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THE RESPONSE OF THE WEIGHTED AVERAGE TIME TO MATURITY OF GOVERNMENT BOND ISSUES TO CHANGES IN THE FINANCIAL/ECONOMIC ENVIRONMENT

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Abstract

This paper describes and analyzes the response of the weighted average time to maturity of government bond issues to changes in financial and economic variables, in light of the financial and European debt crises, using a new database of 12,000 OECD government bonds issues in 2004–12. According to IMF guidelines, public debt should be issued at the lowest possible cost consistent with a prudent degree of risk, two objectives that are diametrically opposed: short debt generally costs less but carries higher risk, while long debt is generally more expensive but less risky. This paper studies which of the above considerations was more significant during the crises: did governments prefer short-term considerations and short debt or prudence and long debt? It shows that debt issuance patterns changed during the crises, shifting from issuing shorter debt for immediate cost minimization before the global financial crisis towards longer debt during the financial and European crises. Using panel-data regressions, I find evidence of short-term time to maturity response to yield curve parameters, issuance quantity response to crises and issuance quantity persistence.

Keywords: debt issuance, financial crisis, time to maturity

1. INTRODUCTION

The ongoing global economic crisis has shown yet again that countries behave in atypical ways in times of crisis. Many developed countries engaged in support programs for sensitive sectors of the local economy, sectoral rescue plans and even widespread nationalizations, such as the partial nationalization of the nine largest banks in the US and the nationalization of the failing Irish banks. The wide range and scope of these rescue programs required large government expenditures, which often exceeded normal expenditure rules or limitations. Since—due to counter-cyclical, Keynesian and political considerations—most developed countries tend not to reduce other expenditures in times of crisis, these countries' deficits have swelled and thus increased their public debt.

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The level of public debt was already high before the crisis. The average ratio of gross public debt to GDP in OECD countries ranged from 70 to 80 percent in the years before the crisis and has risen precipitously in the last several years. Interest expenditures on this debt are significant: some 2 percent of annual GDP on average in OECD countries. Moreover, a rise in interest rates, which could be caused by a change in the perceived probability of a country defaulting on its debts, would affect a country's ability to fund current expenditure and its ability to issue debt and meet its obligations, both short and long term. The crisis and the resulting need for rescue programs for Greece, Ireland and Portugal demonstrate this phenomenon.

The effect of a shock to interest rates on current expenditure and activity in a country grows inversely to the length of the Time to Maturity (TTM) of the public debt, as a country whose debt is largely short-term will need to roll over a great quantity of debt in the near future and at high interest rates, and will thus likely lack the economic fortitude needed to deal with the crisis. A country whose debt has a long TTM will need to issue fewer bonds immediately after the shock to interest rates, likely allowing it to respond better to the crisis and reducing the magnitude of the immediate steps it needs to take in such response. On the other hand, long maturity debt tends—most of the time and in most countries—to bear higher interest rates than short debt and therefore be more expensive to issue, due to time premia and bond purchasers' liquidity preferences.

The starting point for evaluating the tradeoffs between risks and cost in selecting issuance maturities is the common objective of public debt managers, exemplified 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".* Within this framework there are several theories regarding debt managers' behavior. The ability to raise long-term debt at interest rates reasonable for the period signals stability and economic strength (Das, et. al. 2010). It can also make future debt rollover easier which, in and of itself, contributes to stability. In contrast, short-term bonds are more liquid and thus generally allow funding of the debt at lower costs. Short-term issues can, of course, signal an inability to raise long-term debt at reasonable rates and therefore signal economic or fiscal instability.

This paper strives to determine whether, on balance, signaling stability or lowering funding cost is the primary motivation in choosing the TTM of government bond issues and whether this motivation is stable over time and crises. It uses a newly constructed comprehensive database of public debt issuance in a number of developed countries to evaluate the short-term considerations behind the decision on issuance maturity and, to a lesser extent, issuance quantity.

The paper aims to define the issuance maturity response function of national debt management offices to short-term macroeconomic factors. It takes into account the individual scheduling/announcement limitations of the Debt Management Office (DMO) in its ongoing work. This work can incorporate many factors: government cash flow management, market liquidity, demand smoothing, cost (interest) minimization, government interest expenditure planning and scheduling, and risk minimization including

rollover risk, market risk and currency risk. The paper deals primarily with two aspects and the signaling options related to them: risk minimization and cost minimization.

The reason for the focus on TTM on issue is that, with the debt crisis, the high and growing central government debt ratios in many of the developed countries are used as indicators of fiscal space/relative indebtedness/ability to pay debts, i.e., fiscal risk. But two countries with identical debt ratios but different average debt TTMs are in very different fiscal states: the one with the low TTM needs to rollover more debt sooner and thus has much higher rollover risk, but likely has a lesser interest rate burden (the low cost of funding of short TTM may be cancelled out by the costs of the higher rollover risk), the other has higher interest expenses over a longer period but has much less rollover risk. As average TTM is a stock measure, the only way to identify a future shift between low and high TTM states is to examine the short-term changes in the maturities at which debt is issued each month.

The remainder of this paper is structured as follows: Section 2 reviews the relevant literature. Section 3 describes the database and the variables and details the development of debt issuance in the sample countries in 2004–2012. Section 4 explains the methodology. Section 5 estimates the issuance response of debt management offices to macroeconomic variables, particularly as it concerns time to maturity on issue and quantity issued. Section 6 concludes and suggests further lines of inquiry.

2. LITERATURE REVIEW

This research is associated with several streams in the literature. One stream estimates national debt managers' reaction function and the change in the quantity and makeup of debt issuance in response to changes in economic variables, particularly relating to the global financial crisis. Hoogduin, Öztürk and Wierts (2011) use annual panel data for 11 European countries to explain the percentage of debt issued with a maturity of one year or less. They find that this percentage rises when long interest rates rise and interpret this as support for the view that debt managers focus primarily on lowering funding costs. They also find a significant growth in the share of short debt issuance from 1999 and an even greater increase from 2008, the start of the financial crisis. De Broeck and Guscina (2011) use a database of debt issues for 16 European countries in the years 2007–2009 to see the effects of the global financial crisis on the quantity and composition of debt issued. They explain the size and composition of monthly issues, including the percentage of DLTF[1] debt issued, with several economic variables and a crisis dummy. They find that total monthly issuance is negatively affected by inflation and changes in economic sentiment, while DLTF issuance is negatively affected by inflation and positively affected by growth in industrial production and the growth of the central government debt. Stancu and Minescu (2011) use a database for 7 Central and Eastern European countries to investigate the effects of inflation, crisis and sovereign rating at issuance on the TTM and initial yield of

[1] DLTF—domestic currency, fixed interest rate instruments with long maturity.

government bonds. They find that inflation has a significant positive effect on the yield at issue of Government debt.

Another stream in the literature deals with Fiscal Space and/or sustainable public finance and includes Ghosh, Kim, Mendoza, Ostry and Qureshi (2011) and Bi and Leeper (2012). This literature estimates countries' resistance to shocks and the effects of the global financial crisis on fiscal policy, often using the public debt to GDP ratio as a fundamental variable in such estimations. I have not yet found a significant reference to the TTM of the public debt in this literature, despite the fact that the likelihood of public finance being sustainable increases with the TTM of the public debt.

Several different measures of debt maturity appear in the literature. Broner, Lorenzoni, and Schmukler (2008) use average weekly maturity of debt issuance. Arellano and Ramanarayanan (2012) examine both quantity-weighted time to maturity and Macaulay duration, and select the latter, as they feel that it is more comparable across bonds with different coupon rates. The choice of time to maturity, rather than duration, as the maturity measure in this paper was driven by the fact that the two measures focus on fundamentally different risks. Time to maturity is a measure of rollover risk, i.e., when does the sovereign issuer need to repay the principal, while duration is primarily an expression of sensitivity to interest rate changes. A bond with a 5-year duration may be a 5-year zero coupon bond, a 7-year low coupon bond or a 10-year high coupon bond. While their interest rate risk may be similar or identical, their effect on the issuer's rollover risk is quite different.

3. DATABASE AND DESCRIPTIVE STATISTICS

a. Database

A government debt issuance database was constructed for this paper. It includes micro data on central government debt issuance for the countries in the sample from 2004–2012.[2] The database is intended to encompass all marketable central government debt issuance in the sample period, foreign and domestic. It is made up of approximately 11,900 issuances, 6,200 of which had a TTM of over one year on issuance. Database expansion is ongoing, with the eventual target of covering all OECD countries.

The database does not include non-marketable/non-tradable debt issuance, as the issuance criteria, purposes and purchasers of such debt are different between countries. It also does not include savings bond issuance, as the purchase of savings bonds is generally not driven by government short-term supply decisions but rather by individual citizens' demand for non-intermediated risk-free saving.[3]

[2] The sample runs from January 2004 to mid-2012. The start date is due to data limitations. Appendix Table A1 lists the countries and periods included in the database.

[3] Savings bonds are retail debt instruments which commonly have some or all of the following characteristics: limited transferability, early redemption options and limits on quantities purchasable by individuals. Examples include US Savings Bonds, Israel Bonds, Canada Savings Bonds and Kiwi Bonds.

Treasury bills[4] of all maturities are included—despite their common description by many official sector issuers as liquidity instruments—because, as we have seen over the global financial and European debt crises, liquidity issues can sometimes suddenly become sustainability issues, i.e., funding issues. In some cases these are explicitly funding instruments and an essential part of the ongoing issuance strategy.

As the goal of this database is to examine fiscal responses, debt issuances are not included in cases where they are issued as monetary, rather than fiscal, instruments. The reason these are not included is that they are issued at the discretion of the central bank, are not counted in national debt statistics and are not used to fund current government activity or bond redemptions. In the current sample the only examples are the *Makam* in Israel and Monetary Stabilization Bonds in South Korea, whose issuance decisions are made solely by the Bank of Israel and the Bank of Korea, respectively, as one of the instruments of monetary policy.

The data was compiled from national debt management agencies, central banks and ministries of finance and supplemented by Bloomberg. It includes the issuance and maturity dates, amount sold, average yield, average price, currency, indexation, fixed/floating interest rate, bid-to-cover ratio and amount demanded (if an auction).

b. Variables

As the purpose of this paper is to investigate the short-run relationship between issuance and economic/financial variables, issuance data from the database are aggregated by country on a monthly basis. Indexed and floating rate issues are included, as are foreign currency issues, which are converted into local currency at current exchange rates. These categories were not treated separately due to a relative rarity in the sample. The main variable of interest is:

WATTM $_{i,t}$ - Average time to maturity (in years) of the debt issued by country i in month t, weighted by the quantity of each maturity issued by country i in month t.

The total time to maturity of monthly issuance is the result of a compound decision, selecting which maturities to issue this month and what quantity of each. As seen in Debt Issuance Strategies (section 3.e), some countries determine bond maturity in short-run decisions and some determine quantities.[5] If either variable is determined in the month of issuance or the month before, considering the decision as a response to short-term economic/financial data is correct. For example, if maturities are determined quarterly (as in the UK) but quantities are announced only a week or two before the auction, then each month's WATTM is a decision variable to be determined by the Debt Management Office, as it can allocate quantity among maturities to suit the changing economic/financial situation.[6]

[4] Treasury bills are zero-coupon debt instruments issued with maturities of three to 12 months.

[5] If maturities are pre-announced then they set upper and lower bounds for the WATTM. If quantities (but not maturities) are pre-announced, WATTM is bounded only by the range of series available to be issued.

[6] Germany was excluded from the sample because it publishes annual issuance schedules including issuance dates, maturities, series, coupon and quantity, and generally holds to them (see section 3.e—Debt

Other debt variables:

Total Issuance $_{i,t}$ – Sum quantity of debt issued by country i in month t, in euros. The euro is the most common currency of issue in the sample, and other currencies were converted to euros at market exchange rates for comparability.

Normalized Real Debt Issuance $_{i,t}$ - Total Issuance $_{i,t}$ deflated by CPI $_{i,t}$ to January 2005 prices and normalized by country, subtracting country average real debt issuance and divided by the standard deviation. This variable was normalized since it could not be taken in differences or percentage changes due to a number of zero issuance observations and could not be scaled by country due to a lack of monthly GDP data.

The conversion to fixed prices was for comparability across countries and periods.

Number of Issues $_{i,t}$ – Number of individual debt issuances by country i in month t,

Macro-Economic/Financial Variables:

The yield curve variables are derived from the end-of-month closing yields from Bloomberg Fair Market Value Curves, which are option- and coupon-free yield curves. They are based on the common empirical proxies for the yield curve factors (Afonso & Martin, 2012; Diebold, Rudebusch & Aruoba, 2006)).

Yield curve level $_{i,t}$ – [$Yield_{i,t}(3\ Month) + Yield_{i,t}(2\ year) + Yield_{i,t}(10\ year)$] / 3

Yield curve slope $_{i,t}$ – [$Yield_{i,t}(10\ year) - Yield_{i,t}(3\ Month)$]

Yield curve curvature $_{i,t}$ – [$Yield_{i,t}(3\ Month) + Yield_{i,t}(10\ year) - 2*Yield_{i,t}(2\ year)$]

IP$_{i,t}$ – Industrial Production Index, Seasonally Adjusted, for country i in month t.

CPI$_{i,t}$ – Monthly Change in Consumer Price Index, for country i in month t.

Central Bank Rate$_{i,t}$ – Central Bank Interest Rate for country i in month t.

CDS$_{i,t}$ –Premium on five-year Credit Default Swap for country i in month t.

Stock Yield$_{i,t}$ – Monthly Yield of the primary stock index in country i in month t.

Advanced IP$_t$ – Industrial Production Index for the advanced countries in month t.

Advanced CPI$_t$ – Change in Consumer Price Index for the advanced countries in month t.

Average Rating$_{i,t}$ – An index ranking country i's ratings from the three major rating agencies in month t from 20 (highest) to 0 (lowest) and averaging them.

Financial Crisis – A dummy variable which takes the value of 1 during September 2008–December 2009 and the value of 0 otherwise.

European Debt Crisis – A dummy variable which takes the value of 1 from January 2010 until the end of the sample and the value of 0 otherwise.

The data for the CPI, Ratings, and Stock Yield came from Bloomberg. The data for the IP, Advanced IP, and Advanced CPI came from IMF data. Central Bank Rates came from national central banks. CDS data was compiled from Bloomberg and Thomson Reuters.

Issuance Information Strategies). The probability that German issuance is affected by monthly short-run effects is thus negligible.

c. Summary Statistics

The countries examined in this paper were selected because they are small, open developed economies, which were affected by second-run effects of the financial and European Debt crises, but did not have major crises erupt locally. This group is interesting because the countries in it have the advantages of developed economies, including well developed capital markets in which domestic government debt can easily be issued. They are also more likely to be good examples of global best practices than countries currently dealing with local economic crises.

Table 1 presents summary statistics for all the variables throughout the entire period and broken down into pre-crisis, financial crisis and European debt crisis. Some variables show the effects of the financial crisis but appear to have somewhat recovered since then. Among those are industrial production and the changes in CPI in the advanced economies as a whole and changes in CPI in the individual countries. The average industrial production index in the individual countries has actually risen.

Other variables show signs of the continuing crisis. The low levels of the sovereign yield curves and the still dropping central bank rates imply a combination of a continuing rush to safety in government bonds due to a high level of risk and financial repression of domestic banks (Reinhart, Kirkegaard, & Sbrancia, 2011).

Still others are as yet unclear. Debt issuance rose quickly during the financial crisis, but has dropped somewhat since. At the same time, the number of monthly debt issuances has continued to rise, as have the slope of the yield curve and the WATTM. These data may imply that with deficit reduction beginning in most of the sample countries, their issuance needs have dropped somewhat and their leeway to optimize their debt portfolio and extend maturities has grown. They may also imply that, despite the low level of interest rates, countries are worried about issuing excessively and appearing risky, and are therefore issuing longer debt now, despite its higher cost, in order to signal that they are fiscally responsible.

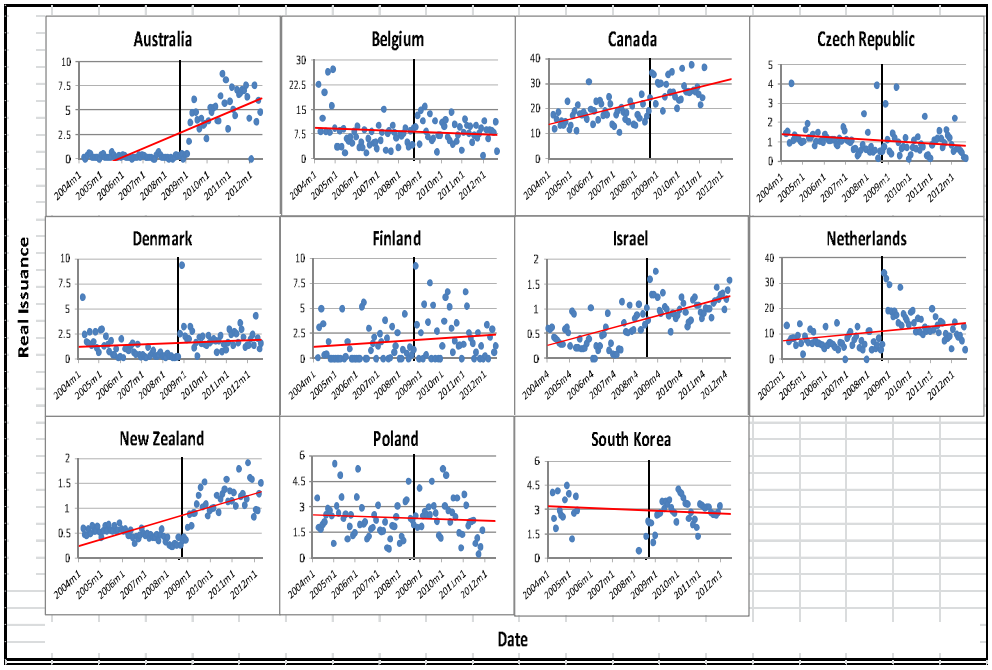
Table 1
Summary Statistics

	Entire Period			Pre-Crisis			12/2009–09/2008			10/2012–01/2010		
	mean	sd	N	mean	sd	N	mean	sd	N	mean	sd	N
Weighted Average TTM (in years)	4.53	3.71	1130	4.33	3.85	596	4.40	3.93	192	4.97	3.29	342
Number of Issues	9.73	8.87	1130	7.47	5.97	596	11.81	9.48	192	12.50	11.34	342
Normalized Real Debt Issuance	0.01	1.00	1129	0.39-	0.84	596	0.47	1.13	192	0.44	0.90	341
Real Debt Issuance (millions of euros)	6453	8590	1129	5226	6694	596	8523	11046	192	7432	9582	341
Total Debt Issuance (millions of euros, current prices)	7057	9535	1130	5398	6911	596	9399	12158	192	8632	11157	342
Yield Curve Level	3.66	1.53	1129	4.39	1.26	595	3.34	1.40	192	2.57	1.30	342
Yield Curve Curvature	0.77	0.82	1129	0.29	0.60	595	1.23	0.67	192	1.36	0.67	342
Yield Curve Slope	1.55	1.32	1129	0.74	1.04	595	2.54	1.12	192	2.41	0.84	342
Change in CPI	0.21	0.41	1129	0.23	0.42	596	0.08	0.40	192	0.24	0.38	341
Industrial Production Index, SA	105.90	13.37	1125	104.60	9.42	596	103.40	12.55	192	109.70	18.18	337
Central Bank Interest Rate	3.01	1.91	1130	3.98	1.75	596	2.21	1.60	192	1.76	1.34	342
Industrial Production in the Advanced Economies	99.38	5.90	1125	102.50	4.64	596	92.74	6.11	192	97.68	3.45	337
Change in CPI in the Advanced Economies	2.03	1.05	1130	2.45	0.70	596	0.71	1.42	192	2.04	0.60	342
CDS premium	65.61	67.28	854	14.50	17.72	355	104.20	80.90	172	100.80	56.56	327
Average Rating	18.41	2.14	1130	18.43	2.23	596	18.35	2.11	192	18.42	1.99	342

d. Debt Issuance Patterns in the Developed Countries

Figure 1 and Appendix Table A2 show the progression of total real issuance in the various countries in the sample. Total real monthly issuance has risen significantly in Australia, Canada, Israel, New Zealand, Finland and the Netherlands, and has not dropped significantly in any sample country. In most countries the issuance growth was focused on the financial crisis, and issuance has dropped somewhat since 2010.

Figure 1
Development of Real Issuance
(Billions of euros, constant prices January 2005, by issuance month)



The red line is a linear fit. The X-axes are scaled differently in each graph.
The vertical line marks the start of the financial crisis, September 2008.

Figure 2 shows a partial cause of the higher issuance: The slope of the yield curve rose during the financial crisis in all countries in the sample (except South Korea) and the level of the curve dropped in most countries, making short-term debt significantly cheaper to issue. During the European debt crisis, however, the level of the yield curves of all countries except Israel and Australia continued to fall and their slopes rose slightly, while the yield curves for Israel and Australia rose and flattened.

Figure 2
Three-Period Average Yield Curves (Zero Coupon Curves)

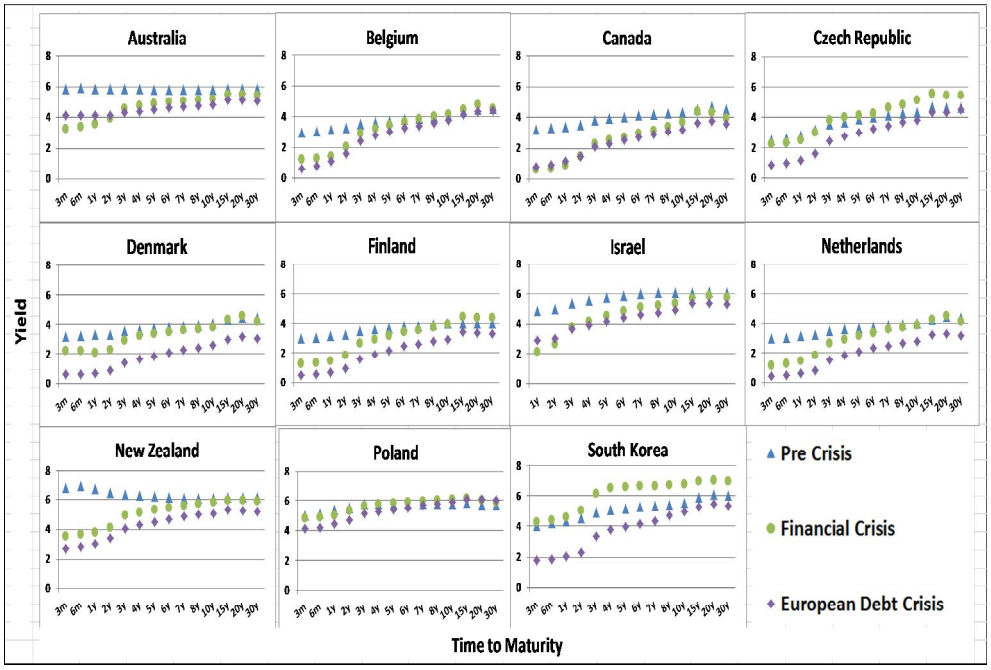
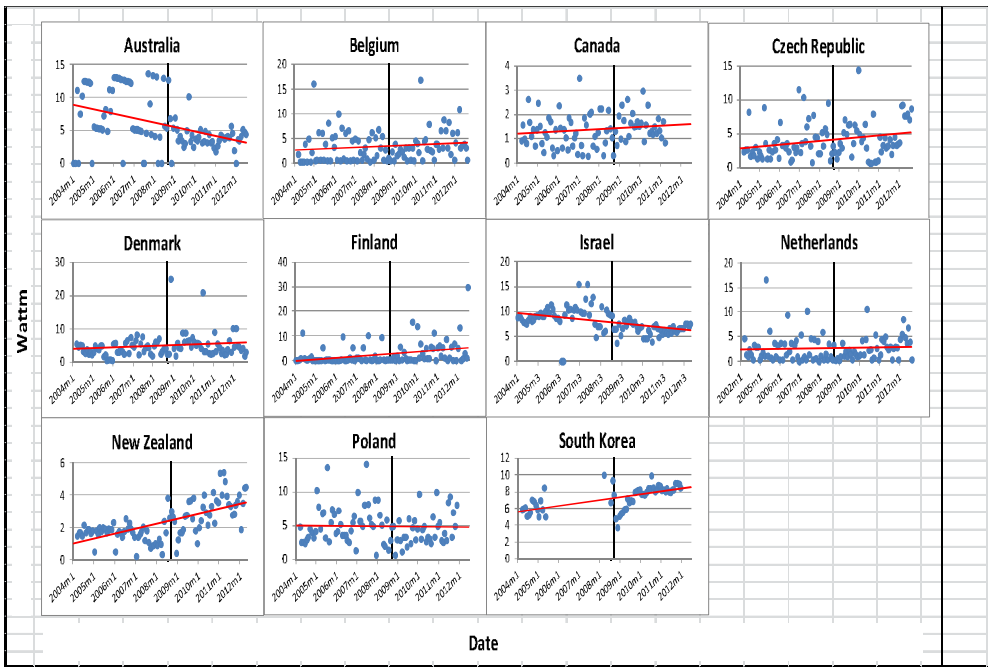


Figure 3 and Appendix Table A3 show that despite the increase in issuance and the drop in yields, WATTM rose slightly on average during the financial crisis and rose even more during the European debt crisis, despite the falling curves.

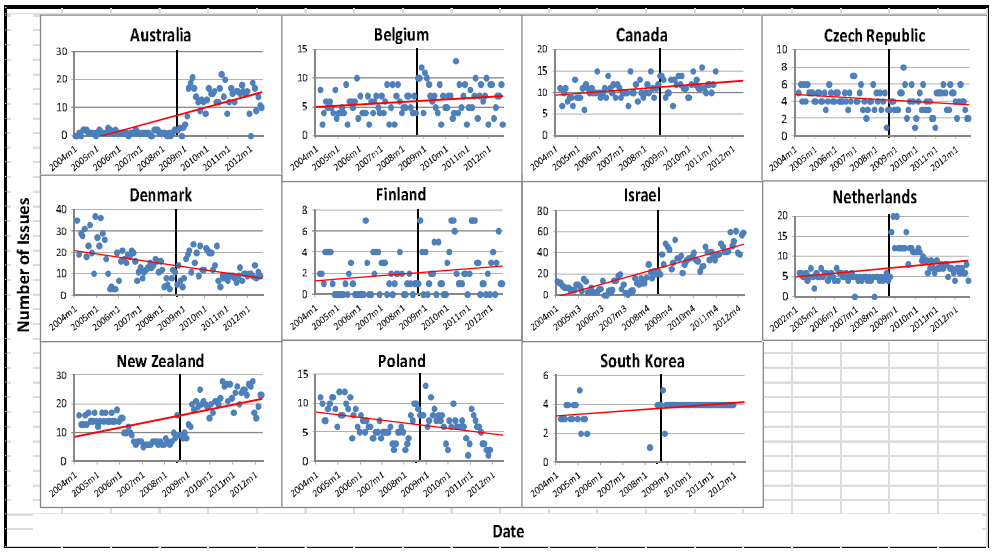
Figure 3
Development of Weighted Average Time to Maturity (years, by issuance month)



The red line is a linear fit. The X-axes are scaled differently in each graph.
The vertical line marks the start of the financial crisis, September 2008.

Figure 4 and Appendix Table A4 show that the number of issues moved in a generally similar manner to total real issuance, with the exception of Israel and Australia, in which the number of issues grew quickly. As mentioned in section 3.e, this was due to policy changes in the two countries that may be endogenous to the crisis.

Figure 4
Change in Issuance Frequency (number of issues, by issuance month)



The red line is a linear fit. The X-axes are scaled differently in each graph.
The vertical line marks the start of the financial crisis, September 2008.

e. Debt Issuance Information Strategies

One important question to be asked when studying the short-run decision making of DMOs is how much decision space they actually have: What decisions can they make in the short-term and what are made in the long-term and rarely, if ever, respond to immediate changes in the economic environment? This paper investigates this issue by determining whether a country publishes or announces a national debt issuance calendar/auction schedule/issuance strategy and reviewing the appropriate documentation in each country where it exists.

The investigation reveals that there are significant differences between countries as to what information they publish and how often. The variance is significant and ranges from Finland, which does not publish advance issuance information for bonds other than announcing bond issues a week before the auction date, to the UK, which announces bond maturities, coupons and indexation quarterly but announces the quantity to be issued in each issuance only a week before the issuance, to Germany, which publishes an annual debt issuance strategy which includes issuance dates, maturity, series and quantity, and generally holds to it. For the latter reason, Germany is not included in our sample, as the DMO does not make decisions relevant to the study in the short term. (See Appendix Table A5 for details by country.)

Based on this information, the DMOs in all other countries in the sample have the ability to select either the quantities to be issued or the maturities to be issued on a monthly basis and thus set the monthly weighted average TTM.

The investigation also revealed several country-specific issuance policy shifts, which may or may not be endogenous: Australia restarted issuance of T-bills from 2009 after a freeze begun in mid-2003; Israel began issuing T-bills in 2006 and changed policy to issue more often into fewer bond series. These policy shifts may affect the results and have not yet been fully mapped.

Future studies must also consider the effects of maturity swaps on average TTM, as these can radically change country risk profiles without being obvious to the public. Such effects need to be mapped out and detailed data must be retrieved across countries.

f. Conclusion from the results of sections 3.c–3.d

At the beginning of the crisis, with yields and central bank rates falling and expenditures and deficits expanding, countries in the sample increased the size and frequency of their debt issuance and enjoyed the benefits of the flight to safety due to the crashing markets. In this process they issued more short-term debt than they otherwise would have.

Later, when the crisis shifted from financial markets to European debt issues, yields and central bank rates continued to drop. Despite this, most countries in the sample issued less debt than during the financial crisis and at longer maturities. The likely justification for this is a combination of deficit reduction in those countries starting to bear fruit and reducing the quantity of new debt they needed to issue, and concern about either being perceived as risky by market participants or about the danger and relevancy of rollover risk even for developed countries. Another possibility is that risk increased in the European debt crisis relative to the financial crisis—but continually falling central bank rates, low growth and financial repression constrained domestic banks to buy government debt and thus keep yields low.

4. METHODOLOGY

To build on the conclusions of the previous section and more precisely evaluate the effects of the crisis and various economic variables on WATTM and issuance quantity, I use regression analysis for panel data. The equation I run is as follows:

$$Y_{i,t} = \alpha Y_{i,t-1} + \beta X_{i,t} + f_i + \varepsilon_{i,t}$$

where

$Y_{i,t}$ is the dependent variable, either WATTM or normalized real issuance, by country i in month t

$Y_{i,t-1}$ is the lagged dependent variable by country i in month t

$X_{i,t}$ is a vector of explanatory variables, some of them lagged and differenced

f_i is a vector of country fixed effect variables which take the value of 1 if country=i and the value of 0 otherwise

$\varepsilon_{i,t}$ is the error term

The regression coefficients are estimated using OLS with robust (Huber-White) and country-clustered standard errors. (Estimations with OLS using Newey-West standard errors to correct for possible serial autocorrelation give generally similar results and are presented in the robustness check in Tables 2, 4 and 5.)

Most of the explanatory variables enter the regression with one lag in order to avoid endogeneity problems because, as discussed in section 3.b, WATTM is a monthly decision for DMOs in the sample.

I include the lagged dependent variable in the explanatory variables because, while the choice of WATTM is a monthly one, it is often, if not always, part of a quarterly or annual issuance plan/guideline. This guideline generally includes a planned issuance quantity and an approximate debt instrument breakdown, which constrain the general issuance structure and might make WATTM a short-term mean reverting process.

Stationarity testing of the main variables using the Fisher test (Maddala and Wu, 1999) showed that the central bank interest rate, the CDS premia, the average rating and the level and the slope of the yield curve were not stationary. The null hypothesis of unit-root was rejected for their first differences and the levels and differences of the other variables.

Due to the relatively small number of clusters in the current sample, I run the basic regressions with and without country clustering. The results are broadly in line with the main results. I also run OLS with Newey-West standard errors to correct for possible serial correlation. These results are also broadly in line with the main results (Table 2, regressions 3–4).

Time dummies are included in some robustness checks in order to control for period-specific common changes across the panel in each month. Specifications that more explicitly control for specific global variables are presented in each table.

Some countries do not issue every month. There is thus a question of how to treat months with zero issuance. In this paper, those observations were treated as decisions not to issue in a particular month and were kept. As a robustness check the basic sets of regressions (Tables 2 and 3) were run twice—once with episodes of zero issuance as WATTM=0 and once excluding observations with either current and/or lagged zero issuance. The results were in line with the main results and are not presented here.

5. RESULTS

a. Hypotheses on Issuance and Quantity Response Functions

This section describes the expected effects of the explanatory variables on the WATTM and issuance quantity. Considering the common debt management objectives, it is expected that DMOs focusing on cost minimization will lower maturities if slopes rise, due to a simple supply/demand response. A focus on cost minimization will generate lower issuance

maturities when levels rise as well, with this contrarian stance lowering the cost of any debt issued, relative to its cost without the level change.

The effect of a change in the central bank rate is unclear, as its primary transmission channels—the yield curve and the CPI—are both controlled for in the same regression, but it is interesting as one of the primary fundamentals of yield curve level.

The expected effect of the CPI is also unclear as inflation both affects government spending, increasing the deficit and the need for short, cheap issuance, and reduces the existing non-indexed debt burden and increases fiscal space.

The industrial production index is commonly used as a proxy for economic growth. The expectation is that an increase in growth decreases risk and yield demanded and thus lowers the need for short maturities.

An increase in CDS premia and a drop in average rating should reduce maturities if the DMO is focused on cost minimization and increase them if the DMO focuses on risk minimization and signaling stability. These are included in one set of regressions to verify that the yield curves fully incorporate country risk.

Improvement in the global economy, as captured by industrial production and CPI in the advanced economies, should be risk reducing for the local economy and thus encourage longer maturities, while a crisis is expected to do just the opposite.

b. Explaining WATTM

The results of the regressions with WATTM as the dependent variable appear in Table 2. The results are in line with the descriptive results (section 3.f) and with priors implying a focus on cost minimization rather than risk reduction. The preferred regression is regression (1) (marked in grey). When the yield curve level goes up one percentage point, the DMO shortens the maturity of issuance by approximately a year. Based on average curves in the data, shortening by one year would reduce cost, on average, by 9 basis points pre-crisis, by 31 basis points during the financial crisis and by 28 basis points during the European debt crisis. Conversely, when the yield curve level falls, the DMO extends the maturity of issuance. This could also be the result of the DMO taking advantage of financial market instability and the resulting flight to safety to issue long maturities relatively cheaply. It is interesting that while the slope is negatively signed as expected, it is not significant. This implies that the tradeoffs between long and short yields, and the signals resulting from such, are less important to the debt manager than parallel changes in the absolute cost of funding. Neither crisis dummy variable is significant in regression (1), nor is any variable other than the yield curve level.

Table 2 includes three other specifications as robustness checks. Regression (2) includes time dummies in order to control for all period-specific effects, not just advanced country industrial production, CPI and the existence of a crisis. The differences between (1) and (2) suggest that the international variables and crisis dummies used so far do not capture all of the period-specific effects that the time dummies do. Regression (3) does not include country-clustered standard errors, in order to ensure that the relatively small number of countries does not distort the clustering. Regression (4) includes Newey-West standard errors, in order to correct for possible serial autocorrelation. The main results are very

similar across all four specifications, though with the following differences: In regressions (3) and (4) the sign of the lag of WATTM is positive and significant, suggesting a significant autocorrelation. In regression (2) CPI is positive and significant.

Table 2
Determinants of Weighted Average Time to Maturity on Issue

	1	2	3	4
Weighted Average Term to Maturity	Basic†	Time Dummies†	No Country Clustering	Newey-West Standard Errors
Lag Weighted Average Term to Maturity	0.152 [0.178]	0.179 [0.115]	0.152** [0.025]	0.152** [0.014]
Lag Change in Yield Curve Level	-0.813* [0.051]	-1.194** [0.029]	-0.813* [0.070]	-0.813** [0.023]
Lag Change of Yield Curve Curvature	0.013 [0.964]	-0.093 [0.775]	0.013 [0.967]	0.013 [0.960]
Lag Change of Yield Curve Slope	-0.015 [0.950]	-0.203 [0.675]	-0.015 [0.956]	-0.015 [0.955]
Lag Change in CPI	0.288 [0.191]	0.388** [0.046]	0.288 [0.147]	0.288 [0.121]
Lag Industrial Production Index	-0.009 [0.639]	-0.016 [0.413]	-0.009 [0.373]	-0.009 [0.377]
Lag Industrial Production Index in Advanced Economies	0.007 [0.834]		0.007 [0.774]	0.007 [0.778]
Lag CPI in Advanced Economies	-0.095 [0.499]		-0.095 [0.418]	-0.095 [0.421]
Financial Crisis Dummy	-0.341 [0.615]		-0.341 [0.446]	-0.341 [0.494]
European Debt Crisis Dummy	0.319 [0.664]		0.319 [0.287]	0.319 [0.291]
Country Fixed Effects Time Dummies Constant	Yes No 6.726** [0.036]	Yes Yes 12.888* [0.080]	Yes No 6.726*** [0.003]	Yes No 2.558 [0.276]
Observations R-squared Adjusted R-Squared	1028 0.313 0.3	1028 0.38 0.301	1028 0.313 0.3	1028

P values are in parentheses. *, ** and *** indicate statistical significance at the 10, 5 and 1 percent levels, respectively.
† The results include robust and country-clustered standard errors.

The positive significant sign of CPI in regression (2) and insignificant industrial production conflict with some results found in the literature. De Broeck and Guscina (2011) find that a rise in expected inflation reduces DLTF issuance and a rise in industrial production increases it, while Hoogduin, et al. (2011) find that a rise in lagged inflation increases the share of short financing, thus reducing average TTM. These differences may be due to the longer time frame and wider coverage of the dataset compiled for this paper.

In Table 3 the basic regression from Table 2 in presented, with the addition of interactions of the lagged dependent variable, the three yield curve variables, CPI and IP with both crisis variables. Joint f-tests are then run to determine the total effect of each variable during each period. The results of Table 3 show that, while the yield curve level was negative and significant before the crises, it became insignificant during the crises. The Table also shows that WATTM was significantly persistent during the financial crisis, meaning that countries that increased or reduced WATTM during the crisis tended to continue to do so. The significant positive sign of both crisis dummies in this regression show that the tendency was to increase WATTM during the crises.

Table 3
Interacted Determinants of Weighted Average Time to Maturity on Issue

Weighted Average Term to Maturity	Entire Period	Financial Crisis Interactions	Euro Crisis Interactions	Joint F-Test for Entire Period & Financial Crisis	Joint F-Test for Entire Period & Financial Crisis
Lag Weighted Average Term to Maturity	0.177 [0.172]	0.095 [0.546]	-0.227 [0.190]	0.273** [0.035]	-0.050 [0.759]
Lag Change in Yield Curve Level	-1.460** [0.027]	0.967* [0.095]	1.189 [0.371]	-0.493 [0.256]	-0.271 [0.808]
Lag Change of Yield Curve Curvature	-0.156 [0.652]	-0.032 [0.919]	0.99 [0.248]	-0.188 [0.547]	0.834 [0.289]
Lag Change of Yield Curve Slope	0.433 [0.250]	-0.755 [0.136]	-0.184 [0.784]	-0.321 [0.329]	0.249 [0.644]
Lag Change in CPI	0.014 [0.441]	-0.041** [0.025]	-0.023 [0.163]	-0.027 [0.212]	-0.009 [0.679]
Lag Industrial Production Index	0.204 [0.414]	-0.064 [0.884]	0.272 [0.354]	0.140 [0.748]	0.476 [0.154]
Lag Industrial Production Index in Advanced Economies	-0.007 [0.830]				
Lag CPI in Advanced Economies	-0.03 [0.826]				
Financial Crisis Dummy	3.579* [0.075]				
European Debt Crisis Dummy	3.571* [0.094]				
Country Fixed Effects Time Dummies Constant	Yes No 5.874* [0.067]				
Observations R-squared Adjusted R-Squared	1028 0.329 0.308				

The table presents one regression with interactions of all the individual country variables with the two crisis variables. It also presents joint F-Tests of each variable for the entire period with its counterpart for each crisis period.
P values are in parentheses. *, ** and *** indicate statistical significance at the 10, 5 and 1 percent levels, respectively.
† The results include robust and country-clustered standard errors.

In Table 4 two risk variables, CDS and average rating, are added to the regressions of Table 2 in order to check if the yield curves fully incorporate country risk. There is no CDS data available for approximately 300 observations in the sample, due, in part, to the fact that there are no CDS contracts for Canada, and, in part, to the fact that CDS contracts for many of the countries in the sample were not traded until 2006–2007. In order to ensure that omitting those observations does not bias the results, regression (1) in Table 2, above, is run on the smaller sample but without the risk variables.

The main results of Table 4 are very similar to those of Table 2, with several minor differences. The basic regression is identical, whether with or without risk variables, while in the time dummies regression CPI is no longer significant and industrial production is. Regressions (4) and (5) show the lag of WATTM as positive and significant and the financial crisis dummy as negative and significant. Neither risk variable is significant in any regression.

Table 4
Effect of Country Risk Variables on the Weighted Average Time to Maturity on Issue

	1	2	3	4	5
Weighted Average Term to Maturity	Basic†	Basic†	Time Dummies†	No Country Clustering	Newey-West Standard Errors
Lag Weighted Average Term to Maturity	0.141 [0.212]	0.142 [0.205]	0.179* [0.094]	0.142* [0.055]	0.142** [0.030]
Lag Change in Yield Curve Level	-0.931** [0.022]	-0.869* [0.053]	-1.522** [0.011]	-0.869 [0.117]	-0.869** [0.042]
Lag Change of Yield Curve Curvature	0.022 [0.948]	0.008 [0.982]	-0.183 [0.654]	0.008 [0.982]	0.008 [0.979]
Lag Change of Yield Curve Slope	-0.048 [0.863]	-0.052 [0.870]	-0.363 [0.520]	-0.052 [0.866]	-0.052 [0.869]
Lag Change in CPI	-0.004 [0.890]	-0.003 [0.906]	-0.004 [0.899]	-0.003 [0.831]	-0.003 [0.828]
Lag Industrial Production Index	0.24 [0.287]	0.234 [0.265]	0.549** [0.026]	0.234 [0.344]	0.234 [0.308]
Lag Industrial Production Index in Advanced Economies	-0.021 [0.694]	-0.022 [0.684]		-0.022 [0.540]	-0.022 [0.542]
Lag CPI in Advanced Economies	-0.114 [0.519]	-0.109 [0.505]		-0.109 [0.455]	-0.109 [0.432]
Financial Crisis Dummy	-1.224 [0.167]	-1.229 [0.154]		-1.229** [0.028]	-1.229** [0.038]
European Debt Crisis Dummy	-0.414 [0.672]	-0.434 [0.664]		-0.434 [0.307]	-0.434 [0.299]
Lag Change in Credit Default Swap Premium (Basis Points)		-0.001 [0.922]	0.011 [0.136]	-0.001 [0.930]	-0.001 [0.919]
Lag Change in Average Country Credit Rating		-1.557 [0.195]	-0.667 [0.463]	-1.557 [0.164]	-1.557 [0.139]
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes
Time Dummies	No	No	Yes	No	No
Constant	5.897 [0.213]	5.927 [0.212]	6.271*** [0.006]	5.927* [0.056]	5.353 [0.106]
Observations	768	768	768	768	768
R-squared	0.246	0.247	0.349	0.247	
Adjusted R-Squared	0.227	0.226	0.231	0.226	

P values are in parentheses. *, ** and *** indicate statistical significance at the 10, 5 and 1 percent levels, respectively.
† The results include robust and country-clustered standard errors.
The results of running regression (1) from Table 2 on this smaller sample are included for purposes of comparison with the full sample.

The results of this section show that cost minimization was the primary motivation of debt managers before the crises and that this motivation did not continue into the financial and European crises. During the crises there was a general shift towards raising WATTM, which was not driven by yield curve, risk or growth variables.

c. Explaining Issuance Quantity

All the issuance figures were converted to euros so that they would be comparable. I chose the euro as it was the currency most prominently issued already—common to the 3 eurozone countries in the sample and the majority of the foreign currency issues of Poland and the Czech Republic. To create the total real issuance variable, I first used local inflation in each country to convert its issuances to real January 2005 euros. I then created a normalized issuance variable for each country, in order to get the coefficients of the variables in standard deviations of normalized real debt issuance.

The lag-normalized real debt issuance is significant and positive in Table 5, which makes it clear that issuance quantity is persistent. Lagged WATTM is significant and negative, showing an intertemporal trade-off in the decision of how much to issue versus how long to issue for. The positive sign of the financial crises is somewhat offset by the negative sign of developed country IP, making the impact of the crises on issuance quantity significant but tied to the monthly state of the advanced economies. The number of issuances is naturally positive and significant, as there are upper bounds to the practical size of the individual issuance, in terms of market liquidity. The yield curve curvature is also positive and significant but its interpretation is unclear.

Table 5
Determinants of Normalized Real Debt Issuance (Normalized by Country)

	1	2	3	4
Normalized Real Debt Issuance	Basic†	Time Dummies†	No Country Clustering	Newey-West Standard Errors
Lag Normalized Real Debt Issuance	0.272*** [0.000]	0.273*** [0.000]	0.272*** [0.000]	0.272*** [0.000]
Lag Weighted Average Term to Maturity	-0.046*** [0.001]	-0.040*** [0.005]	-0.046*** [0.000]	-0.046*** [0.000]
Lag Number of Debt Issuances	0.019** [0.044]	0.021* [0.064]	0.019*** [0.002]	0.019*** [0.002]
Lag Change in Yield Curve Level	-0.029 [0.830]	-0.143 [0.546]	-0.029 [0.849]	-0.029 [0.851]
Lag Change of Yield Curve Curvature	0.079* [0.056]	0.044 [0.461]	0.079 [0.323]	0.079 [0.285]
Lag Change of Yield Curve Slope	0.16 [0.106]	0.035 [0.814]	0.160* [0.059]	0.160** [0.049]
Lag Change in CPI	0.035 [0.446]	-0.031 [0.678]	0.035 [0.567]	0.035 [0.567]
Lag Industrial Production Index	-0.006 [0.217]	-0.006 [0.312]	-0.006* [0.076]	-0.006* [0.091]
Lag Industrial Production Index in Advanced Economies	-0.018** [0.012]		-0.018** [0.011]	-0.018** [0.013]
Lag CPI in Advanced Economies	0.041 [0.189]		0.041 [0.265]	0.041 [0.260]
Financial Crisis Dummy	0.343* [0.075]		0.343** [0.023]	0.343** [0.023]
European Debt Crisis Dummy	0.435*** [0.008]		0.435*** [0.000]	0.435*** [0.000]
Country Fixed Effects	Yes	Yes	Yes	Yes
Time Dummies	No	Yes	No	No
Constant	2.142*** [0.001]	0.566 [0.404]	2.142*** [0.002]	2.099*** [0.002]
Observations	1025	1025	1025	1025
R-squared	0.291	0.392	0.291	
Adjusted R-Squared	0.276	0.312	0.276	

P values are in parentheses. *, ** and *** indicate statistical significance at the 10, 5 and 1 percent levels, respectively.
† The results include robust and country-clustered standard errors.

Table 6
Interacted Determinants of Normalized Real Debt Issuance

Normalized Real Debt Issuance	Entire Period	Financial Crisis Interactions	Euro Crisis Interactions	Joint F-Test for Entire Period & Financial Crisis	Joint F-Test for Entire Period & Financial Crisis
Lag Normalized Real Debt Issuance	0.221*** [0.001]	0.023 [0.855]	0.107 [0.262]	0.244* [0.087]	0.327*** [0.000]
Lag Weighted Average Term to Maturity	-0.032* [0.071]	-0.025 [0.429]	-0.033 [0.170]	-0.058* [0.074]	-0.065*** [0.002]
Lag Number of Debt Issuances	0.008 [0.499]	0.019 [0.294]	0.019 [0.198]	0.027* [0.087]	0.027*** [0.003]
Lag Change in Yield Curve Level	0.012 [0.961]	-0.076 [0.856]	-0.034 [0.909]	-0.065 [0.847]	-0.023 [0.887]
Lag Change of Yield Curve Curvature	0.069 [0.572]	0.088 [0.687]	0.045 [0.829]	0.157 [0.276]	0.114 [0.386]
Lag Change of Yield Curve Slope	0.2 [0.182]	-0.022 [0.906]	-0.083 [0.715]	0.178 [0.320	0.117 [0.393]
Lag Change in CPI	-0.017 [0.813]	-0.08 [0.620]	0.184 [0.294]	-0.097 [0.499]	0.166 [0.229]
Lag Industrial Production Index	0.006* [0.097]	-0.007 [0.327]	-0.016** [0.020]	-0.001 [0.942]	-0.009* [0.089]
Lag Industrial Production Index in Advanced Economies	-0.028*** [0.000]				
Lag CPI in Advanced Economies	0.04 [0.201]				
Financial Crisis Dummy	0.94 [0.227]				
European Debt Crisis Dummy	1.979** [0.014]				
Country Fixed Effects	Yes				
Time Dummies	No				
Constant	1.759** [0.029]				
Observations	1025				
R-squared	0.31				
Adjusted R-Squared	0.283				

The table presents one regression with interactions of all the individual country variables with the two crisis variables. It also presents joint F-Tests of each variable for the entire period with its counterpart for each crisis period.
P values are in parentheses. *, ** and *** indicate statistical significance at the 10, 5 and 1 percent levels, respectively.
[†]The results include robust and country-clustered standard errors.

6. CONCLUSION

This paper has described and analyzed public debt issuance in 11 OECD countries in 2004–12 using a newly constructed database. It has identified crisis-related changes in the quantity and maturity of debt instruments used by those countries since the start of the financial crisis in 2008.

Governments in the sample countries responded to the financial crisis by increasing debt issuance and increasing the maturities at which they issued, due to both increased funding needs brought on by the crisis and to the low cost of sovereign funding derived from their risk-free status.

While the findings show that debt management offices focused on debt cost minimization before the financial crisis, the average WATTM on issuance rose during the crises, when the DMOs' focus shifted to crisis response. This is a significant finding, as it means that advanced economies tended during these crises to engage in prudent debt management, following IMF guidelines, rather than increasing short term risk in order to pick up pennies in front of a steamroller.

This paper is a work in progress. Among the targets of that progress are: expansion of the database to cover more, and eventually all, OECD countries; explaining differences in issuance structures—choices of indexation/foreign currency/floating interest rates/number, and size and type of issuance; incorporating maturity swaps into the database and evaluating their effects on average TTM and rollover risk.

Appendix

Table A1: Debt Issuance Database Coverage

	period available	Number of Monthly observations	Number of Issues in Sample
Australia	01/2004–08/2012	104	672
Belgium	01/2004–10/2012	106	641
Canada	01/2004–03/2011	87	1,120
Czech Republic	01/2004–09/2012	105	441
Denmark	01/2004–10/2012	106	1,510
Finland	01/2004–07/2012	103	211
Germany	01/2005–10/2012	94	405
Israel	01/2004–06/2012	102	2,344
Netherlands	01/2004–10/2012	106	728
New Zealand	01/2004–08/2012	104	1,574
Poland	01/2004–11/2011	95	630
South Korea	01/2004–05/2005, 07/2008–12/2011	60	226
UK	01/2004–08/2012	104	1,555

Table A2: Three-Period Statistics of Total Debt Issuance
(monthly aggregation, billions of euros, current prices)

		2004–08/2008	09/2008–2009	2010–2012
Australia	mean	0.3	3.1	6.9
	sd	*0.2*	*2.2*	*2.4*
Belgium	mean	8.4	10.3	9.5
	sd	*5.5*	*4.3*	*3.5*
Canada	mean	18.6	30.4	31.4
	sd	*4.3*	*5.5*	*5.5*
Czech Republic	mean	1.2	1.3	1.1
	sd	*0.7*	*1.1*	*0.6*
Denmark	mean	1.1	2.7	2.3
	sd	*1.1*	*2.3*	*1.0*
Finland	mean	1.3	2.8	2.5
	sd	*1.7*	*3.3*	*2.3*
Israel	mean	0.5	1.2	1.3
	sd	*0.4*	*0.3*	*0.3*
Netherlands	mean	7.5	21.2	13.4
	sd	*3.3*	*8.1*	*4.2*
New Zealand	mean	0.5	1.0	1.6
	sd	*0.1*	*0.4*	*0.4*
Poland	mean	2.4	2.8	2.8
	sd	*1.1*	*1.0*	*1.5*
South Korea	mean	3.1	3.1	3.6
	sd	*1.5*	*0.9*	*0.8*
UK	mean	16.8	32.8	34.8
	sd	*3.5*	*10.0*	*6.8*
Total	mean	5.4	9.4	8.6
	sd	*6.9*	*12.2*	*11.2*

Table A3: Three-Period Statistics of Weighted Average TTM
(in years, monthly aggregation)

		2004–08/2008	09/2008–2009	2010–2012
Australia	mean	7.8	5.0	3.7
	sd	*4.5*	*3.1*	*1.1*
Belgium	mean	3.2	1.9	4.6
	sd	*3.1*	*1.2*	*3.4*
Canada	mean	1.3	1.5	1.5
	sd	*0.7*	*0.6*	*0.6*
Czech Republic	mean	3.7	4.8	4.3
	sd	*2.5*	*3.2*	*2.7*
Denmark	mean	4.1	8.1	5.1
	sd	*1.8*	*8.0*	*3.6*
Finland	mean	1.4	1.9	4.8
	sd	*2.8*	*4.0*	*6.1*
Israel	mean	9.3	7.1	6.2
	sd	*3.1*	*1.4*	*1.0*
Netherlands	mean	2.6	1.4	3.4
	sd	*3.0*	*1.0*	*2.4*
New Zealand	mean	1.6	2.3	3.5
	sd	*0.6*	*1.0*	*1.0*
Poland	mean	5.3	3.7	5.1
	sd	*2.8*	*1.6*	*2.5*
South Korea	mean	6.6	6.5	8.4
	sd	*1.4*	*1.4*	*0.5*
UK	mean	8.1	8.4	7.9
	sd	*3.9*	*2.1*	*2.5*
Total	mean	4.3	4.4	5.0
	sd	*3.8*	*3.9*	*3.3*

Table A4: Three-Period Statistics of Number of Issues (monthly aggregation)

		2004–08/2008	09/2008–2009	2010–2012
Australia	mean	1	10	14
	sd	*1*	*7*	*4*
Belgium	mean	5	7	6
	sd	*2*	*3*	*3*
Canada	mean	10	12	12
	sd	*2*	*2*	*2*
Czech Republic	mean	4	4	4
	sd	*1*	*2*	*1*
Denmark	mean	16	14	11
	sd	*9*	*6*	*5*
Finland	mean	2	2	3
	sd	*2*	*2*	*2*
Israel	mean	10	34	41
	sd	*8*	*10*	*10*
Netherlands	mean	5	13	8
	sd	*1*	*4*	*2*
New Zealand	mean	11	16	23
	sd	*4*	*5*	*4*
Poland	mean	7	7	5
	sd	*3*	*3*	*2*
South Korea	mean	3	4	4
	sd	*1*	*1*	*0*
UK	mean	13	18	18
	sd	*2*	*2*	*2*
Total	mean	7	12	13
	sd	*6*	*9*	*11*

Table A5: Issuance Information Strategies

	Bonds		T-Bills		Comments
	Maturity	Quantity	Maturity	Quantity	
Australia	Announced week before tender	Announced week before tender	Announced week before tender	Announced week before tender	Announce planned approximate total yearly issuance annually. Will issue indexed bonds almost every month.
Belgium	Announced week before tender	Announced week before tender	Announced annually		Announce auction dates annually, cancel some during the year.
Canada	Tender dates and maturity announced quarterly	Announced week before tender			Announce planned annual total issuance and series which will be issued into annually.
Czech Republic	Announced middle of previous month	Announced middle of previous month			Publish annual issuance calendar with tender dates and approximate total annual issuance.
Denmark	Announced week before tender	Announced week before tender			Announce planned annual total issuance and some tender dates annually.
Finland	Announced week before tender	Announced week before tender	Announced week before tender	Announced week before tender	Announce planned annual total issuance and quantity planned for T-bills and bonds.
Israel	Announced end of previous month	Announced on a rolling 3-month basis	Announced end of previous month	Announced end of previous month	
Netherlands	Announced quarterly	Approximate amounts announced quarterly			Publish annual issuance calendar with tender dates, general guidelines on what will be issued during the year and approximate total annual issuance.
New Zealand	Announced business day before tender	Either announced business day before tender or quarterly (See notes)	Announced business day before tender	Announced business day before tender	Announce annual total issuance twice yearly. Announce tender dates quarterly, occasionally with defined quantities for all tenders.
Poland	Announced week before tender	Announced week before tender			Tender dates published quarterly.
South Korea	Announced end of previous month	Announced end of previous month	Announced end of previous month	Announced end of previous month	Announce planned annual total issuance annually.
UK	Announced quarterly	Announced week before tender	Announced quarterly	Announced quarterly	Publish annual issuance calendar with tender dates, general guidelines on what will be issued during the year and approximate total annual issuance.

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