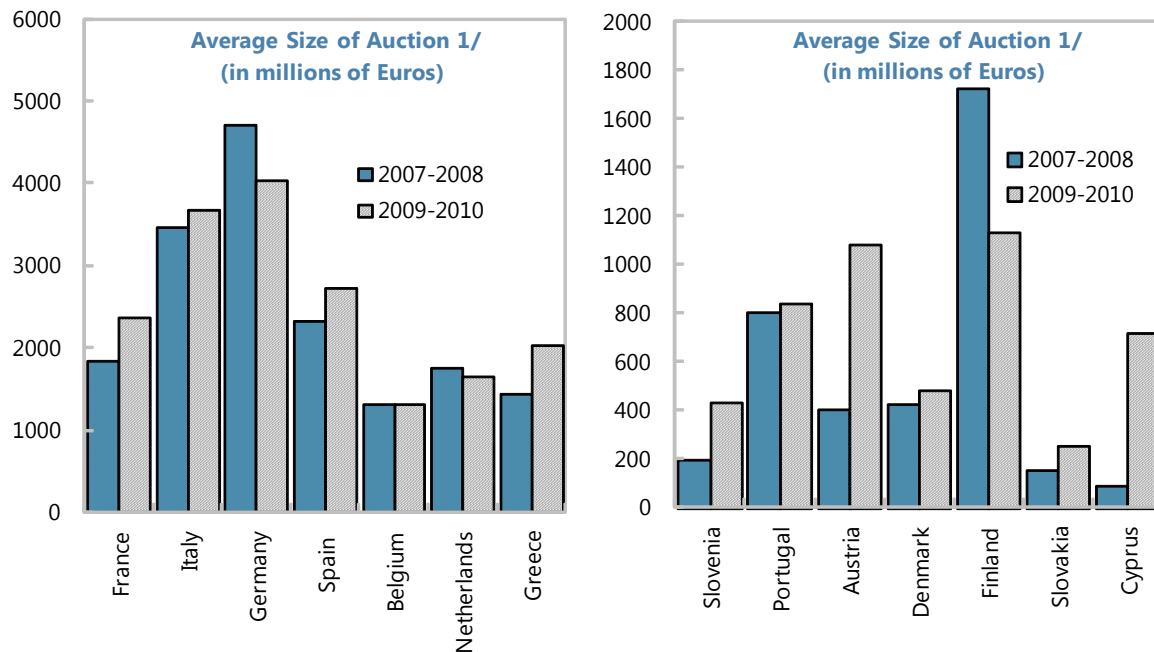
**Additional gross issuance needs were mostly met through an increase in the frequency of auctions.** A comparison of the number of auctions before and during the crisis shows an increase in almost all euro zone countries. The increase was most pronounced in Ireland, France, the Netherlands, and Spain.



Sources: DeBroeck-Guscina Debt Issuance Database, WEO, and Haver Analytics.

1/For cross-country consistency includes only gross issuances that are captured in the database. We exclude internationally issued TBills and commercial paper, buybacks, taps, IMF loans, cancelled or failed auctions.

**In addition to an increase in the frequency of bond auctions, the average size of issuances went up in most euro area countries.** The increase in size is especially noteworthy in Austria, Cyprus, Malta and Slovenia, and also in Greece. But not all the euro zone countries followed this pattern: the average issuance size fell in Finland, Germany, and the Netherlands.



Sources: DeBroeck-Guscina Debt Issuance Database, WEO, and Haver Analytics.

1/For cross-country consistency includes only gross issuances that are captured in the database. We exclude internationally issued TBills and commercial paper, buybacks, taps, IMF loans, cancelled or failed auctions.

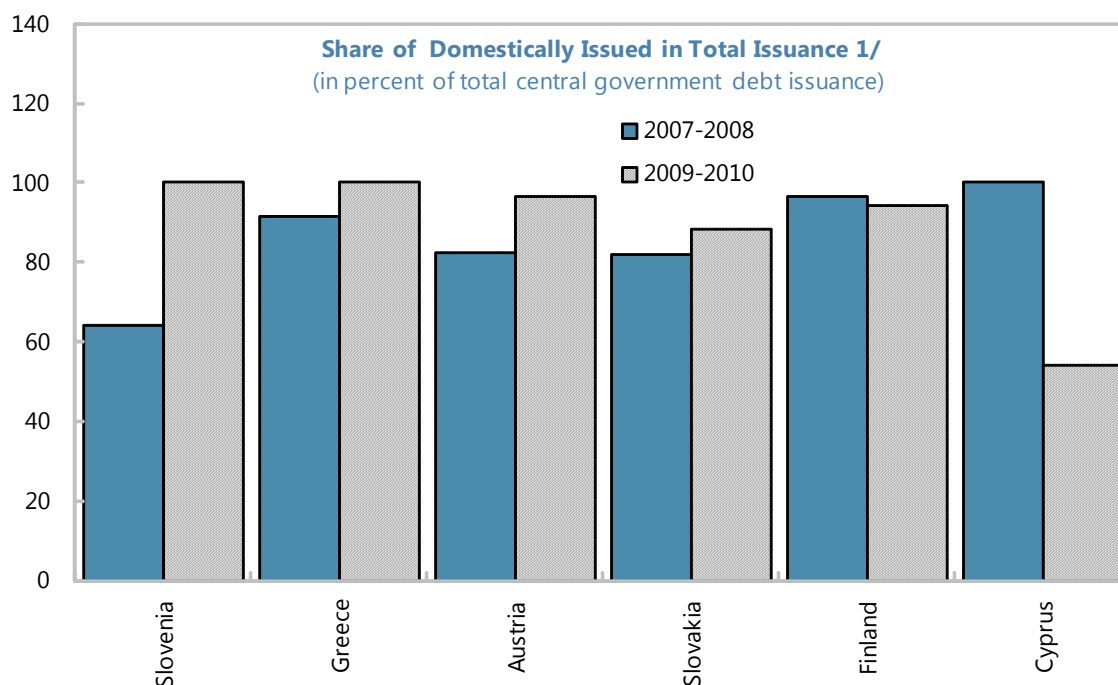
### 3. Spread widening and spread differentiation

**Rising deficits and debt have pushed up and disentangled sovereign primary market spreads.** Spread movements relative to the German Bund since the start of the crisis have reflected increasing concerns over debt sustainability and sovereign risk. Moreover, the spreads increased significantly more in higher risk countries such as Greece and Ireland. Spreads in the primary market generally moved in line with those in the secondary market.

### 4. An evolving role of international placements and syndication

**A number of euro zone countries have shifted issuance to the international market.** For instance, in Austria, more than 95 percent of outstanding debt is domestically issued, but only 60 percent of the new issuances were placed in domestic markets during the crisis period. Such a movement was not observed in other euro zone countries, however. For example, in Slovenia, the share of domestically issued bonds increased during this period.

These shifts reflect, among other factors, the depth of the market for domestically issued debt, and the degree of preference of local investors for domestically issued instruments.

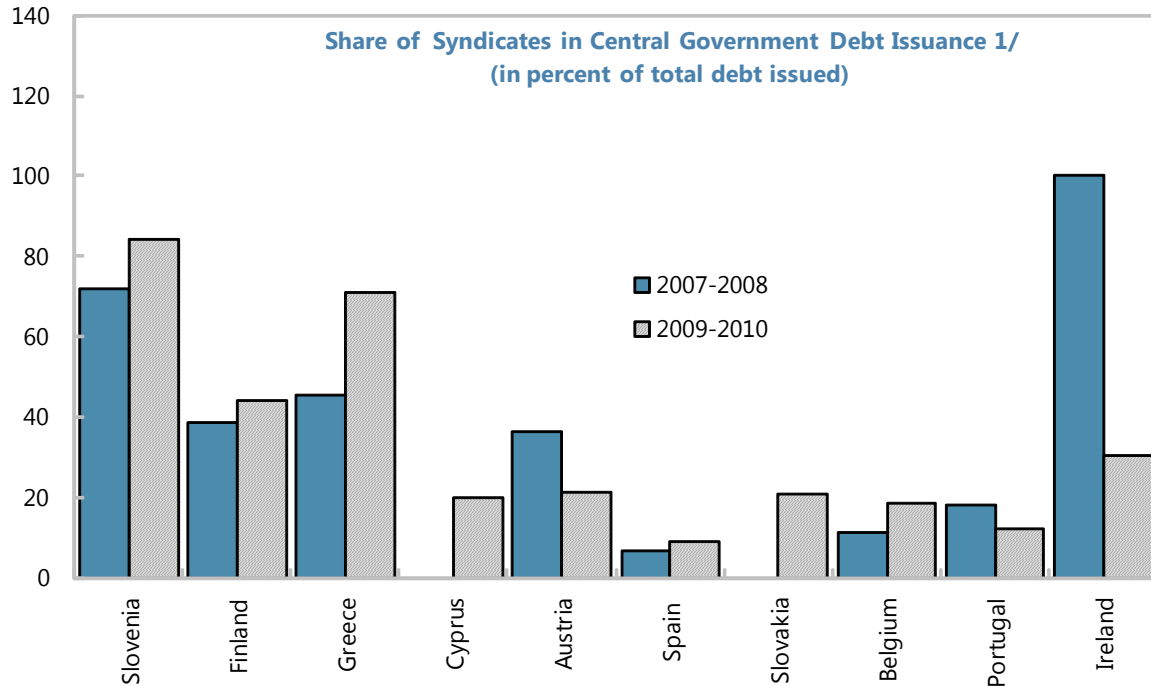


Sources: DeBroeck-Guscina Debt Issuance Database, WEO, and Haver Analytics.

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**The crisis has affected the use of syndication as a selling technique.** Prior to the crisis, a number of countries, Belgium and France for instance, used syndication to introduce a new bond to the market, followed by re-issuances through auctions. In Austria, Finland and Ireland, on the other hand, syndication accounted for most of the issuance in 2007 and 2008. Recourse to syndicates generally increased during the crisis: Cyprus and Slovakia showed the most pronounced increase, and Belgium and France, in a deviation from past practice, used syndication beyond first issuances. However, in some cases, for instance in Austria, Ireland<sup>8</sup>, and Portugal, the share of syndicated issuance was reduced during the crisis.

<sup>8</sup> Ireland issued only three bonds during 2007–08, all of which were placed via syndication.

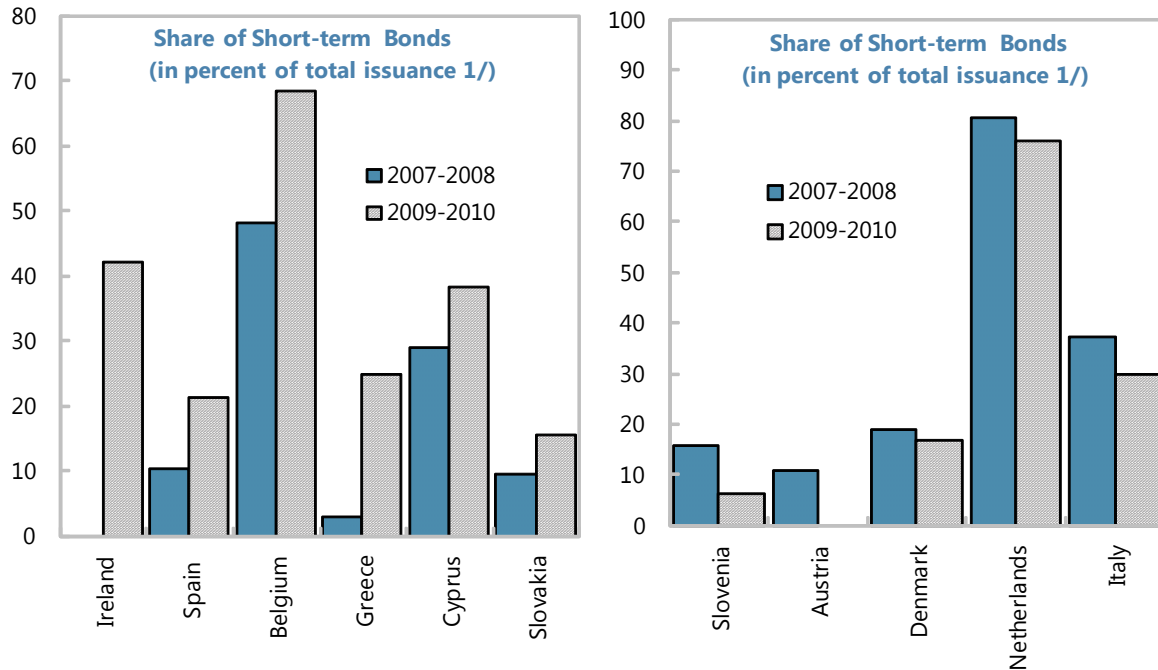


Sources: DeBroeck-Guscina Debt Issuance Database, WEO, and Haver Analytics.

1/For cross-country consistency includes only gross issuances that are captured in the database. We exclude internationally issued TBills and commercial paper, buybacks, taps, IMF loans, cancelled or failed auctions.

## 5. Shorter Maturities

**The maturity of new issuances shortened in a range of euro zone countries.** In some cases, Belgium and the Netherlands, for instance, capital injections in the financial sector in the fall of 2008 were initially financed with issuing and rolling over short-term debt, followed by a gradual switching to longer maturities, with a view to smoothing the impact of the additional debt supply in the long-term market segment. In other countries, very low short-term interest rates, a reflection of major monetary policy easing in the euro zone, motivated the shift to shorter maturities. The increase in short-term debt issuances was especially pronounced in Greece (which hardly issued any Treasury bills prior to the crisis), Ireland, Slovakia, and Spain.

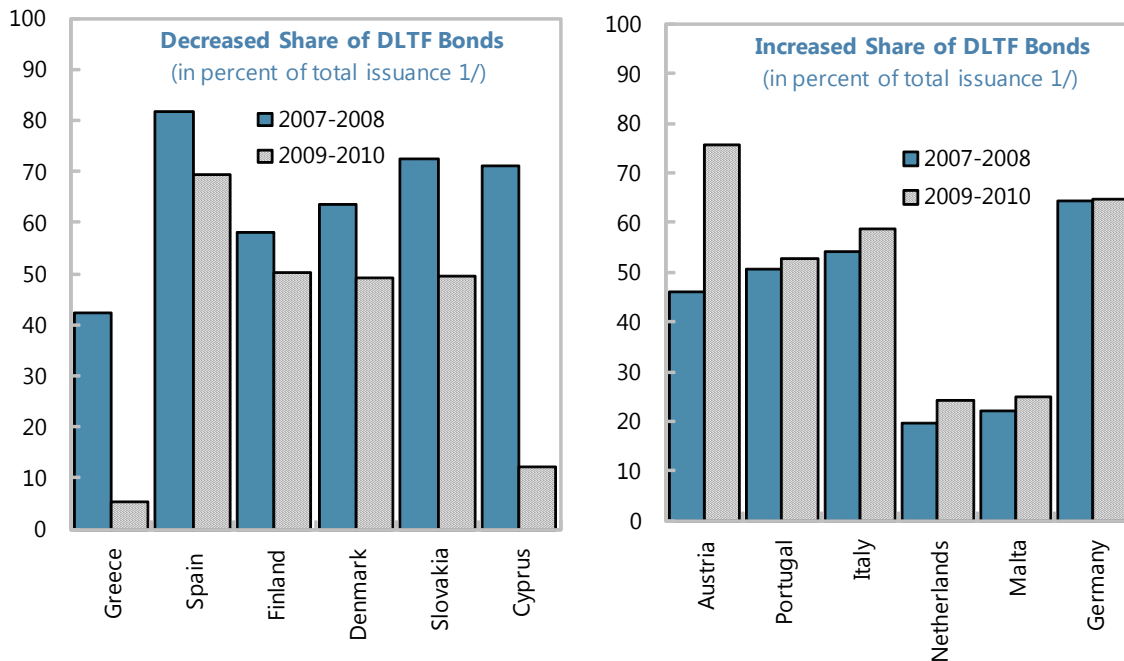


Sources: DeBroeck-Guscina Debt Issuance Database, WEO, and Haver Analytics.

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## 6. Somewhat less local currency fixed interest rate debt

**The crisis has affected the composition of debt issuance by principal and coupon structure.** Prior to the crisis, the most common issuance mode in the euro zone countries was debt denominated in domestic currency, with long maturity and a fixed interest rate. The share of debt with the principal and/or the coupon linked to inflation, a foreign currency or a short-term interest rate was relatively small. In the crisis period, the share of domestic local currency fixed rate debt (DLTF) went down significantly in Cyprus and Greece, and also in Denmark, Slovakia and Spain. It remained relatively stable in Belgium, Germany, and France. A few countries actually increased the share of DLTF issuances—Austria, Italy, the Netherlands and Portugal.



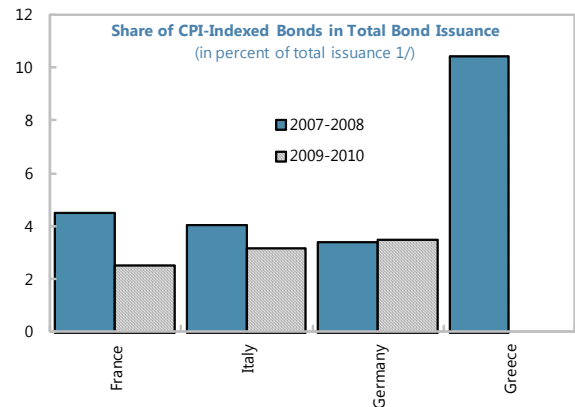
Sources: DeBroeck-Guscina Debt Issuance Database, WEO, and Haver Analytics.

1/For cross-country consistency includes only gross issuances that are captured in the database. We exclude internationally issued TBills and commercial paper, buybacks, taps, IMF loans, cancelled or failed auctions.

## The evolution of the use of alternative principal and coupon formulas was not uniform.

### a. Less CPI-Indexed Debt

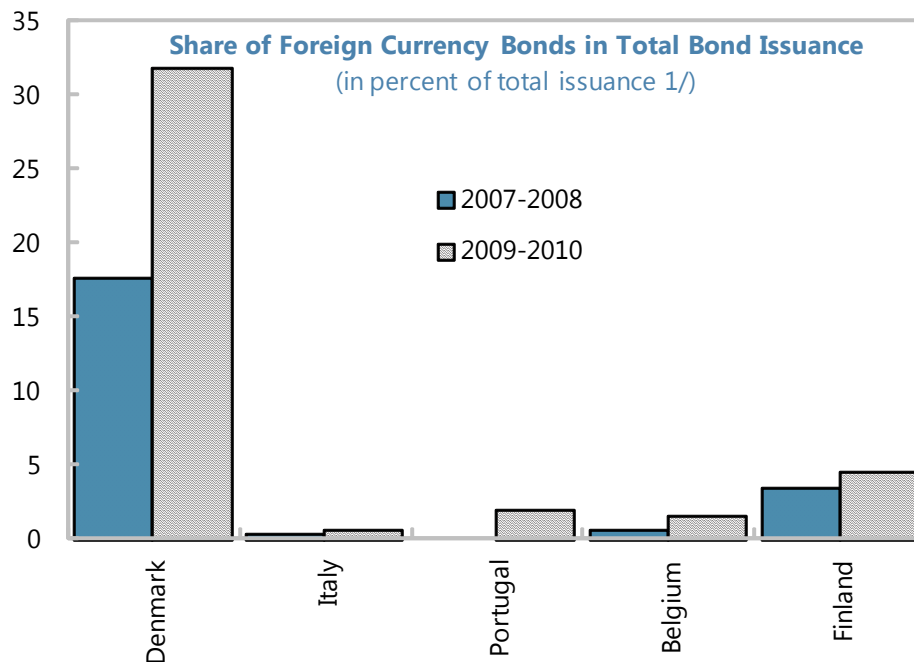
Inflation indexed bonds were not common in the euro area before the crisis. In fact, when the crisis broke, only four member countries still issued debt indexed to some measure of inflation. In the 2009–10 period, France and Italy significantly reduced the share of inflation-indexed bonds, and Greece abandoned the instrument altogether.



Sources: DeBroeck-Guscina Debt Issuance Database, WEO, and Haver Analytics.  
1/For cross-country consistency includes only gross issuances that are captured in the database. We exclude internationally issued TBills and commercial paper, buybacks, taps, IMF loans, cancelled or failed auctions.

## b. More Foreign Currency-Denominated Debt

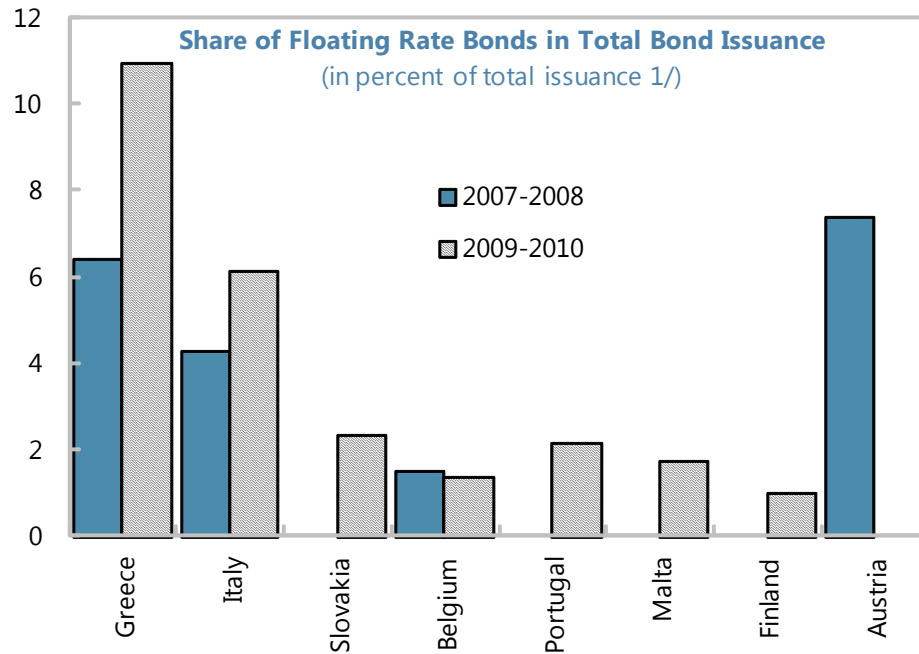
A number of euro zone sovereigns raised the proportion of foreign currency-denominated debt during the crisis period. In particular, they issued US dollar debt in the fall of 2009 to take advantage of the strength of the euro and low US dollar interest rates in that period. The share of foreign currency denominated debt increased especially in Denmark but also in Belgium, Finland, Italy and Portugal. Germany issued US dollar denominated bonds for the first time in decade. Austria, on the other hand, significantly reduced the share of foreign currency denominated bonds, while Greece and also Slovakia, which adopted the euro in the beginning of 2009, abandoned foreign currency issuances altogether.



Sources: DeBroeck-Guscina Debt Issuance Database, WEO, and Haver Analytics.  
 1/For cross-country consistency includes only gross issuances that are captured in the database. We exclude internationally issued TBills and commercial paper, buybacks, taps, IMF loans, cancelled or failed auctions.

### c. More Floating Rate Debt

A range of euro zone members issued a higher share of floating rate debt. Greece almost doubled the share of floating rate bond issuances in the crisis period compared with the previous two years. Some countries, for instance, Finland, Malta, Portugal and Slovakia, which did not issue floating rate bonds prior to the crisis, introduced them during the crisis.



Sources: DeBroeck-Guscina Debt Issuance Database, WEO, and Haver Analytics.  
 1/For cross-country consistency includes only gross issuances that are captured in the database. We exclude internationally issued TBills and commercial paper, buybacks, taps, IMF loans, cancelled or failed auctions.

*The table below summarizes shifts in the structure of government borrowing before and during the crisis.*

Table 1. Changes in the Structure of Sovereign Borrowing  
(in percent of total issuance)

Country	Time Period	Auctions	Domestic	Short-term	For. currency	CPI indexed	Variable rate	DLTF
Austria	2007-2008	45.8	82.2	10.6	17.3	0.0	7.4	45.8
	2009-2010	75.5	96.6	0.0	3.4	0.0	0.0	75.5
Belgium	2007-2008	88.2	100.0	48.1	0.7	0.0	1.5	40.1
	2009-2010	86.7	100.0	68.4	1.6	0.0	1.4	41.4
Cyprus	2007-2008	100.0	100.0	28.9	0.0	0.0	0.0	71.1
	2009-2010	53.8	53.8	38.3	0.0	0.0	0.0	12.3
Denmark	2007-2008	82.3	82.3	18.8	17.7	0.0	0.0	63.5
	2009-2010	65.8	65.8	16.7	31.9	0.0	0.0	49.1
Finland	2007-2008	58.0	96.6	0.0	3.4	0.0	0.0	58.0
	2009-2010	50.1	94.1	0.4	4.5	0.0	1.0	50.1
France	2007-2008	99.0	100.0	65.9	0.0	4.5	0.0	29.6
	2009-2010	99.1	100.0	66.5	0.0	2.5	0.0	30.1
Germany	2007-2008	99.2	99.4	32.3	0.0	3.4	0.0	64.3
	2009-2010	99.5	100.0	31.9	0.5	3.5	0.0	64.7
Greece	2007-2008	45.3	91.5	2.9	1.1	10.4	6.4	42.3
	2009-2010	29.2	99.9	24.8	0.0	0.0	11.0	5.4
Ireland	2007-2008	0.0	100.0	0.0	0.0	0.0	0.0	0.0
	2009-2010	69.6	100.0	42.1	0.0	0.0	0.0	27.4
Italy	2007-2008	99.4	99.4	37.3	0.4	4.0	4.3	54.0
	2009-2010	95.9	99.2	29.6	0.6	3.2	6.1	58.7
Malta	2007-2008	99.6	100.0	77.6	0.0	0.0	0.0	22.0
	2009-2010	100.0	100.0	73.4	0.0	0.0	1.7	24.9
Netherlands	2007-2008	100.0	100.0	80.5	0.0	0.0	0.0	19.5
	2009-2010	100.0	100.0	76.0	0.0	0.0	0.0	24.0
Portugal	2007-2008	82.0	100.0	31.5	0.0	0.0	0.0	50.5
	2009-2010	84.1	97.9	31.7	2.0	0.0	2.2	52.5
Slovakia	2007-2008	81.9	81.9	9.5	18.1	0.0	0.0	72.4
	2009-2010	67.5	88.2	15.5	0.0	0.0	2.4	49.6
Slovenia	2007-2008	28.3	64.1	15.8	0.0	0.0	0.0	12.5
	2009-2010	15.8	100.0	6.1	0.0	0.0	0.0	9.7
Spain	2007-2008	91.9	98.6	10.4	1.4	0.0	0.0	81.5
	2009-2010	90.4	99.2	21.2	0.6	0.0	0.3	69.2

Source: DeBroeck-Guscina Debt Issuance Database

### III. ECONOMETRIC ANALYSIS AND RESULTS

**Complementing the descriptive analysis above, an econometric exercise can provide additional insight into crisis-related changes in government debt issuance and issuance practices.** In particular, the exercise aims to address the questions as to what impact the crisis had on total debt issuance and as to what extent it moved the composition of debt issuance away from pre-crisis placement techniques and DLTF standards. It also examines what the role of macroeconomic variables and investor sentiment has been. These questions are explored using a panel of 16 euro area countries<sup>9</sup> and Denmark for the January 2007–December 2011 period.

**The econometric analysis draws from the newly constructed debt database.**<sup>10</sup> However, for the purposes of this analysis, individual issuances are aggregated into monthly flows. The macroeconomic variables (economic sentiment, industrial production, inflation, central government debt-to-GDP ratio, exchange rates, and spreads) are provided by Haver Analytics. Variable definitions and sources are in Appendix Table 1.

#### A. Determinants of Total Issuance

**Regression analysis can help clarify the impact of the crisis, the debt stock, macroeconomic variables and investor sentiment on issuance.**<sup>11</sup> Higher debt typically implies higher roll-over needs and hence higher gross issuance. However, depending upon the maturity structure of the debt, this effect may be absent in the relatively short period considered in this paper. In terms of macroeconomic variables, higher growth and higher business confidence are typically associated with lower headline deficits, while higher levels of inflation will tend to go together with a higher nominal deficit, and thus more borrowing. However, the prior effect of a change in the inflation rate is ambiguous: to the extent it is unanticipated, a change in inflation also acts as a tax on debt and affects the government budget constraint in real terms, with implications for gross financing needs.

**The determinants of total issuance can be examined in a panel set-up.** The panel data equation in levels can be written as:

$$y_{i,t} = y_{i,t-1} + \beta X_{i,t} + v_i + \varepsilon_{i,t}$$

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<sup>9</sup> Estonia did not issue sovereign debt in the sample period.

<sup>10</sup> The information on cancelled issuances is not employed, however.

<sup>11</sup> Such regression analysis can complement a simple decomposition of changes in gross issuance into rollover and net issuance.

where  $y_{i,t}$  is total issuance of bonds,  $X_{i,t}$  is a vector of explanatory variables, and the  $\beta$  s represent estimated coefficients. The disturbances are split into unobserved country effects  $v_{i,t}$ , which are i.i.d. and panel level effects  $\varepsilon_{i,t}$ . The regression coefficients are estimated using OLS with Newey-West standard errors.<sup>12</sup> Using first differences eliminates the cross-sectional effects:

$$\Delta y_{i,t} = \Delta y_{i,t-1} + \beta \Delta X_{i,t} + u_{i,t}$$

Specifically, the change in the log of debt issuance (expressed in billions of euros) can be regressed on the changes in debt stock, inflation, growth in industrial production, and an economic sentiment indicator, with a crisis dummy added. The results of the regressions with *changes* in total issuance as the dependent variable are summarized in Table 2.

**The significant estimation results for the whole sample are broadly in line with priors.** Equation (6) in Table 2A represents the preferred specification. Pressures in international financial markets emerged in August 2007, but a full-blown global financial crisis did not erupt until September 2008. For the purposes of the empirical exercise we define January 2007–June 2008 as pre-crisis era, and July 2008–December 2011 as the crisis period. The results are broadly similar for other definitions of the crisis period (January 2009–December 2011).

**The crisis dummy is positive and significant at the 1 percent level in most specifications.** The estimation results are robust to all combinations of the explanatory variables. A positive and significant coefficient on the level of debt in the previous year is in line with our prior, and implies that some of the increase in issuances was driven by the roll-over of existing debt. As to the macroeconomic variables, an increase in the inflation rate is associated with a drop in debt issuance at the 5 percent level. Growth is also negatively associated with changes in total issuance, at the 1 percent level. However, changes in industrial production, business confidence and the secondary market spread with a 10-year Bund are not statistically significant.

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<sup>12</sup> The high degree of persistence in the dependent variable complicates the use of a GMM approach.

Table 2A. Determinants of Total Debt Issuance (in differences)

	(1)	(2)	(3)	(4)	(5)	(6)
Change in Debt Issuance $t_{-1}$	0.217*** (0.074)	0.217*** (0.073)	0.217*** (0.073)	0.190*** (0.074)	0.195** (0.092)	0.218*** (0.091)
Crisis period dummy (2008H2-2011)	0.331*** (0.061)	0.333*** (0.062)	0.332*** (0.062)	0.186** (0.059)	0.139** (0.059)	0.283*** (0.080)
Change in sentiment		-0.446 (0.631)	-0.404 (0.656)	-0.419 (0.631)	-0.196 (0.681)	-0.015 (0.694)
Inflation			-0.029 (0.032)	-1.419** (0.631)	-1.701** (0.816)	-2.106** (0.959)
Growth in IP				-0.011*** (0.002)	-0.011*** (0.002)	-0.006 (0.004)
log of CG debt $t_{-12}$					0.024** (0.012)	0.036*** (0.014)
Change in spread with U.S. bond $t_{-1}$						0.026 (0.023)
Constant	0.056 (0.040)	0.052 (0.041)	0.053 (0.041)	0.052 (0.041)	-0.009 (0.067)	-0.031 (0.075)
Observations	912	912	912	912	768	720
F statistic	12.16	9.84	8.25	10.8	9.86	5.99
Prob>F	0.000	0.000	0.000	0.000	0.000	0.000

## Notes:

Standard errors in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

The reported results are based on seasonally adjusted variables with country and period fixed effects. Postcrisis dummy is defined as 0 for January 2007 through June 2008, and 1 for January July 2008 through December 2011.

**Results from exploring country heterogeneity suggest significant differences between country groupings (Table 2B).** The crisis dummy is significant at the 1 percent level in high deficit countries (Belgium, France, Greece, Portugal and Spain), suggesting that these countries increased their borrowing during the crisis above and beyond what the macroeconomic variables can explain. Countries not facing high deficits or high debt, however, increased their borrowing only marginally in response to the crisis (lower coefficient and only 10 percent level of significance). High debt countries potentially found it difficult to increase their issuance, and some eventually lost market access for long-term instruments (Cyprus, Greece, Ireland, and Portugal). Macroeconomic fundamentals (inflation) mattered more for high-deficit and high-debt countries than for moderate deficit countries (the lower level of statistical significance of these results can be explained by a

smaller sample). The additional borrowing of high-deficit and high-debt countries was also sensitive to changes in the debt stock and changes in investor sentiment. In all country groupings, changes in industrial production, investor's sentiment and spreads were not significant in explaining changes in gross issuances.

Table 2B. Determinants of Total Debt Issuance (in differences)—Exploring Heterogeneity

	(1)	(2)	(3)	(4)	(5)
	<i>Base</i>	<i>High Deficit</i>	<i>High Debt</i>	<i>Moderate Deficit</i>	<i>Moderate Deficit &amp; Debt</i>
Change in Debt Issuance $_{t-1}$	0.218*** (0.091)	0.011 (0.124)	0.200** (0.083)	0.401*** (0.084)	0.240** (0.098)
Crisis period dummy	0.283*** (0.080)	0.487*** (0.148)	0.142 (0.108)	0.025 (0.076)	0.153* (0.091)
Change in sentiment	-0.015 (0.694)	0.674 (1.164)	-0.529 (0.806)	-0.305 (0.655)	-0.454 (0.700)
Inflation	-2.106** (0.959)	-16.736* (9.901)	-13.197** (6.228)	-1.067* (0.590)	-2.7357*** (1.017)
Growth in IP	-0.006 (0.004)	-0.004 (0.006)	0.0004 (0.005)	-0.006 (0.005)	-0.007 (0.005)
log of CG debt $_{t-12}$	0.036*** (0.014)	0.224*** (0.057)	0.005 (0.034)	0.006 (0.018)	0.038** (0.015)
Change in spread with U.S. bond $_{t-1}$	0.026 (0.023)	0.306 (0.243)	0.32 (0.239)	0.019* (0.010)	0.028 (0.020)
Constant	-0.031 (0.075)	-0.844*** (0.284)	0.250* (0.146)	0.075 (0.084)	0.088 (0.077)
Observations	720	288	240	432	624
F statistic	5.990	5.64	2.93	5.28	5.91
Prob>F	0.0000	0.0000	0.0026	0.0000	0.0000

Notes:

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The reported results are based on random effect estimation with three-month moving averages of the variables. Postcrisis dummy is defined as 0 for January 2007 through June 2008, and 1 for July 2008 through December 2009.

High deficit countries include Ireland, Greece, Spain, Portugal, France, and Belgium.

High Debt countries Greece, Italy, Cyprus, Ireland, and Portugal

## B. Determinants of Issuance Composition

**Crisis-related funding pressures are expected to force deviations from established best practices of issuance instrument and procedure choice.** These practices have been defined as issuance of domestic currency, fixed interest rate instruments with long maturity using

competitive auctions. DLTF instruments and competitive auctions in principle ensure that from the government's point of view, the safest debt is issued. However, auctions can be more risky than other issuance techniques: a failed auction can undermine investor confidence. Direct placement and syndication, on the other hand, can reduce placement uncertainty, but may also limit the investor base and carry higher intermediation costs, including fees. Faced with the need to place a massive increase in debt, euro zone sovereign debt managers have been willing to entice investors by assuming more risk through instrument choice, and to pragmatically select issuance techniques on a case-by-case basis taking into account placement risk versus intermediation costs trade-offs. To the extent it can limit the cost of funding, a move away from DLTF debt can be a proper government debt management choice.

**The crisis as such is accordingly expected to have had the following impact on the composition of debt issuance:**

- *More issuance in international markets:* offers additional protection to investors in case of default
- *Ambiguous impact on the use of direct placement and syndicated techniques:* these techniques can reduce placement uncertainty, but are also more costly
- *Less DLTF issuances:* With DLTF debt, the investor assumes most of the issuance risk. Given heightened market uncertainty and the surge in debt issuance, investors are expected to want less risk exposure and prefer debt of shorter maturity, or debt indexed to foreign currency, a short-term interest rate and possibly inflation. These alternatives to DLTF placements are discussed below:
  - *More short-term debt:* is typically less costly in the short run for the debtor and can smooth the impact of higher debt issuance on interest payments (inter-temporal risk transfer); such debt is less risky for the investor
  - *Ambiguous impact on CPI-indexed debt:* in principle better protection for the investor, but the crisis has reduced inflation and inflation expectations, bringing down the related value of inflation protection
  - *More foreign-currency debt:* shifts currency risk exposure from the investor to the debtor
  - *More floating rate debt:* is typically less costly in the short run for the debtor; transfers risks related to changes in global interest rates and in the country's perceived creditworthiness from the investor to the debtor.

**Debt, macroeconomic fundamentals and investor confidence are expected to be important as well.** In recent years, research on the macroeconomic and confidence factors determining the composition of government debt has focused on emerging market countries and stock data (see, for instance, Jeanne and Guscina (2006), Guscina (2008), Mehl and Reynaud (2008), Guscina, Ilyina and Kamil (2010)). However, most insights from this analysis carry over to the advanced economies and issuance (gross flows) data. Notably, it emphasizes that while DLTF debt is the least risky from the debtor's standpoint, creditors will only accept it at a low interest cost to the extent they view government policies as credible and fundamentals as strong. Among other variables, low inflation, associated with a prudent monetary policy, and robust economic growth are expected to promote DLTF issuance at a low interest cost.

**Based upon the recent research on DLTF shares, the following priors can be formulated:**

- Higher debt has a non-linear effect on DLTF shares and the use of auctions. Debt has to achieve a critical mass for liquidity purposes and generate institutional investor interest. However, once the debt (as a share of GDP) exceeds a certain threshold, sovereign risk is a concern and DLTF instruments are less attractive for investors
- Higher economic growth (proxied by growth in industrial production) creates more favorable conditions for safer and less costly borrowing practices from the government's point of view (more DLTF debt placed via competitive auctions). The variable's effect on total borrowing is negative: higher growth is typically associated with lower headline deficits
- Higher inflation (expectations) will make it harder for governments to issue DLTF debt and use auctions. As inflation erodes the returns on nominal debt in real terms, investors want to avoid or receive compensation for the risk of real return erosion. However, as inflation in the euro area was generally modest in 2007–11, it is unlikely to have exceeded the threshold above which inflation could have materially affected the choice of debt instrument or selling technique in this period
- Finally, greater investor confidence in the economy (as proxied by business sentiment) will support investor risk appetite and facilitate issuance of DLTF instruments using auctions. As a forward looking variable, investor sentiment can be more important than macroeconomic fundamentals in determining the success of individual auctions (and thus the share of new issues that are placed via auctions).

**Censored Tobit estimation methodology is used for the regression analysis of issuance composition.** Since DLTF debt shares or auction shares are bounded between zero and one, the estimation technique employed has to take into account the limited dependent variable. Given the panel structure of our dataset, the possible existence of unobservable country

effects also has to be considered. Since unobserved country heterogeneity can bias standard Tobit estimation, we resort to random-effects Tobit estimation, which is defined as a combination of linear and probabilistic regressions (see, for instance, Greene, *Econometric Analysis*, 2007).

**The results for auction shares are summarized in Table 3A, with equation (6) representing the preferred specification.** The crisis dummy is highly significant with a positive sign in almost all specifications. It implies that the financial crisis as such had a positive effect on the share of debt placed via auctions above and beyond the one related to the other determinants. While the use of syndication is less risky, it is also more costly. An increase in the share of auctions in the crisis period implies that governments in the euro area tried to raise funds at the lowest possible cost. Inflation is statistically significant at the 1 percent level and enters with a negative coefficient. This suggests that macroeconomic volatility (proxied by inflation) brings down the share of bonds placed via competitive auctions. The level of debt is statistically significant at the 1 percent level in the preferred estimation, suggesting that countries with a higher debt stock typically shift to auctions as the placement technique of choice. The business sentiment indicator is positive in various specifications, suggesting that for competitive auctions to be successful, investor confidence mattered more than ex post economic indicators. The result is not robust to including growth and spreads, however. The secondary market spread with 10-year US Bond is positively associated with the share of auctions. This suggests that as the cost of borrowing increases, governments are more likely to use auctions, as opposed to more costly syndicates.

Table 3A. Determinants of Auction Share in Total Issuance—Censored Tobit Estimation

	(1)	(2)	(3)	(4)	(5)	(6)
Crisis period dummy	0.831** -0.421	1.341*** (0.515)	1.295** (0.532)	0.858 (0.620)	1.062* (0.627)	0.123*** (0.029)
Sentiment		2.069* (1.193)	3.998*** (1.194)	4.067*** (1.428)	1.834 (1.820)	0.268*** (0.096)
Inflation			-0.273*** (0.087)	-0.321*** (0.102)	-0.335*** (0.102)	-0.018*** (0.004)
log of CG debt <sub>t-12</sub>				0.347* -0.187	0.381* (0.197)	0.774*** (0.072)
Growth in IP					0.049** (0.023)	-0.001 (0.001)
Spread with 10-year U.S. bond						0.041*** (0.006)
Constant	-0.176 (0.568)	-2.292* (1.363)	-3.136** (1.247)	-4.157*** (1.589)	-2.01 (1.936)	-2.961*** (0.438)
Observations	925	925	925	759	759	711
Number of ID	16	16	16	16	16	15
Wald test	10.74	13.6	28.46	23.54	28.01	219

Notes:

Standard errors in parentheses. \*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

The reported results are based on censored tobit effect estimation. Postcrisis dummy is defined as 0 for January 2007 through June 2008, and 1 for July 2008 through December 2009.

**Results for country sub-groupings show considerable heterogeneity (Table 3B.)** The high debt subgroup has the highest coefficient on the crisis dummy, implying that these countries relied relatively more on auctions during the crisis.<sup>13</sup> In these high debt countries, the stock of debt and investor sentiment matter the most in terms of explaining the share of bonds raised at auctions. Higher spreads vis-à-vis the German Bund are also associated with a higher share of debt placed via auctions. In the high deficit countries, the crisis variable is not significant, but the stock of debt, investor sentiment, and the spread all are associated with a higher share of borrowing through auctions. For moderate deficit/moderate debt countries, the crisis dummy is significant, and investor sentiment and spreads are significant but with the opposite effect than in the two previous country subgroups: these variables are in this case associated with lower auction shares. This could be related to flight-to-safety within the euro zone in 2010–11, which improved investor sentiments towards these countries and

<sup>13</sup> In the high-debt countries, the volume of primary issuances is also expected to be large enough to ensure sufficient liquidity.

brought down their spreads. For all country subgroups, inflation is negatively associated with the share of bonds issued through the use of auctions with a coefficient which is broadly similar across different groups.

Table 3B. Determinants of Auction Share in Total Issuance—Exploring Heterogeneity

	(1)	(2)	(3)	(4)	(5)	(6)
	<i>Base</i>	<i>no Ireland in 2011</i>	<i>High Deficit</i>	<i>High Debt</i>	<i>Moderate Deficit</i>	<i>Moderate Deficit &amp; Debt</i>
Crisis period dummy	0.123*** (0.029)	0.117*** (0.029)	0.014 (0.029)	0.225*** (0.057)	0.132*** (0.037)	0.114*** (0.041)
Sentiment	0.268*** (0.096)	0.251*** (0.096)	0.448*** (0.101)	1.238*** (0.194)	-0.252* (0.129)	-0.452*** (0.134)
Inflation	-0.018*** (0.004)	-0.020*** (0.005)	-0.028*** (0.004)	-0.017** (0.008)	-0.012*** (0.003)	-0.010*** (0.003)
log of CG debt $t_{-12}$	0.774*** (0.072)	0.628*** (0.086)	1.219*** (0.063)	1.323*** (0.134)	0.057* (0.031)	0.067 (0.047)
Growth in IP	-0.001 (0.001)	0.000 (0.001)	-0.003*** (0.001)	0.001 (0.002)	0.002 (0.001)	0.002 (0.001)
Spread with 10-year U.S. bond	0.041*** (0.006)	0.038*** (0.006)	0.038*** (0.005)	0.066*** (0.009)	-0.188*** (0.033)	-0.085* (0.045)
Constant	-2.961*** (0.438)	-2.263*** (0.463)	-5.980*** (0.519)	-6.704*** (1.103)	0.882*** (0.189)	0.931*** (0.243)
Observations	711	703	284	269	427	336
Number of ID	15	15	6	5	9	7
Wald test	219	135.87	661.7	279.9	98.75	61.44

Notes:

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The reported results are based on censored tobit effect estimation. Postcrisis dummy is defined as 0 for January 2007 through June 2008, and 1 for July 2008 through December 2009.

High deficit countries include Ireland, Greece, Spain, Portugal, France, and Belgium.

High Debt countries Greece, Italy, Cyprus, Ireland, and Portugal

**The results of the panel regressions for the shares of DLTF debt confirm the priors for the macroeconomic variables (Table 4A).** For the sample as whole, the crisis dummy is not statistically significant. However, the coefficient on the inflation rate is negative and statistically highly significant; a 1 percent increase in inflation rate is associated with a 2.5 percent drop in the share of DLTF issuance. Industrial production growth is positively associated with the share of DLTF debt, with a coefficient significant at the 5 percent level. A one percent increase in industrial production growth is associated with 0.6 of a percent increase in the share of DLTF debt. The sentiment indicator is always positive (meaning that investors confidence translates into a higher share of DLTF borrowing), but the effect is not statistically significant when controlling for other macroeconomic fundamentals such as growth in industrial production, exchange rate movements, and secondary market spreads.

The debt variable is only significant at the 10 percent level. Spreads with 10-year US Bond and changes in the exchange rate are not statistically significant.

Table 4A. Determinants of DLTF Issuance—Censored Tobit Estimation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Crisis period dummy	-6.922*** (2.026)	-2.825 (3.500)	-1.753 (3.519)	-2.219 (3.506)	-4.291 (3.750)	-4.125 (3.749)	-3.825 (3.936)
Sentiment		0.182 (0.126)	0.266** (0.133)	0.290** (0.133)	0.037 (0.177)	0.199 (0.225)	0.199 (0.225)
Inflation			-1.310* (0.690)	-1.097 (0.692)	-2.553*** (0.847)	-3.036*** (0.941)	-2.975*** (0.972)
Log of CG debt				9.156** (4.026)	8.313* (4.958)	8.505* (4.945)	8.544* (4.953)
Growth in IP					0.600** (0.268)	0.597** (0.267)	0.599** (0.267)
Spread with 10-year U.S. bond						0.03 (0.025)	0.029 (0.026)
Change in euro/dollar Exchange rate							-10.517 (42.130)
Constant	56.335*** (7.174)	36.957** (15.619)	31.155** (15.837)	-15.992 (25.974)	19.265 (33.267)	2.281 (36.180)	1.743 (36.268)
Observations	391	381	381	381	347	347	347
Number of ID	15	14	14	14	13	13	13
Wald test	11.68	13.63	17.4	22.67	33.82	35.25	35.31

Notes:

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The reported results are based on random effect estimation with three-month moving averages of the variables. Postcrisis dummy is defined as 0 for January 2007 through June 2008, and 1 for July 2008 through December 2009.

**Results by sub-groupings also in this case suggest heterogeneity (Table 4B).** The crisis dummy is highly significant in the high deficit and high debt countries, with the expected negative sign. This implies that while the crisis did not affect DLTF issuance in all euro area countries, it did in countries with a more vulnerable fiscal position, which found it harder to borrow in DLTF terms. The macroeconomic indicators, on the other hand, could explain changes in the structure of government borrowing in moderate deficit countries. Both inflation and growth are highly significant with signs in line with the priors. Higher debt in the moderate deficit countries is associated with a higher DLTF share, at the 10 percent level, suggesting the presence of the liquidity effects discussed above.

Table 4B. Determinants of DLTF Issuance—Exploring Heterogeneity

	(1)	(2)	(3)	(4)	(5)
	<i>Base</i>	<i>no Greece</i>	<i>High Deficit</i>	<i>High Debt</i>	<i>Moderate Deficit</i>
Crisis period dummy	-4.291 (3.750)	-4.135 (4.074)	-20.346*** (5.120)	-22.623*** (5.386)	6.807 (5.343)
Sentiment	0.037 (0.177)	0.855 (0.207)	-0.483* (0.256)	0.194 (0.220)	0.108 (0.257)
Inflation	-2.553*** (0.847)	-2.507*** (0.918)	-1.327 (0.999)	-0.971 (1.155)	-4.046*** (1.380)
Log of CG debt	8.313* (4.958)	7.687 (4.888)	-13.379 (12.638)	-10.363 (7.251)	10.570* (5.794)
Growth in IP	0.600** (0.268)	0.534* (0.301)	0.578 (0.529)	-0.532 (0.410)	1.020*** (0.363)
Constant	19.265 (33.267)	14.618 (34.757)	195.433** (79.030)	166.111*** (51.144)	1.55 (42.235)
Observations	347	320	129	95	218
Number of ID	13	12	4	4	9
Wald test	33.82	30.49	40.39	31.36	25

## Notes:

Standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The reported results are based on random effect estimation with three-month moving averages of the variables. Postcrisis dummy is defined as 0 for January 2007 through June 2008, and 1 for July 2008 through December 2009.

High deficit countries include Ireland, Greece, Spain, Portugal, France, and Belgium.

High Debt countries include Belgium, Greece and Italy.

#### IV. CONCLUSION

**This paper has documented and analyzed crisis-related changes in government debt issuance practices in the 17 euro zone countries and Denmark.** Using a newly constructed database on primary market debt issuance during 2007–11, we find evidence of a shift away from pre-crisis standards of best funding practices—competitive auctions of debt instruments with a fixed coupon, long maturity and local currency denomination (DLTF). Exploiting the cross-country panel data dimension of the data, we conclude that the crisis as such and changes in the macroeconomic environment and investor sentiment can account for a significant proportion of the deviation.

**The crisis has forced governments to assume additional risk.** Shorter maturities, a foreign currency denomination, or a floating rate coupon have reduced investor risk, while giving government debt managers the opportunity to limit the immediate impact of the crisis on interest payments in return for accepting more risk. The negative effect of the crisis on DLTF debt issuance was especially pronounced in high debt euro area countries, and could point to a regime change in government debt issuance practices in these countries.

**In addition to the crisis, the debt stock, investor sentiment and macroeconomic fundamentals continued to have an important impact.** The paper's results in this regard are broadly in line with those suggested by previous theoretical and empirical research. In particular, a higher debt stock is associated with higher issuance, with a higher share of auctions in high debt countries, and with a higher share of DLTF issuance in moderate deficit countries. Stronger investor sentiment is associated with lower issuance and facilitates the use of auctions. Growth and inflation are highly significant with the expected sign in explaining the share of DLTF issuance in moderate deficit countries, but they have limited explanatory power as to the use of auctions both in the aggregate and for country sub-groupings—in line with the theoretical ambiguity of the link between macroeconomic variables and the share of auctions in issuances.

**Additional contingent exposure is a major concern.** Euro zone sovereigns have generally assumed more issuance risk and in some cases opportunistically pursued interest cost minimization during the crisis. In particular, the shift to shorter maturities, and the issuance of floating rate and foreign currency denominated debt allowed governments simultaneously to match reduced risk appetite of investors and, in an environment with exceptionally low short-term interest rates, limit the impact of higher deficits and debt on interest payments. But they also exposed these governments to substantially higher refinancing and repricing risks and, in the case of foreign currency-denominated debt, important exchange rate risks.

## Appendix Table

Table A1. Variable Definitions and Sources

Variable	Description	Source
Crisis period dummy	= 0 for January 2007 - June 2008 time period = 1 for July 2008 - December 2011 time period	De Broeck-Guscina Debt Database
Sentiment	Economic sentiment indicator (SA, long-term average=100)	Haver Analytics
Inflation	12-month change in harmonized consumer price index (SA, 2005=100)	Haver Analytics
Growth in IP	12-month change in industrial production: industry excluding construction (SA/WDA, 2005=100)	Haver Analytics
Log of CG debt	Log of central government: consolidated gross debt (NSA, Mil.EUR-ECU)	Haver Analytics
Spread with 10-year U.S. bond	Spread between long-term interest rate: rolling 12-month average (%) in the country and the U.S.	Haver Analytics
Change in euro/U.S. dollar exchange rate	12-month change in euro per U.S. dollar	IMF, <i>World Economic Outlook</i>

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