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Long-term Government Bond Yields

and Macroeconomic Variables

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Abstract

This thesis investigates the relationship between how much economic influence a country has and how much risk the market assesses associates with that country. This is done by regressing macroeconomic variables with theoretical effect on the repayment ability of a sovereign state, upon 10-year government bond yields. We examine a panel data model consisting of OECD countries between 1980 and 2013. We divide the countries into two groups: the G7 group and small countries. We find that there are distinguishable differences between larger and smaller countries and that there is evidence for the US having a special position in the world economy. The results are however somewhat distorted by the latest financial crisis. Smaller countries are harsher judged on their unemployment rate and budget balance whereas larger countries are more likely to experience a decrease in bond yields as their net lending increases. The US has a higher correlation between its GDP growth and bond yield and has apart from the other large countries also a positive effect of running a deficit in the current account, positive effect meaning a negative relation between the two as a lower bond yield is generally desirable. The effect from government debt does not seem to be much difference between the groups but is slightly stronger among larger countries.

Key Words: Government bond, sovereign bond, 10-year bond, long term bond, yield, macroeconomic variables, G7, OECD, USA.

1. Introduction

Government bonds are used to fund a government's expenses including repaying old bonds becoming due. A government typically issues bonds for a fixed amount through an appropriate authority, in the US case the U.S. Treasury, at a beforehand decided interest rate. The market then decides whether the bonds are a good investment given a list of factors, not the least the credit rating of the issuing country. That aside, bond yields are mainly determined by the issuer's perceived creditworthiness, its general risk and in some cases an exchange rate risk. The risk that a nation will default is generally regarded to be low (even though there have been cases of default in the past) and sovereign bonds are generally issued at low yields. Even though it is rare that sovereign bond is not fully subscribed, it occurs every now and then, indicating that the market perceives the yield to low given the risk involved and in relation to other investment alternatives.

This article looks at two sets of countries: the G7 and a set of eight other OECD countries. We use this division as we want to elucidate how a country's influence on the world economy affects its bond yield. To do this we look at how macroeconomic variables affect the bond yields in the two groups; thereby capturing how much risk the market perceives is connected to the different explanatory variables and the economic influence of a country (here we assume that the countries within the groups are more or less homogenous). We investigate data from 1980-2013 and use 10-year government bonds issued in USD, thereby making the exchange rate risk less palpable as the USD is the benchmark currency of the world. Furthermore, given that the US has a special position as the world's leading economy, meaning it has the most power to affect the world market, we will investigate if this notion makes investors judge the US variables differently from all other countries in the sample.

To untangle these possible advantages (the hypothesis is that any differences most likely will be advantages, an assumption widely supported in international economics), we will compare the G7 countries to a group of ad hoc selected OECD countries which were chosen based on past financial stability for reliable data and availability of data.

Apart from the 10-year bond yields, we have data on a set of macroeconomic variables between the years 1980 and 2013. Based on previous studies the variables have been divided into basic and additional data; basic variables will be used in almost all regressions whereas additional variables only will be added to a regression of basic variables.

Our results suggest that both the G7 and especially the USA has a favored position in the bond market, compared to the other, smaller, OECD countries we have included in our data set. The G7 countries show much less sensitivity to fiscal deficits as well as to unemployment rate. The US, apart from being a G7 country, has an advantage in the fact that both current account and net lending seems to have a significant negative effect on their long term bond yields.

This thesis will start by introducing the economic theoretical framework concerning how macroeconomic factors can affect an economy (and in extension its ability to repay loans) and a summarization of previous studies in the field. Following that, we present the data set and explain the method used to derive our results. The largest part of the thesis is however the results and analysis section, where all the findings will be thoroughly presented, followed by a short segment with robustness checks. Lastly we summarize the main takeaways in the conclusion ending with suggestions for future research.

2. Theory

The purpose of this section is to provide a short theoretical motivation of the selected variables as well as providing the reader with additional understanding for the mechanism of estimating the risk attached to a sovereign bond.

Macroeconomic theory tells us that running large budget deficits and consequently increasing ones sovereign debt encourages the interest rate to increase. It leads to hindered economic growth via for instance a decreased investment rate in the long run. The dampening investment effect and the declining GDP growth rate is reflected by the rise in the long-term government bond yields.

Let us now attach the above statement with a more in-depth theoretical analysis of the interaction between the various economic factors and their effects on the long-term bond yields. To unravel the different relations we will begin with the IS-LM model, which is a natural starting points in the search of suitable explanatory variables. Through the perspective of a large economy an increase in net exports or in government expenditure, via for instance larger fiscal deficit caused by a rise in the debt level, will push the equilibrium to shift and results in a higher interest rate level. However, a reverse effect on the interest rate occurs when the domestic money supply expands, which is clear by looking at the LM-curve (Pilbeam, K., 2013).

It is obvious by consulting the Mundell-Flemming model that there is a positive relationship between deficit and interest rate i.e. debt financing rises the interest rate and it might possibly contribute to a crowding out effect or, additionally, it expands output via a stimulation of aggregated demand. The long run is, however, quite different and according to Bernheim (1987) it is a rather difficult assignment to describe it. Since the Keynesian IS-LM model requires numerous assumptions, Bernheim summarises the long run effects to be a fairly complex issue, as various effects cannot be excluded from the analysis. Thus, theoretically it is a rather difficult task to properly depict as it can easily be entangled through perspectives covering short and long run effects.

Bearing the complex nature in mind let us make an attempt to picture the whole theoretical image. Through the eyes of the monetary policy we can investigate the short and long run interest rate by introducing the expectations hypothesis. In short, the long-term interest rate depends on the average of today's and the forecasted short-term interest rate levels:

$$i_t^l \approx \frac{1}{n}(i_t + i_{t+1}^e + i_{t+2}^e + i_{t+3}^e + \cdots + i_{t+n-1}^e) \quad (1)$$

The equation is expressed in logs on both sides. A crucial assumption that is embedded in the formula is the risk neutrality; otherwise if investors are believed to be risk aversive one has to include a corresponding risk premium

because it works as a compensation factor for the investors to bear the underlying asset (Sørensen & Witter-Jacobsen, 2010). A similar relation is expected when referring to inflation and its effect on the government bond yield. Ceteris paribus, an increase in inflation leads to, potentially, a climb on the long-run Phillips curve (Sørensen & Witter-Jacobsen, 2010). In other words, the inflation variable is believed to have a positive effect on the long-term yield. The current account and its shifting factors vary negatively with the yield curve as a higher net export lowers the spreads via a stronger position in the balance of payments hence providing a growth in GDP (Pilbeam, 2013).

Combining the descriptions of the small selection of some of the explanatory variables and their contributions to the riskiness of default, expressed through the changes of the yield rates, it becomes obvious that factors related to risky aspects lower the distance to default. Since for example reckless government borrowing decreases the distance, it means that in order to attract investors the compensation has to be increased because of the additional risk level rise of the government bond. Turning our attention to the other side, we have aspects that affect the economy positively, i.e. increases the distance to default, resulting in a yield decline via for instance a higher GDP growth, lower unemployment rate or, as mentioned previously, stronger current account figures.

3. Empirical Studies

This section covers previous studies in the field, which naturally is our starting point. In brief, the related studies point toward complex relationships depending on the various statistical approaches and the variables' characteristics. At the end of the section there is a short summary highlighting the key information.

In theory, higher government bond yields are connected with for instance unstable fiscal positions such as a large fiscal deficit. The vulnerable situation corresponds to an equilibrium rise in the interest rate, which in turn is a result of a new allocation of resources leading to a crowding out effect. Additionally, an unhealthy fiscal position encourages a heavier inflationary pressure because of a more aggressive monetary policy. Moreover, a further rise in fiscal deficit contributes to an increase in the interest rate and thus increases the bond yield.

Such scenario is regarded as a compensation of the riskiness of the underlying asset, which potential investors have to bear. In other words, the associated risk level emphasises that the probability of default should change to the corresponding level (Gruber W & Kamin B, 2010).

In order to understand the complexity of fiscal variables have on the yield spreads, Alper & Forni (2011), Baldacci & Kumar (2010) and Ardagna et al. (2004) address the presence of possible nonlinearity dilemma. Such scenario would lead to, at a certain debt level, an acceleration effect. In fact, Baldacci & Kumar (2010) point, in their conclusion, that one of their main discoveries is the presence of such acceleration effect on long-term interest rate contributed by fiscal deterioration whereas Alper & Forni (2011) suggest that by excluding a control vector that grasps inter alia the current account balance to GDP only then a U-shape curve occurs. Returning to Ardagna et al. (2004) who use a panel data for 16 OECD countries show of a time span of 1960-2002 discover strong evidence of non-linearity in the public debt that is: the long-term interest rate responses negatively to an increase in the public debt to GDP ratio if for instance the ratio is below 62.5 per cent. Moreover, a 10-basis-point rise in the nominal interest rate on the ten-year government bonds is caused if, ceteris paribus, the primary deficit-to-GDP rises. In other words, an unhealthy fiscal deficit and a growing public debt are both accelerating faster in relation to the corresponding amounts. However, going back to Gruber W & Kamin B (2010), who found that such acceleration effect should be more present during turbulent times, is overall statistically insignificant[1]. Hence, the contradiction that appears is another indication of its complexity.

Furthermore, Engen & Hubbard (2004) focuses, inter alia, on the long-term USA government bond yield and the results do somewhat intertwine with the complexness findings of the acceleration effect. In their results, that covers mid 70's and ends in early 00's, they show that potentially better estimates would be

[1] In brief, Gruber & Kumar use panel data samples consisting of OECD countries and a G-7 sample stretching from 1988 up to 2007. Baldacci & Kumar use the same method for a panel during 1980-2008 of 31 advanced and emerging economies where the advanced are for example: Australia, Denmark, Germany, Japan, USA and so forth.

to include five years forecasts of debt to GDP instead of the current debt to GDP variable since the forecasted variable is significant at a percentage level of 10. In short, Gruber & Kamins' (2010) main results display a relationship where one percentage increase in structural deficit or net debt ratio to GDP contribute to a 15 and 2-percentage boost in the yield curve respectively, for G-7 countries. As the results are roughly half the size when looking at the OECD countries sample, the G7 estimations' size corresponds to the idea that their bond yields have a higher degree of market driven factors as determinants .

Baldacci & Kumar (2010) use a slightly different approach that involves the utilisation of an interactive dummy variable that aims to capture the acceleration effect of the corresponding fiscal deficit and a country's characteristics. The inclusion of interactive term augments the model, which sheds further lights on the role fiscal variables have on the yield structure. In general, a higher deficit creates a tougher path toward recovery. Secondly, during turbulent periods negative shocks produce higher volatility debt dispersions for countries with high fiscal deterioration. Thirdly, higher debt levels rises the interest rate because it responses to the changes in the fiscal deterioration (Baldacci & Kumar, 2010).

The recent crises challenge the economic markets' conditions. In the midst of the financial crisis Aßmann and Hogrefe (2009) provide an insight of the pre-and post crisis's impact on the long-term Euro government bonds. By adopting a trader's point of view of default risk[2] they were able to show that during a few weeks in 2003 there was a shift in the yields' structure. The period of pre-2003 all the four ratio-variables are significant whereas post-2003 only debt to GDP ratio is significant followed by, again, the four variables become significant at the brink of the financial crisis. In summary, because of the single currency the yield spreads work as a mirror image of the Euro-area's liquidity and credit risk.

[2] A trader's main risk indicators are believed to be forecasts of: debt ratio, budget balance ratio and current account ratio where all are relative to their specific countries' GDP. Also, they use the outstanding amount of domestic debt securities of the public sector in order to proxy the market capitalisation i.e. liquidity risk. Lastly, since the sample space covers early years of 21th century up to March 2009, weekly data adjusted to German bond spreads of the ten oldest EU-members have been used.

Although Aßmann and Hogrefe (2009) statistically found a relationship between macro variables and the yield curve, Barrios et al. (2009) argue in order to receive a deeper, and perhaps a clearer, picture of the interaction of these variables it preferably is an advantage to use quarterly data rather than weekly data. More specifically on average, a one-percentage increase in a Euro-country's fiscal deterioration boosts the yield with 2,4 basis point relative to the German yields spreads.

Combining Barrios et al. (2009) results with studies such as Baldacci & Kumar (2010), a heavier emphasis of acceleration scenarios appear to exist for at least Euro-countries during the early 21th century years. In order to avoid collinearity Barrios et al. omits the fiscal balance when focusing on the impact of the debt variable and its squared term, both lagged by one quarter. The facts that both variables are statistically significant indicate of non-linearity nature. In addition since the value of the squared term is higher than debt itself point toward a faster acceleration effect of the yield curve (2009).

A common feature of Barrios et al and Aßmann & Hogrefe (2009) is the finding that the debt level in the Euro-area helps to, rather successfully, explain one of the underlying forces driving the long-term government bond yields. Moreover, Barrios et al. (2009) state that generally because of the unstable public finances channelled through high current account deficits and debt levels put further financial constraints thus decreases the distance to default for a Euro member.

Continuing on the focus of the EMU government bond spreads another economic and statistical approach is to substitute the fiscal variables with rating data provided by rating agencies. In fact, Manganelli & Wolswijk (2009) argue that by doing such replacement it will benefit the estimates because rating data do not only include current fiscal positions but also future, i.e. forecasts, of the variables. In brief, the methodical approach to capture the different yield levels a logical way is to use the German long-term government bonds as a benchmark since it is rated: AAA. Next step is to calculate the difference between triple bond and AA+ and continue in the same manner for the gap between AA+ and non-AA+ bonds.

This procedure gives the associated risk premiums corresponding to the various distances to default intervals.

As previously mentioned[3], the role of the interest rate is found to be one of the underlying macroeconomic factors supported by statistically significance. In other words, a high rate level pushes the yield curve upwards. Moreover, in an occurrence of a downgrade event it leads to austerity fiscal measures that automatically push up the interest rate. Obviously, the opposite scenario happens in a time characterised with loose monetary policies linked with low interest rates that contribute to an overall yield spread reduction (Manganelli & Wolswijk, 2009).

Although Ludvigson & Ng (2009) mainly focus on the macro factors interaction in the US bond risk premium there is, however, a correlation when combining their findings with spread fluctuations in the Euro-market when taking into account international factors done by Manganelli & Wolswijk (2009). In short Ludvigson & Ng (2009) are able to show that US risk premiums and excess bond returns are determined by various macro factors, such as inflation. Furthermore, it is necessary to mentioned that in spite of a large monthly data, which begins in January 1964 and ends in December 2003, it consists of one and up to five year coupon US government bond prices[4]. The authors are able to establish predicative estimation powers that unfortunately decline the longer the forecasted periods are. Nonetheless, it is clear that such factors play important role of explaining the US government bond yields (Ludvigson & Ng, 2009).

Combining the previously stated empirical facts, Manganelli & Wolswijk (2009) use the ten-year US government bond as a benchmark leading to discoveries, for example interest rate variable continues to be significant and positive, that support the influential aspect of international factors at the Euro government bond market. Needless to say, the US economy seems to play an important global factor, which spills over into the EMU government bond markets. Alper & Forni

[3] Please see for instance: Baldacci & Kumar (2010)

[4] For interested readers please view page: 5036 for more detail description of the data.

(2011)[5] point to a similar tendency as they conclude that the interest rate and its channel is a successful factor when addressing the various spillover effects caused by advanced economies where especially USA's long-term interest rates have externalities characteristics on other OECD yields.

In a time span that covers almost the entire decade of the nineties, Claessens et al (2007) present support that combine lower inflation rates relate to larger local government bond markets. The reason is because a low rate also has low inflation volatility leading to a non-inflate debt situation, which in turn makes the debt level less risky.

Interestingly, Alper & Forni (2011) point toward a negative relationship between yields and expected inflation, meaning that it decreases the yields in the advanced economies (2011). Comparing their results with Arslanalp & Poghosyan (2014), who investigate several advanced economies in quarterly panel data over 2004-2012, it becomes clear that the influential aspect of inflation as a yield determinant is rather ambiguous. Theoretically higher expected inflation results in a higher yield level, which is proposed by Arslanalp & Poghosyan. Regardless (2014) of having a small impact, nonetheless it helps to explain the variation of the dependent variable. Al other variables constant, a 1-percentage change fluctuates the bond yield by 18-23-percentage movement. The minor change mirrors the statement that in advanced economies inflation expectations are kept at low levels thus long-term investor regard the importance as a diminishing factor.

In contrast to Baldacci & Kumar (2010) who, in overall, point toward an insignificant negative GDP growth effect on the bond spreads whereas Arslanalp & Poghosyan (2014) manage to statistically present a negative relationship between yield and growth levels explained by the possibility that quarterly data grasp the fluctuations better than annual data. The insignificant argument of GDP growth is further supported by Alper & Forni (2011) since their results show a

[5] The sample space covers panel data of the years 2002-2010 for both advanced and emerging economies.

non-significant connection on expected one-year real GDP growth has on advanced economies long-term government bonds.

Obviously, the mixed findings provide different insights of the OECD economies' yield levels. The different results depend, among other things, on the econometric methods and the data's characteristics.
Another interesting aspect that should be highlighted is the interplay between current account and the magnitude of the debt level. Nickel & Vansteenkiste (2008) point toward in their panel data analysis of 22 industrial economies stretching between 1981 up to 2005 found that in their reduced country sample consisting of the eleven largest euro area countries show that the interaction becomes insignificant when the GDP debt level ratio exceeds 80 %.

To summarise the key aspects there are diffuse findings concerning the contribution of debt to GDP of the yield curve. In addition, the equivocality involve an absent or an occurrence of potential debt acceleration effects captured by the variable: $debt^2$. Short-run interest rate with its statistical significance appears to affect to government bonds positively whereas expected inflation does not share the equivalent clear interpretation. In other words the unclear reflection is stressed by for instance results presented by Alper & Forni (2011) who found a negative relationship upon the yield structure. Finally, GDP growth ratio does not generally help to reveal the complicated long-run government bond subject.

4. Data

The data section will briefly introduce the reader to the data we have collected.

We will use a panel data model to study the difference between the two groups. The G7 group consists of USA, Japan, Germany, United Kingdom, France, Italy and Canada with an average GDP of 3.727.126.392 USD in 2012 years nominal values. The small countries group consist of Spain, Australia, the Netherlands, Belgium, Switzerland, Austria, Denmark and Finland with an average GDP of 458.315.354,

again with 2012 years nominal values[6]. The intuition behind this division is to investigate if economies that arguably can affect the world economy more (G7 countries) can be significantly distinguished from smaller western countries. The data start in 1980 and ends in 2013 and are on an annual basis.

The selection of what variables to include was done by testing after having gathered possible affecting variables from the IS/LM model. The variables included in our regressions are; the dependent variable: 10-year bond yields, basic variables: short-term interest rate, inflation, GDP growth, government debt as percentage of GDP and Budget balance as percentage of GDP, and the additional variables: unemployment rate, current account balance as percentage of GDP and net lending/borrowing as percentage of GDP. All data have been collected from the databases "OECD Economic outlook" and "Datastream" and have been estimated via Eviews. However, the panel data are not entirely completed since there are missing values in the beginning and at the end of the sample space i.e. early years of 1980's and for some variables during 2013. A detailed description of the data is available in Appendix. The appendix also contains descriptive statistics and figures of the data.

5. Model and Method

This part will clarify how we have constructed our model and what specifications we have used for our regressions. We will also explain why we do so and justify our choice of method.

The econometric estimation are done by constructions of fixed effects panel least squares (for a detailed description of fixed effects please see: Kennedy 2008) through general to specific approach and Generalized Method of Moments (GMM). With White's period robust standard errors the PLS regression[7] is:

$$y_{it}^{10Y} = \alpha_i + \beta_1 r_{it} + \beta_2 \pi_{it} + \beta_3 g_{it} + \beta_4 d_{it-1} + \beta_5 d_{it-1}^2 + \beta_6 b_{it-1} + \delta x_{it} + \varepsilon_{it} (2)$$

[6] See appendix for the list of selected countries with GDP.

[7] In matrix notation we have: $Y = X\beta + \epsilon$ expressed in panel data form under the assumption of no heteroscedasticity and stationary properties (Wackerly et al. 2008)

where r_{it} is the short-term interest rate, π_{it} is the inflation rate and d_{it-1} is the previous year's debt to GDP ratio, d_{it-1}^2 capture debt's acceleration effect, b_{it-1} represents the previous year's fiscal balance to GDP ratio in per cent, x_{it} represents different included variables such as unemployment rate, current account and net lending. Finally, all explanatory variables are expressed in percentage form.

All variables have been tested for stationarity using an Augmented Dickey Fuller (ADF) test[8]. All variables except the current account are stationary. However, it is assumed to be stationary in the long run and therefore the decision was made not to investigate stationary characteristics further in order not to loose potential important information, which can of course penalise our estimations and analyses. In brief, there is a trade off between correct economically interpretations and achieving good statistical properties. Moreover, such trade off creates other problematic issues for instance the credibility of misspecification test for example structural break test. Potential non-linearity or non-stationary problems make Ramsey RESET tests unreliable (Banerjee et al. 2010) and henceforth we ask the reader to bear the trade off issue in mind.

Because of the dilemma the GMM approach works as a back up approach because it relaxes some of the OLS assumptions and instead uses an instrumental variable, we use lagged dependent variable that grasps different method of moment problems (Verbeek, 2012). Lastly, correlation matrices for the different variables and descriptive statistics are presented in the appendix. The OLS-method regressions have been estimated with fixed cross-section and period effects and white period robust standard errors. In the case of using GMM, the regressions have been estimated using fixed period effects but with a difference cross-section effect using AB 1-step GMM weights and white period standard errors. In the tables below, * marks significance at a 10% level, ** at a 5% level and *** at a 1% level, standard errors are given in parenthesis below all the coefficients.

[8] For more detail description please consult Enders (2010) and for the usage of robust standard errors see Verbeek, (2012)

6. Results and Analysis

In this section we will go through all our results in detail. Although we present all regressions for continuity and transparency, comments will only be made on coefficients which are interesting from an economic inference perspective. Values which are worth examining closer are highlighted with bold print. The reader can easily find how the regressions are constructed by observing what variables are included in the tables. A summarization of the key results can be found in the last paragraph of the chapter.

Taking our starting point in previous studies, this study will begin with the basic variables presented above. Initial general-to-specific approach are in line with earlier findings and support the chosen starting point. Initially we will investigate the two samples individually and then join the samples together and use dummies to distinguish between the two groups. Lastly a dummy for the US will be added in the same manner as for the G7 group. We are looking for significant differences between the two sub samples, mainly with focus on the GMM regressions even though the standard errors of the OLS.

Let us begin with the base regressions for the G7 countries sample seen in Table 1. The first regression excludes the fiscal balance variable and instead uses the lagged debt variable. According to the table, the variable GDP growth is the only variable that is insignificant, suggesting that it does not contribute to a variation of the dependent variable. Interestingly, when replacing lagged debt variable with lagged fiscal balance growth becomes significant; hence there is a possibility that previously year's debt to GDP is heavily correlated with GDP growth. The economic interpretation takes the form of a clash between the two variables i.e. a crowding out effect where if the debt level in the previous year has increased with an additional unit percentage it crowds out the current GDP growth by a certain percentage amount because of the strangle effect it has on investment opportunities. Moving on to regression 3, the inclusion of the squared variable of previous annually debt level we can conclude that the theory of an acceleration effect cannot be supported, thus leading to the conclusion that non-linearity phenomenon is not a problem. Including fiscal balance makes the debt level insignificant and

Table 1						
OLS	**Basic Variables for G7 Countries**					
Variables	Reg. 1	Reg . 2	Reg . 3	Reg . 4	Reg . 5	
C	3.190069***	3.302938***	3.190163***	3.294824***	3.291584***	
	(0.094135)	(0.184237)	(0.091339)	(0.200288)	(0.193686)	
SIR	0.385950***	0.277492***	0.386943***	0.310756***	0.312966***	
	(0.048209)	(0.048518)	(0.048414)	(0.041848)	(0.044055)	
I	0.299091***	0.320563***	0.299325***	0.245703***	0.247696***	
	(0.077817)	(0.070601)	(0.078434)	(0.064178)	(0.064078)	
G	0.057526	0.132522***	0.057026	0.120218***	0.119558***	
	(0.048487)	(0.040040)	(0.048863)	(0.038082)	(0.035508)	
DEBT(-1)	0.031054***		0.032287***	-0.003467	-0.000280	
	(0.009329)		(0.009645)	(0.013379)	(0.011782)	
DEBT(-1)^2			-0.000289		-0.001238	
			(0.001028)		(0.001225)	
BB(-1)		-0.064858**		-0.065948**	-0.069878**	
		(0.031839)		(0.028835)	(0.031227)	
Adj. r^2	0.967606	0.972784	0.967426	0.972844	0.972789	
AIC	2.089412	2.136560	2.098387	2.003038	2.008724	
BIC	2.774736	2.911240	2.799287	2.786368	2.809461	
DW	0.961306	0.986810	0.958404	1.020220	1.003503	
OLS	**Additional Variables for G7 Countries**					
Variables	Reg . 6	Reg . 7	Reg . 8	Reg . 9	Reg . 10	Reg . 11
C	2.517437***	2.502002***	3.086721***	3.079078***	3.182419***	3.180600***
	(0.376421)	(0.368059)	(0.182063)	(0.205912)	(0.100902)	(0.104843)
SIR	0.381012***	0.383279***	0.402650***	0.396876***	0.386942***	0.388256***
	(0.043296)	(0.043810)	(0.039953)	(0.043348)	(0.050384)	(0.051079)
I	0.319334***	0.320366***	0.286906***	0.287692***	0.299262***	0.299556***
	(0.076155)	(0.076727)	(0.102773)	(0.101795)	(0.077630)	(0.078233)
G	0.079172*	0.078474*	0.056059	0.058972	0.057758	0.057278
	(0.043321)	(0.043451)	(0.052274)	(0.056217)	(0.047682)	(0.048040)
DEBT(-1)	0.020028*	0.022730*	0.024958***	0.010599	0.031003***	0.032314***
	(0.012099)	(0.011563)	(0.005993)	(0.020721)	(0.009396)	(0.009713)
DEBT(-1)^2		-0.000693		0.002135		-0.000310
		(0.000966)		(0.002781)		(0.001075)
U	0.082653*	0.084577*				
	(0.046988)	(0.046360)				
CA			-0.010692	-0.015131		
			(0.043916)	(0.048345)		
LEND					-0.001069	-0.001337
					(0.004598)	(0.005093)
Adj. r^2	0.968525	0.968386	0.962992	0.963075	0.967420	0.967238
AIC	2.064048	2.071846	2.065050	2.066265	2.098568	2.107510
BIC	2.764949	2.788321	2.779901	2.797002	2.799468	2.823986
DW	0.976445	0.969435	0.901388	0.906928	0.961886	0.958962

it suggests a potential collinearity situation (see for instance: Salvador et al. 2009) as by running the regressions that only include one of these variables point toward a significant effect on the long-run government bond yield.

Not surprisingly when running the two explanatory variables simultaneously as in regression five, it is only the lagged fiscal balance that is significant which again emphasises the presence of collinearity. By having this in mind, we exclude the fiscal balance variable in favour of the debt variable when testing for additional variables. The modified models reveal a statistically significance, which the unemployment ratio has upon the dependent variable whereas the current account and private lending do not share a corresponding statistical impact. The significant variables share a positive relation with the dependent variable. and debt has increased with one percentage unit it contributes to an approximately 0,02 percentage additional increase in the long-term yield curve. Combining the findings with previous studies such as Baldacci & Kumar (2010) and Alper & Forni (2011) our estimations seem to disagree with Baldacci & Kumar when looking at the acceleration effect while partially agree with Alper & Forni. Nonetheless together with what Baldacci & Kumar conclude, our results point toward an overall fiscal deterioration effect among the G7 economies.

Let us turn our attention to the small countries' sample in table 2. The same procedure was used and according to the results when including the different optional variables inflation is, in overall, significant except for running the regression that has private lending (see regression 11). Combining the findings with the fact that an increase of the short term interest rate is a response to the sudden rise in inflation it makes sense that such estimation results is likely, accordingly it should be highlighted and noted.

In general, the findings do, somewhat, support the idea presented by Gruber & Kamin (2010) that since the fiscal variables such as debt have higher values point toward that the G7 sample has a heavier emphasise of market driven factors as their underlying determinants. In a more in-depth analysis we can note that the majority of the findings do not support the idea of a debt acceleration effect.

Table 2						
OLS	**Basic Variables for Small Countries**					
Variables	Reg . 1	Reg . 2	Reg . 3	Reg . 4	Reg . 5	
C	3.137415***	3.625639***	3.076668***	3.605228***	3.535828***	
	(0.469167)	(0.249439)	(0.455833)	(0.245278)	(0.231204)	
SIR	0.534826***	0.401979***	0.539282***	0.395031***	0.397232***	
	(0.099791)	(0.044695)	(0.100923)	(0.050598)	(0.050457)	
I	0.126671	0.117843	0.122386	0.125392	0.119220	
	(0.078355)	(0.086362)	(0.077538)	(0.093130)	(0.093723)	
G	-0.009409	-0.087608	-0.007952	-0.090773	-0.085935	
	(0.049156)	(0.065767)	(0.045083)	(0.059722)	(0.054830)	
DEBT(-1)	0.069590***		0.057203**	-0.007420	-0.023851	
	(0.022369)		(0.023987)	(0.021023)	(0.021050)	
DEBT(-1)^2			0.002403		0.003948***	
			(0.001916)		(0.001022)	
BB(-1)		-12.43722***		-12.79047***	-12.52650***	
		(2.265532)		(2.970628)	(2.859628)	
Adj. r^2	0.955974	0.969252	0.956223	0.967093	0.968804	
AIC	2.376942	1.680051	2.374407	1.691612	1.641593	
BIC	3.014459	2.398860	3.026091	2.419928	2.385742	
DW	0.799258	0.930726	0.811002	0.928937	1.034547	
OLS	**Additional Variables for Small Countries**					
Variables	Reg . 6	Reg . 7	Reg . 8	Reg . 9	Reg . 10	Reg . 11
C	2.018962***	2.015477***	3.229586***	3.053472***	3.551237***	3.477610***
	(0.452144)	(0.422302)	(0.426792)	(0.408279)	(0.326203)	(0.325888)
SIR	0.490108***	0.487385***	0.519363***	0.541953***	0.488460***	0.489346***
	(0.075202)	(0.075203)	(0.091199)	(0.091393)	(0.072292)	(0.074232)
I	0.179468***	0.178417***	0.128353*	0.121260*	0.120771*	0.113766
	(0.067440)	(0.066033)	(0.102773)	(0.065989)	(0.070159)	(0.070057)
G	-0.003835	-0.009682	0.128353	-0.019503	-0.031274	-0.030588
	(0.049783)	(0.045285)	(0.054507)	(0.045073)	(0.048988)	(0.042444)
DEBT(-1)	0.035915**	0.019296	0.074655***	0.054422**	0.049551**	0.023997
	(0.017431)	(0.021883)	(0.021511)	(0.021360)	(0.020407)	(0.016439)
DEBT(-1)^2		0.001300		0.003139***		0.004416
		(0.001929)		(0.001029)		(0.000858)
U	0.167106***	0.168013***				
	(0.031025)	(0.032265)				
CA			0.028813	0.030538		
			(0.052086)	(0.049781)		
LEND					0.017931	0.026429
					(0.052212)	(0.050046)
Adj. r^2	0.962520	0.964311	0.953969	0.957463	0.961215	0.962544
AIC	2.215984	2.173244	2.426091	2.353400	2.268344	2.236663
BIC	2.853501	2.839095	3.065453	3.021178	2.937454	2.920319
DW	**0.715990**	**0.730225**	**0.750907**	**0.722754**	**0.678998**	**0.739117**

However, the roles of the fiscal variables show that there is an econometrical connection between their movements upon the dependent variable. In other words, according to regression 3 the lagged debt variable suggests that an additional percentage debt increase leads to a roughly 0,0572 percentage increase upon the long-term government bond yields among the small OECD countries when scenario of acceleration effect has been considered.

As mentioned above in the case of the G7 sample, when including both fiscal balance and debt level, both annually lagged, the debt variable is insignificant while the fiscal balance is significant pointing toward a collinearity dilemma[9]. Interestingly, when looking at the different information criteria we can conclude that the G7 sample has lower criteria values, which supports the argument that there is a higher level of economical homogeneity compared to the small countries' sample.

The analysis should again be considered with caution because of the possibility of autocorrelation indicated by the Durbin-Watson value. One of the reasons of the D-W value is the fact that crises create outliers and since it is panel data the difficulty of setting an outlier boundary becomes harder. In other words, common crises are considered as outliers[10] while individual circumstances are not regarded as a solid argument for creating dummy-variables that catches for instance a country specific economic turmoil. Additionally, since according to theory current account is stationary in the long-run it would be a disadvantage to make it stationary since important information could potentially be lost, leading to a weaker conclusion of the different influential powers of the long-term yield structure. Notwithstanding the two notifications it would be beneficial to turn our attention to our GMM estimations.

An appropriate starting point is to begin with the regressions of the G7 countries when investigating the various potential impacts. According to the GMM results in table 3 there are different aspects that need to be addressed since they

[9] Such dilemma could possibly be the case when looking at the role of the interest rate and its function toward inflation.
[10] For example the recent financial or the EMU crises.

Table 3

GMM	**Basic Variables for G7 Countries**					
Variables	Reg . 1	Reg . 2	Reg . 3	Reg . 4	Reg . 5	
Y(-1)	0.407075***	0.473742***	0.453785***	0.597358***	0.656491***	
	(0.053909)	(0.071929)	(0.078078)	(0.058429)	(0.034537)	
SIR	0.301740***	0.214380***	0.310008***	0.194868***	0.195715***	
	(0.024057)	(0.052318)	(0.027231)	(0.059357)	(0.054805)	
I	0.129160***	0.302699***	0.110874**	0.108880	0.082553	
	(0.039678)	(0.097289)	(0.050711)	(0.071685)	(0.068040)	
G	0.111705***	0.195372***	0.111073***	0.131703***	0.127760***	
	(0.031930)	(0.048487)	(0.024565)	(0.029524)	(0.026857)	
DEBT(-1)	0.020534		**0.044284****	**0. 014720***	**0.047037****	
	(0.013854)		(0.015269)	(0.007978)	(0.006094)	
DEBT(-1)^2			**-0.004197****		**-0.006474****	
			(0.001762)		(0.001739)	
BB(-1)		**-0.065513****		**-0.043567****	**-0.052555****	
		(0.027406)		(0.021810)	(0.025468)	
GMM	**Additional Variables for G7 Countries**					
Variables	Reg . 6	Reg . 7	Reg . 8	Reg . 9	Reg . 10	Reg . 11
Y(-1)	0.405279***	0.446971***	0.419827***	0.430788***	0.414869***	0.458091***
	(0.065232)	(0.086568)	(0.052403)	(0.052882)	(0.055371)	(0.076349)
SIR	0.303408***	0.317674***	0.288644***	0.298194***	0.316163***	0.324489***
	(0.027706)	(0.029353)	(0.023155)	(0.024839)	(0.030227)	(0.027044)
I	0.130066***	0.114451**	0.081312	0.101774**	0.107956**	0.089885
	(0.045050)	(0.053625)	(0.052304)	(0.047586)	(0.043930)	(0.054754)
G	0.112049***	0.112598***	0.098890***	0.099826***	0.099381***	0.097897***
	(0.033643)	(0.027251)	(0.021402)	(0.014403)	(0.022269)	(0.021154)
DEBT(-1)	0.019863	**0.041904****	-0.008120	0.01906	0.019538	0.041550***
	(0.018671)	(0.018199)	(0.008752)	(0.020721)	(0.013960)	(0.015341)
DEBT(-1)^2		**-0.004306****		-0.001118		-0.003827**
		(0.001729)		(0.001385)		(0.001479)
U	0.006614	0.029553				
	(0.050129)	(0.037559)				
CA			**-0.085843****	**-0.075001***		
			(0.039917)	(0.038370)		
LEND					**-0.047614*****	**-0.050223*****
					(0.015285)	(0.018787)

clash with the least squares estimations. Comparing the two different approaches we can see that in the GMM estimation that includes only lagged debt level is not significant while in the corresponding panel least squares regression it is significant at a one percentage level (see regression 1). The opposite finding applies for the GDP growth variable and it could be the case that in the OLS

regressions other variables such as the debt variable makes the growth variable insignificant as they are rather heavily correlated with one another (see the correlation matrices in the appendix). Interestingly, the annually lagged fiscal balance variable shares the same econometrical finding at a five percentage significant level. Hence, if the budget balance increases by an additional percentage unit it decreases the yield curve, in general, by roughly 0,065-percentage unit.

Turning our attention to the acceleration effect regression 3 captures the squared, annually lagged debt level of GDP such non-linearity effect is present when looking at the GMM estimations while compared to the least squares it is not present, pointing toward another contradiction in our results. Nonetheless, if such effect exists it means that if a G7 country increases its debt level further it accelerates the debt impact causing a more vulnerable fiscal position for the country and it leads to an increase in the yield level. Next step is to look at regression 5 that is the interaction between debt level and budget balance. In short, the two variables are significant, at a 5-percentage level, and it could most possible be explained by the relaxation of various Gauss-Markov assumptions, which GMM method possess. In other words, the dynamic regression captures the different fiscal effects caused by the debt level and by budget balance that is: by increasing the variables, it causes the yield curve to climb further and in the case of the budget balance it decreases the yield curve. In brief, we can also see that the acceleration effect becomes stronger when budget balance is included along with the debt level.

Moving on to the various additional variables, in order to have consistent comparisons with the least square regressions we focus on the role of the debt level and its acceleration effects. The unemployment rate variable is insignificant whereas, as mentioned before, is significant in the panel least squares estimates. Moreover in contrast to the G7 panel least squares there are opposite occurrences when looking at the roles of current account and private lending. Additionally, current account makes the debt level and its acceleration effect insignificant. Nickel & Vansteenkiste (2008) have found a rather similar relation when looking at the interaction between current account and the level of debt

that is: as mentioned earlier the interaction becomes insignificant after a certain threshold, which could be described by the Ricardian equivalence i.e. through the perspective of consumers a further increase in the debt level is downplayed by the consumption fall.

Table 4

GMM	**Basic Variables for Small Countries**				
Variables	Reg. 1	Reg. 2	Reg. 3	Reg. 4	Reg. 5
Y(-1)	0.679741***	0.575709***	0.675245***	0.626481***	0.618451***
	(0.063189)	(0.087171)	(0.063889)	(0.068462)	(0.072704)
SIR	0.241899***	0.204042***	0.247122***	0.166984***	0.171174***
	(0.037435)	(0.042047)	(0.040953)	(0.046823)	(0.047272)
I	0.025446	0.142919***	0.023658	0.130064***	0.129371***
	(0.023821)	(0.045667)	(0.023140)	(0.041407)	(0.041185)
G	0.015772	-0.027972	0.017445	-0.034243	-0.032782
	(0.031620)	(0.036213)	(0.029218)	(0.026386)	(0.025875)
DEBT(-1)	0.015131**		0.009100	-0.014422	-0.017970
	(0.006196)		(0.006445)	(0.011748)	(0.013424)
DEBT(-1)^2			0.001295		0.000943
			(0.001077)		(0.000918)
BB(-1)		-7.735069***		-7.415182**	-7.337299**
		(2.234405)		(3.067451)	(3.000584)

GMM	**Additional Variables for Small Countries**					
Variables	Reg. 6	Reg. 7	Reg. 8	Reg. 9	Reg. 10	Reg. 11
Y(-1)	0.586396***	0.586475***	0.604107***	0.599155***	0.631482***	0.626567***
	(0.078057)	(0.077809)	(0.061566)	(0.063370)	(0.066320)	(0.065541)
SIR	0.314101***	0.313970***	0.304793***	0.306775***	0.270645***	0.272981***
	(0.029717)	(0.028993)	(0.035240)	(0.036424)	(0.036469)	(0.037897)
I	0.070795	0.070893	0.072348	0.073111	0.046727	0.046634
	(0.044242)	(0.053625)	(0.057430)	(0.057380)	(0.036595)	(0.036202)
G	0.048335*	0.048267*	0.052839***	0.053690***	0.029616	0.030542
	(0.024677)	(0.025108)	(0.014658)	(0.014131)	(0.028300)	(0.028143)
DEBT(-1)	0.008529	0.008825	0.014711	0.010064	0.017657**	0.012440
	(0.013371)	(0.012139)	(0.009970)	(0.010127)	(0.007263)	(0.007657)
DEBT(-1)^2		-5.92E-05		0.000825		0.000930
		(0.000936)		(0.000814)		(0.000772)
U	**0.058107****	0.058373**				
	(0.021183)	(0.023734)				
CA			-0.006790	-0.006701		
			(0.013974)	(0.013317)		
LEND					-0.011468	-0.011597
					(0.013399)	(0.013155)

Moving on the small countries in table 4, in brief the budget balance lagged by one year appears to be significant whereas the debt level and its squared variable are insignificant throughout the core dynamic regressions. In other words, the previous year's debt level does not contribute to a climb in the current yield curve. A short presentation of the different control variables contributions to the government bond yield show that under the presences of debt and its acceleration effect, unemployment ratio is significant pointing toward a scenario of a one percentage increase in unemployment rate pushes the slope of the yield curve upwards with approximately 0.058 %.

Surprisingly, the growth variable is positive and significant[11], hence it points toward an ambiguity where one side of the coin represents the hypothesis that investors view an increase in growth as an indication of future downturn in the business cycle. While on the other side, it contradicts with the theory that a higher growth rate should reduce the yield spread of the government bond because it goes hand in hand with a more stable economy. Moving on to the inclusions of the current account and private lending variables, they both are insignificant (regression 10 and 11). Thus, according to the estimations these two variables do not contribute variations of the OECD countries' yield curves. The story is, however, different when looking at the short-term interest rate and the instrumental variable. In brief, the significance of the short-run interest rate connects well with the expectations theory.

To be able to separate the effects the variables have upon the government bond yields, we have run a series of joint regression for the two samples. We can then include dummies for individual countries or groups of countries. This can further give us confidence about the conclusion drawn in the separate samples or oppose the same. It can also help us see how the coefficients vary between the samples and reveal new correlations. Some regressions that were consistently run when investigating the separate samples have been discarded as they gave no additional significant information there, and were hence uninformative at a holistic level. We will still keep debt squared included as this is a variable that

[11] As mentioned previously, the correlation matrix for the small countries share the same tendency as in the G-7's matrix.

has been discussed widely in previous studies. All the OLS regressions run with the joint sample show worryingly low Durbin Watson statistics at around 0.6 - 0.7. Although we have used white period covariance method, we should accordingly be cautious with the standard errors and consequently the p-values. Variables found to be significant at a 1% level are still to be seen as very reliable though.

Table 5

OLS						
Variables	Reg. 1	Reg. 2	Reg. 3	Reg. 4	Reg. 5	Reg. 6
C	3.118194***	3.400514***	3.111615***	1.890204***	3.090215***	3.417905***
	(0.286435)	(0.248052)	(0.276048)	(0.391590)	(0.295671)	(0.184381)
SIR	0.487950***	0.401956***	0.487982***	0.449251***	0.495137***	0.445554***
	(0.057295)	(0.034661)	(0.057704)	(0.048199)	(0.052706)	(0.033950)
I	0.178155***	0.164428**	0.177739***	0.237530***	0.166987***	0.181719***
	(0.057726)	(0.078916)	(0.057426)	(0.063087)	(0.057650)	(0.056763)
G	0.021220	0.015318	0.021427	0.054965	0.019067	0.007787
	(0.039711)	(0.051316)	(0.043463)	(0.042265)	(0.042265)	(0,038206)
DEBT(-1)	**0.043347****		0.041047**	0,020222	0.041825***	0.033299***
	(0.014275)		(0.017043)	(0,012479)	(0.021883)	(0.011345)
DEBT(-1)^2			0.000416			
BB(-1)		-0.068417*				
		(0.038688)				
U				**0.161464****		
				(0.026348)		
CA					0.023767	
					(0.039607)	
LEND						0.005882
						(0.013537)
Adj. r^2	0.956368	0.956927	0.956282	0.960752	0.954411	0.960299
AIC	2.321018	2.255527	2.324832	2.216968	2.302590	2.237553
BIC	2.785556	2.770915	2.798135	2.690271	2.781259	2.717781
DW	0.685742	0.633487	0.689188	0.671465	0.671664	0.712825

First off, the joint sample is run accordingly to previous form, as can be seen in table 5 (OLS) and table 6 (GMM). In table 5, debt is found to have a similar significance and the coefficient is found to be somewhere between the values that are found in the previous tables and there is still no non-linear effect of debt to be found. Opposing the previous OLS regressions, we now cannot observe a

significant effect of fiscal balance, as can be seen in regression: 2. This will be further untangled when we include a dummy for the G7 countries although it can already now be mentioned that it seems small countries have a clearly larger budget deficit effect.

Table 6.

GMM	**Basic and Additional Variables Joint Regression**					
Variables	Reg. 1	Reg. 2	Reg. 3	Reg. 4	Reg. 5	Reg. 6
Y(-1)	0.619765***	0.573895***	0.626739***	0.598224***	0.660305***	0.621457***
	(0.053411)	(0.072104)	(0.051745)	(0.065326)	(0.052787)	(0.055649)
SIR	0.213809***	0.182267***	0.211390***	0.218544***	0.210045***	0.214878***
	(0.037369)	(0.046670)	(0.038778)	(0.038245)	(0.037229)	(0.035860)
I	0.065137***	0.211466***	0.065890***	0.078311***	0.069973***	0.071952***
	(0.016456)	(0.073063)	(0.016490)	(0.044242)	(0.020157)	(0.012177)
G	0.064855**	0.059612	0.063438**	0.068629***	0.075573***	0.067428***
	(0.025650)	(0.042179)	(0.027397)	(0.025895)	(0.024312)	(0.024803)
DEBT(-1)	**0.022989****		0.030353**	0.018683	0.013819**	0.021988**
	(0.009852)		(0.012353)	(0.011506)	(0.005978)	(0.010555)
DEBT(-1)^2			**-0.001962**			
			(0.001596)			
BB(-1)		-0.017640				
		(0.013871)				
U				**0.028966***		
				(0.016847)		
CA					**-0.023093***	
					(0.013288)	
LEND						**-0.018855****
						(0.009401)

The only additional variable which is significant is unemployment, showing similar results as in the corresponding regression for small countries. The notion that changes in unemployment rate affects small countries more than G7 countries remains and the inclusion of the variables still renders in insignificant debt.

The GMM regressions show a slightly lower significance for debt, which could partially be explained by the low D-W statistics in the OLS regressions. The coefficient is also about half the OLS-value. Here, fiscal balance is found to unlikely be significant, in line with the general OLS results in table 5. All the additional variables show significance at a 10% level and net lending at a 5% level as well. They all show intuitive signs and coefficients around the same

levels (ca. 0,2) as debt indicating that they have an equally large effect on the yield. These findings, together with the previous tables can now be used as benchmarks when including the dummies and separate the effects. As our goal is to establish if there are any differences in how the market evaluates large countries and small countries we will naturally include a dummy for that. We chose to use G7 as the dummy instead of the other way around for arbitrary reasons. We will also include a US dummy since the US is clearly the dominating economic power in the world. Additionally, the US dollar still enjoys a special position as the world benchmark currency, making US securities and commodities less risky.

In table 7 we observe the OLS regressions with the G7 dummy included. Not surprisingly, adjusted r-squared, AIC/BIC and DW are all very similar to table 5 as the two tables describe the same data. No difference can be established for the debt of for interest rate in regression 1 and 2. In regression 3 we can see big and significant difference in how fiscal balance is affecting the yield. Keep in mind that the value obtained for the interacted variable is to be added to the value obtained from the non-interacted variable, the interacted variable value shows the difference between the two. The main take away is that these coefficients are significantly different from one another and this is further strengthened by previous regressions. The other coefficient that is of interest here is unemployment, which also is found significantly different in regression 5. When consulting the GMM regressions in table 8 the last observation is not supported, leading us to doubt that there is any true effect. The observation regarding budget balance is further strengthened though. By bearing the various clouded statistical properties in the least square estimations, nonetheless together with the dynamic estimations, it does show that fiscal balance play an important role in the establishment of influential determinants on the OECD markets.

In table 9, we have included the US dummy in identical fashion as with the G7 dummy in table 7. We cannot establish that debt is differently judged for US and all other countries. In regression 2 we can distinguish between the short interest rate effects, but since we are looking at OLS regressions and the US value is only significant at a 10% level, we are cautious to make any further conclusions based

Table 7.

OLS	**Joint regressions using the G7 dummy**						
Variables	Reg. 1	Reg. 2	Reg. 3	Reg. 4	Reg. 5	Reg. 6	Reg. 7
C	3.127514***	3.146641***	3.140351***	2.079765***	2.178969***	3.094757***	3.396795***
	(0.282172)	(0.253382)	(0.191873)	(0.382807)	(0.300309)	(0.285922)	(0.183340)
SIR	0.485005***	0.496067***	0.406704***	0.465415***	0.451670***	0.491264***	0.447147***
	(0.054985)	(0.047289)	(0.034585)	(0.048647)	(0.044302)	(0.049497)	(0.034617)
SIR*G7		-0.031935					
		(0.027422)					
I	0.181178***	**0.105576***	0.192072***	0.222419***	0.164622***	0.164982***	0.182183***
	(0.055885)	(0.057796)	(0.073449)	(0.055709)	(0.060322)	(0.058070)	(0.055807)
I*G7		**0.168761****					
		(0.075412)					
G	0.023035	0.014510	0.017297	0.045023		0.015313	0.005103
	(0.039097)	(0.041900)	(0.053423)	(0.040888)		(0.041908)	(0.040073)
G*G7		0.010254					
		(0.040265)					
DEBT(-1)	**0.050799*****	0.053739**		0.016530*	0.012001	0.040172**	0.034144***
	(0.022047)	(0.021089)		(0.009059)	(0.012531)	(0.015757)	(0.011201)
DEBT(-1) *G7	**-0.014911**	-0.012200			0.024565		
	(0.021140)	(0.018636)			(0.019896)		
BB(-1)			**-10.12201*****				
			(2.733850)				
BB(-1) *G7			**10.02896*****				
			(2.722348)				
U				0.158682***	**0.173294*****		
				(0.026092)	(0.021995)		
U*G7				-0.047824	**-0.078972***		
				(0.040469)	(0.043010)		
CA						0.039588	
						(0.051245)	
CA*G7						-0.050838	
						(0.077302)	
Lend							0.025371
							0.048261)
Lend*G7							0.025692
							(0.050079)
Adj. r^2	0.956362	0.957690	0.959626	0.961763	0.962745	0.954616	0.960369
AIC	2.322986	2.297577	2.192868	2.192689	2.174874	2.299938	2.237644
BIC	2.796289	2.797174	2.717981	2.674757	2.661816	2.787472	2.726765
DW	0.692065	0.711091	0.674017	0.720869	0.721789	0.672561	0.717001

on that. The budget balance is not significantly different, saying that the USA is not different from all the other countries in this matter. If we ran the US dummy in a sample with only the USA and the small countries, excluding the other G7 countries, we would likely have seen a different result.

Table 8.

GMM	**Joint regressions using the G7 dummy**					
Variables	Reg . 1	Reg . 2	Reg . 3	Reg . 4	Reg . 5	Reg . 6
Y(-1)	0.635494***	0.621033***	0.486989***	0.596953***	0.662422***	0.625186***
	(0.071574)	(0.053144)	(0.079996)	(0.066281)	(0.053730)	(0.057255)
SIR	0.206283***	0.214020***	0.213840***	0.218413***	0.210717***	0.211937***
	(0.053423)	(0.037162)	0.036541	(0.038156)	(0.037790)	(0.037232)
SIR*G7	-0.001828					
	(0.062382)					
I	0.081118***	0.064084***	0.239625***	0.078845***	0.069826***	0.072323***
	(0.057796)	(0.015630)	(0.080595)	(0.018348)	(0.020097)	(0.012518)
I*G7	-0.038963					
	(0.054806)					
G	0.059515*	0.064647**	0.051881	0.068386***	0.077003***	0.069636***
	(0.030928)	(0.025579)	(0.045619)	(0.026246)	(0.077003)	(0.025977)
G*G7	0.014860					
	(0.027193)					
DEBT(-1)	0.017445**	0.021276**		0.018868	0.013951**	0.021124**
	(0.008739)	(0.009201)		(0.011931)	(0.005861)	(0.010733)
DEBT(-1) *G7	0.005681	0.003717				
	(0.020185)	(0.011598)				
BB(-1)			**-8.383218*****			
			(2.959643)			
BB(-1) *G7			**8.336743*****			
			(2.950735)			
U				0.031370*		
				(0.018245)		
U*G7				-0.009261		
				0.036496		
CA					-0.026772	
					(0.018535)	
CA*G7					0.011998	
					(0.047442)	
Lend						-0.031331
						(0.019811)
Lend*G7						0.016636
						(0.020232)

Table 9.						
OLS	**Joint regressions using the US dummy**					
Variables	Reg. 1	Reg. 2	Reg. 3	Reg. 4	Reg. 5	Reg. 6
C	3.116410***	3.075707***	3.383907***	1.979149***	3.090211***	3.413246***
	(0.286718)	(0.361219)	(0.270377)	(0.386505)	(0.295881)	(0.182188)
SIR	0.488525***	**0.470411****	0.390889***	0.467717***	0.495116***	0.445968***
	(0.057479)	(0.059947)	(0.033876)	(0.048734)	(0.053401)	(0.033912)
SIR*US		**0.070038***				
		(0.037316)				
I	0.177844***	0.196344***	0.204194**	0.222864***	0.166967***	0.180467***
	(0.057875)	(0.058173)	(0.087316)	(0.056503)	(0.057983)	(0.057332)
I*US		-0.087690				
		(0.117898)				
G	0.020716	0.046856	0.010766	0.046204	0.019062	0.007390
	(0.039786)	(0.051814)	(0.058328)	(0.039742)	(0.042447)	(0.038368)
G*US		0.016222				
		(0.028055)				
DEBT(-1)	**0.043009*****	0.056372***		0.015908*	0.041817***	0.032969***
	(0.014447)	(0.019135)		(0.009416)	(0.016061)	(0.011276)
DEBT(-1)*US	**0.008401**	0.017573				
	(0.011830)	(0.016199)				
BB(-1)			**-0.073807***			
			(0.040288)			
BB(-1)*US			**0.054041**			
			(0.040510)			
U				**0.146608*****		
				(0.023907)		
U*US				**0.017846**		
				(0.034135)		
CA					0.023805	
					(0.040704)	
CA*US					-0.001053	
					(0.071394)	
Lend						0.006206
						(0.013868)
Lend*US						-0.035098
						(0.042501)
Adj. r^2	0.956270	0.946791	0.951210	0.961595	0.954301	0.960212
AIC	2.325098	2.521296	2.378084	2.197077	2.306863	2.241609
BIC	2.798401	2.994599	2.883749	2.679145	2.794397	2.730730
DW	0.685752	0.633264	0.562408	0.718256	0.671634	0.713390

Table 10.

GMM	**Joint regressions using the US dummy**					
Variables	Reg. 1	Reg. 2	Reg. 3	Reg. 4	Reg. 5	Reg. 6
Y(-1)	0.565676***	0.605792***	0.539516***	0.587347***	0.658300***	0.609031***
	(0.044854)	(0.059781)	(0.086138)	(0.068073)	(0.053984)	(0.058584)
SIR	0.227388***	0.217691***	0.189987***	0.223346***	0.213552***	0.213788***
	(0.038019)	(0.040326)	(0.046187)	(0.039665)	(0.037535)	(0.037657)
SIR*US	0.011284					
	(0.061021)					
I	0.082909**	0.068369***	0.213642***	0.081289***	0.073729***	0.079004***
	(0.032368)	(0.019593)	(0.078846)	(0.019031)	(0.021106)	(0.014070)
I*US	0.007197					
	(0.119218)					
G	**0.057300****	0.066740**	0.057689	0.071051**	0.081392***	0.067850**
	(0.025530)	(0.025579)	(0.042493)	(0.026246)	(0.025709)	(0.026367)
G*US	**0.087482*****					
	(0.029511)					
DEBT(-1)	0.022050*	0.026425**		0.021487*	0.016403***	0.025697**
	(0.012679)	(0.012095)		(0.011713)	(0.006176)	(0.011329)
DEBT(-1) *US	-0.003027	-0.002338				
	(0.041209)	(0.041482)				
BB(-1)			-0.018848			
			(0.018980)			
BB(-1) *US			0.008293			
			(0.090199)			
U				0.029904**		
				(0.015063)		
U*US				0.021102		
				(0.051631)		
CA					**-0.026869****	
					(0.013189)	
CA*US					**0.083466****	
					(0.033429)	
Lend						**-0.021683****
						(0.010460)
Lend*US						**0.063984****
						(0.032425)

Unemployment rate is found to be different from the other countries, but the US coefficient is not significant. The GMM results in table 10 show that two additional variables, current account and net lending/borrowing, are

significantly different for the US. Both coefficients are higher for the US meaning that the market evaluates the US current negative current account balance and their need to borrow money from abroad to cover national expenditures as something that would lower the ten year bond yield. This clearly indicates that the US has a unique position in the bond market.

The current account deviation can most likely be explained through the fact that the US trade balance has been increasing steadily for a long time meanwhile interest rates has been kept low, but it still reaffirms the widely accepted notion that the US can run high trade deficits without being penalized by the market as hard as any other country. The same goes for net lending, which would call for caution in many other economies, as it in the long run increases the risk for a financial bubble. The values reported for the residual countries are in line with the joint regressions in table 6.

These results show that the G7 countries are only enjoying parts of the USA's unique position as the leading world economy. They do however suggest that they have a certain advantage in regards of budget balance penalisation and possibly in regards of unemployment, where we at least see that the smaller countries do experience an effect whereas we cannot say the same for the G7 countries.

In short, there is a statistical difference between the G7 countries and the smaller countries in regards of how the market perceives fiscal balance and there is a clear connection between unemployment rate and bond yields for small countries where we can see no similar effect for the G7 group. These findings are strengthened by the joint sample analysis. The original separate regressions found a negative correlation between bond yield and lending (and a weak possible correlation to current account balance) for the G7 countries, but this could not be confirmed by the joint analysis. However, including the US dummy, we found that the US differs from other countries in how current account balance and lending is assessed to affect the risk of the bond. The market seems to perceive the US as a less risky investment regardless of what the macroeconomic variables that have been utilized.

7. Robustness Checks

In order to further strengthen the findings presented above, we need to make sure the results are consistent over time and different constellations. Our robustness checks will be performed on the regressions which are of interest for our analysis and consequently our conclusions. We could include or drop variables from regressions as well as change the sample size to see if our findings are consistent. However, we want to be cautious not to include too many variables as well as not limiting our sample too much as the first will render us with possible false significance and the second give us a hard time finding any statistical evidence in the regressions. With this in mind, robustness checks on the joint dataset are more likely to give us affirmative confirmations than on the two separate samples. Since we have already regressed the data in a sequence of constellation in the result and analysis part, this section will only check if our results are consistent over time since all regressions above are performed in the same time-span (1980-2013).

Up until 2008 we can get statistically clear results, but the impact of the financial crisis makes the results rather ambiguous. Financial crashes in 00 and 87 are also likely to affect our results, but not to the same extension as the sub-prime crisis: they seem to have left the market shaken but not stirred. In order to maintain a sample size around 150 observations and still exclude enough observations to make a difference, the time periods 1980-2000 and 1990-2013 will be used. All specifications are just as in the regressions in the result and analysis part.

For the small countries we can conclude that budget balance is only relevant when excluding the latest financial crisis. Debt does not seem to be significant for any of the specific time periods, which is rather surprising as it showed fairly good significance over the whole period. Unemployment on the other hand seems to be robust and shows relatively even values over time.

Robustness, small				
Variable and period	OLS		GMM	
Debt(-1) 80-00	0.117035**	(0.046107)	0.010573	(0.017618)
Debt(-1) 90-13	0.041310**	(0.020313)	0.010325	(0.014774)
BB(-1) 80-00	-14.48613***	(3.387246)	-10.10130***	(2.936938)
BB(-1) 90-13	-10.99337***	(3.599003)	-5.934507	(4.702956)
U 80-00	0.182173***	(0.012023)	0.061864***	(0.016123)
U 90-13	0.139337***	(0.026219)	0.070937**	(0.030259)

Turning our attention to the G7 countries we can find evidence for debt being significant for the period before the crisis. The values for the early period is in line with what was observed for the whole period, although a little higher. Although the OLS regressions show significance for the later period, the fact that there is none in the GMM discourages us from drawing any conclusions. Not too surprisingly there is no significance to observe for budget balance, having shown small effects for the G7 countries for the whole period. Opposite of the small countries, unemployment shows no interpretable coefficients and the same goes for current account. Net lending is however significant for the first of the two periods, possibly also distorted in the later sample by the financial crisis.

Robustness, G7				
Variable and period	OLS		GMM	
Debt(-1) 80-00	0.055195**	(0.021254)	0.055265**	(0.026476)
Debt(-1) 90-13	0.018750***	(0.005937)	0.016301	(0.012290)
BB(-1) 80-00	-0.149059*	(0.076022)	-0.085011	(0.075058)
BB(-1) 90-13	-0.086002***	(0.029670)	-0.020175	(4.702956)
U 80-00	0.028243	(0.110559)	-0.001875	(0.078355)
U 90-13	0.086164*	(0.049157)	-0.031190	(0.052511)
CA 80-00	-0.141234	(0.105123)	-0.055819	(0.065936)
CA 90-13	-0.052155	(0.042018)	-0.077997	(0.050202)
Lend 80-00	-0.017392**	(0.008098)	-0.041197***	(0.015457)
Lend 90-13	-0.007390	(0.015441)	-0.035059	(0.023366)

Looking at the last table, all interacted variables that showed potential have been composed. There is again strong evidence that the G7 countries do not share the large effect of budget balance that the small countries have, this is however only certain for the earlier period. In a similar fashion, unemployment in the G7 countries shows no significance for the later period while the earlier have potential correlation. Turning to the US variables, unemployment and current

account show high levels of interpretability during the earlier period but little for the later. Although lending is significant at a 1% level in the OLS regression for 90-13, the fact that the GMM regression shows an extremely high p-value makes it rather uncertain whether it has any real correlation. Through all, it seems the time period from 80-00 generates more significant values, again largely explained by the recent banking crisis.

Robustness, Joint with Dummies				
Variable and period	OLS		GMM	
BB(-1)*G7 80-00	16.73379***	(4.006942)	12.15359**	(5.790310)
BB(-1)*G7 90-13	9.020207**	(3.496346)	5.241344	(3.862578)
U*G7 80-00	-0.068596	(0.104657)	0.206433**	(0.086203)
U*G7 90-13	-0.033175	(0.035848)	-0.026164	(0.065889)
U*US 80-00	0.175812***	(0.048709)	0.132431***	(0.039350)
U*US 90-13	-0.096364**	(0.039809)	-0.043152	(0.157802)
CA*US 80-00	0.071089	(0.126769)	0.159408***	(0.054011)
CA*US 90-13	-0.101817*	(0.054333)	0.038224	(0.039364)
Lend*US 80-00	-0.005485	(0.042271)	0.070704	(0.072211)
Lend*US 90-13	-0.122585***	(0.034494)	0.015101	(0.050525)

Note that all coefficients in this table are interacted with dummies and relative to a base coefficient. The difference between the two is observed.

8. Conclusion

This thesis investigates the effect the economic influence of a country has on its long term bond yields. We look at the difference between G7 countries and non-G7, but OECD, countries and at the difference between the US and the other OECD countries. This is something that we have not seen in any previous studies. The approach is however supported by macroeconomic theory and our results partly support the same. The econometrical approach used in this paper has been used by earlier empirical studies e.g. Baldami & Kumar (2010), which is that they used panel least squares with fixed effects plus GMM estimator.

We have found that unemployment rate has a greater effect on bond yields in small countries, this is especially true when excluding the financial crisis years, compared to the G7 countries. Another dividing factor seems to be the budget balance where smaller countries show much larger numbers than the G7 countries; this is especially true for the earlier years of our sample period. The debt effect seems to be rather small, a strong contradiction since it is heavily

correlated with the budget deficit. Neither lending nor current account has any significant effect on the bond yields.

In the case of the G7 countries, there is a fairly clear connection between debt and bond yield. This is again especially true for the earlier years and more uncertain for the latter. There is however no clear effect of budget balance and if there is one it is most likely rather small. Regarding unemployment and current account, we cannot draw any conclusions based on the regressions. Lending has a small reversed effect on the yield though. The main advantage of the G7 countries is then that they can borrow more money before they are penalized through increased bond yields and that they do not have to suffer as much from high unemployment rates.

Two things are worth mentioning about the US dummy results: 1. there is a reversed significant effect from lending and current account and 2. the growth rate of the economy has a larger effect on the yield. The first may indicate that the USA is above some of the rules. It can run large trade deficits and borrow large amounts from abroad, both the government and the private sector, without getting penalized by the market. The second indicates that the growth of the American economy is what is to some extent driving international bond yields, not just governmental. This is probably easiest explained through the fact that the USA is the biggest importer of goods and services in the world, if the US economy is limping, it will likely affect the markets valuation of other nations possibility to repay loans given shrinking tax incomes to the government.

For future research we suggest that it would be advantageous to include forecasted explanatory variables rather than current variables, as it has been done in previous studies on similar topics. It can also be advisable to exclude the crisis years of 2008-2012 for higher significance and a better “normal times” model. If possible, an alternative to excluding the crisis could be more data and enough observations to use a moving window. This would certainly smooth the crisis years and make for a better long-term estimation of the regressions.

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Appendix

1. List of Countries

G7	GDP	Smaller OECD Countries	GDP
United States	13.298.023.488	**Spain**	1.107.343.947
Japan	3.925.960.830	**Australia**	808.082.339
Germany	2.591.284.332	**Netherlands**	549.231.755
United Kingdom	1.847.259.417	**Belgium**	325.663.047
France	1.766.294.085	**Switzerland**	296.729.845
Italy	1.449.902.925	**Austria**	277.693.156
Canada	1.211.159.672	**Denmark**	154.105.737
		Finland	147.673.009
Average	3.727.126.392	**Average**	458.315.354

2012 years nominal values in USD

2. Variables Included

Short name	Variable
y	10-year sovereign bonds interest rate (yield)
sir	Short-term interest rate, will work as proxy for the general risk appetite – how risky the market deems the overall situation. Also, this will ensure we look at solvency and not liquidity of the countries.
i	Inflation rate, to better capture the real yield
g	GDP growth, proxy for an economy's economic state
debt	First difference of government debt as percentage of GDP. Reflects a government's service cost of debt.
bb	Budget balance as percentage of GDP
u	Unemployment rate
ca	Current account (balance of trade and net factor income) as percentage of GDP
lend	Net lending/borrowing needed to finance all expenditures within an economy. As percentage of GDP
bm	Broad money Supply. Used to test for monetization of debt (regressions not included in thesis). As percentage of GDP

3. Correlation Matrices

G7 Countries

	BB	BM	CA	DEBT	G	I	LEND	SIR	U	Y
BB	1.000000	0.072192	0.082256	-0.546134	0.263079	0.072243	0.126973	-0.053522	-0.379832	-0.224506
BM	0.072192	1.000000	-0.049116	-0.001550	0.042098	0.045036	-0.041233	0.083326	-0.036851	0.039492
CA	0.082256	-0.049116	1.000000	-0.106069	-0.087559	-0.437226	0.976140	-0.432603	-0.258368	-0.449570
DEBT	-0.546134	-0.001550	-0.106069	1.000000	-0.551968	0.027503	-0.144995	0.124000	0.263884	0.155952
G	0.263079	0.042098	-0.087559	-0.551968	1.000000	0.032551	-0.085507	0.096202	0.016162	0.110616
LEND	0.126973	-0.041233	0.976140	-0.144995	-0.085507	-0.449614	1.000000	-0.468597	-0.210746	-0.490510
I	0.072243	0.045036	-0.437226	0.027503	0.032551	1.000000	-0.449614	0.738537	-0.053834	0.691943
SIR	-0.053522	0.083326	-0.432603	0.124000	0.096202	0.738537	-0.468597	1.000000	-0.016285	0.931041
U	-0.379832	-0.036851	-0.258368	0.263884	0.016162	-0.053834	-0.210746	-0.016285	1.000000	0.140511

Small Countries

	BB	BM	CA	DEBT	G	I	LEND	SIR	U	Y
BB	1.000000	0.072192	0.082256	-0.546134	0.263079	0.072243	0.126973	-0.053522	-0.379832	-0.224506
BM	0.072192	1.000000	-0.049116	-0.001550	0.042098	0.045036	-0.041233	0.083326	-0.036851	0.039492
CA	0.082256	-0.049116	1.000000	-0.106069	-0.087559	-0.437226	0.976140	-0.432603	-0.258368	-0.449570
DEBT	-0.546134	-0.001550	-0.106069	1.000000	-0.551968	0.027503	-0.144995	0.124000	0.263884	0.155952
G	0.263079	0.042098	-0.087559	-0.551968	1.000000	0.032551	-0.085507	0.096202	0.016162	0.110616
LEND	0.126973	-0.041233	0.976140	-0.144995	-0.085507	-0.449614	1.000000	-0.468597	-0.210746	-0.490510
I	0.072243	0.045036	-0.437226	0.027503	0.032551	1.000000	-0.449614	0.738537	-0.053834	0.691943
SIR	-0.053522	0.083326	-0.432603	0.124000	0.096202	0.738537	-0.468597	1.000000	-0.016285	0.931041
U	-0.379832	-0.036851	-0.258368	0.263884	0.016162	-0.053834	-0.210746	-0.016285	1.000000	0.140511

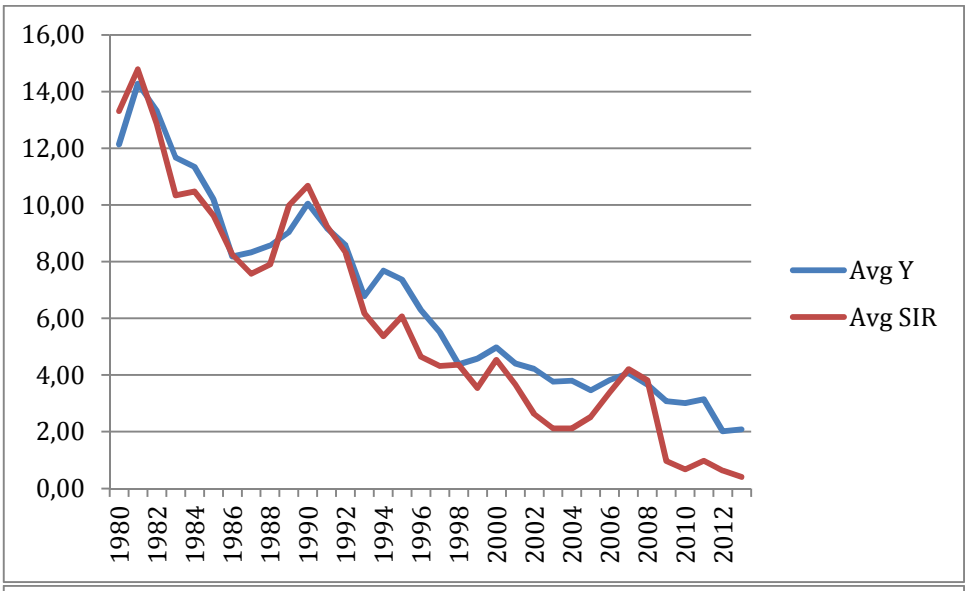
4. Descriptive Statistic

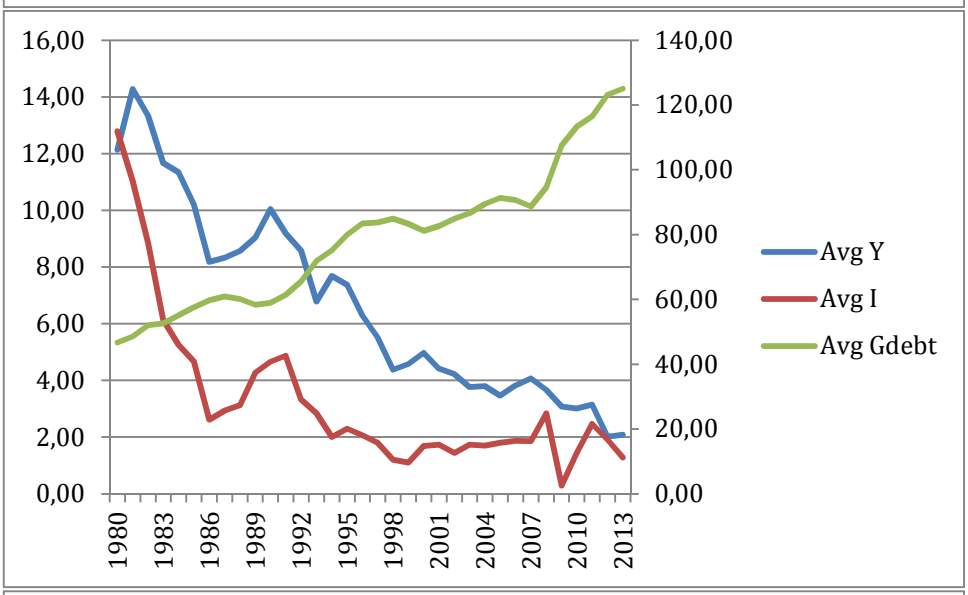
G7	BB	BM	CA	DEBT	G	I	LEND	SIR	U	Y
Mean	-4.219516	5.802373	-1.769059	2.680992	1.911219	2.698919	-0.551599	5.114400	7.712535	6.076205
Median	-3.719367	5.644571	-2.300000	1.800000	2.118007	2.200000	-1.158069	4.391767	7.950000	5.010000
Maximum	3.545093	17.68213	7.500000	18.43470	7.258980	13.30000	7.533045	18.35861	11.92500	16.29000
Minimum	-12.68582	-6.065420	-12.42900	-9.380000	-5.526976	-1.300000	-5.272844	0.051521	2.892000	0.840000
Std. Dev.	3.156337	4.100547	3.429756	4.903908	2.072884	2.308302	2.640158	3.966852	2.132299	3.451178
Skewness	-0.340603	-0.094994	0.139571	0.621831	-1.041179	1.906092	0.771051	0.864809	-0.176440	0.892573
Kurtosis	3.014612	3.052501	4.091605	3.632976	5.125577	8.442938	3.316692	3.233189	2.133051	3.221781
Jarque-Bera	3.578644	0.299483	9.785901	15.01085	68.25184	340.3871	19.10414	23.47923	6.753462	24.94363
Probability	0.167073	0.860931	0.007499	0.000550	0.000000	0.000000	0.000071	0.000008	0.034159	0.000004
Sum	-780.6105	1073.439	-327.2760	495.9836	353.5756	499.3000	-102.0459	946.1640	1426.819	1124.098
Sum Sq. Dev.	1833.094	3093.866	2164.433	4424.890	790.6199	980.3998	1282.560	2895.408	836.5929	2191.556
Observations	185	185	185	185	185	185	185	185	185	185

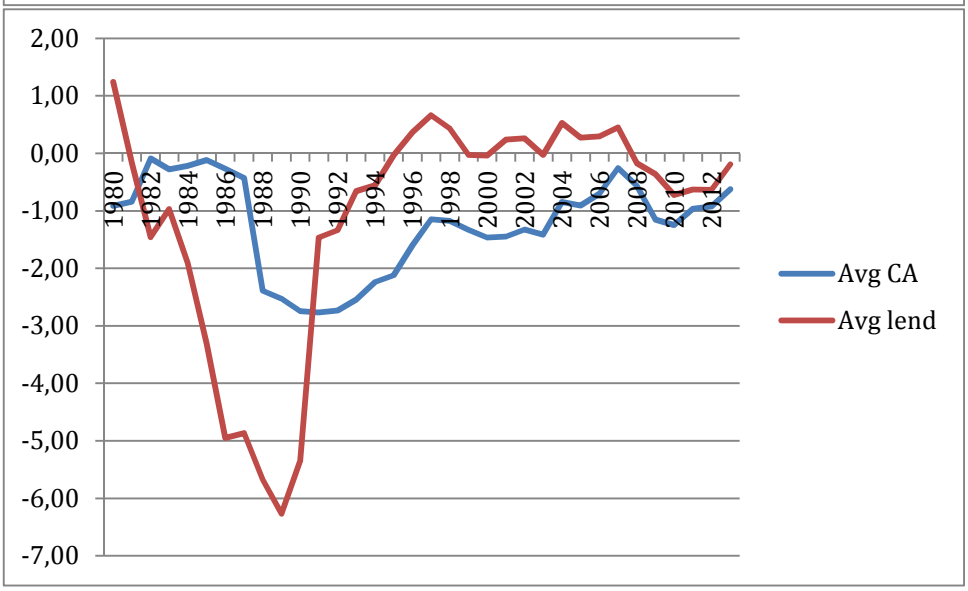
Small Countries	BB	BM	CA	DEBT	G	I	LEND	SIR	U	Y
Mean	-0.019670	542.9846	1.485601	0.544510	2.181394	2.750000	1.331293	5.336347	6.888064	6.216200
Median	-0.020655	7.036742	1.902500	-0.045000	2.529565	2.300000	1.785534	4.391767	6.075000	5.460000
Maximum	0.070192	116955.5	14.80000	17.41000	6.205788	11.40000	14.47554	17.61167	25.00000	15.38000
Minimum	-0.111171	-99.89467	-9.995000	-9.840000	-8.538613	-0.700000	-9.577358	0.117153	0.501000	1.400000
Std. Dev.	0.034097	7920.791	4.705121	4.461880	2.120513	2.051890	4.498505	3.841581	3.986000	2.928508
Skewness	0.041595	14.66301	0.218394	0.724268	-1.542095	1.747171	0.135219	1.101717	1.930547	0.914102
Kurtosis	3.141798	216.0040	2.901463	4.330815	7.069763	6.857299	2.762078	3.705266	7.824676	3.254576
Jarque-Bera	0.245500	419929.1	1.821153	35.14639	236.8498	246.0601	1.178501	48.61870	346.8521	30.94821
Probability	0.884485	0.000000	0.402292	0.000000	0.000000	0.000000	0.554743	0.000000	0.000000	0.000000
Sum	-4.287955	118370.6	323.8610	118.7033	475.5439	599.5000	290.2218	1163.324	1501.598	1355.132
Sum Sq. Dev.	0.252284	1.36E+10	4803.982	4320.117	975.7564	913.6250	4391.331	3202.430	3447.739	1861.027
Observations	218	218	218	218	218	218	218	218	218	218

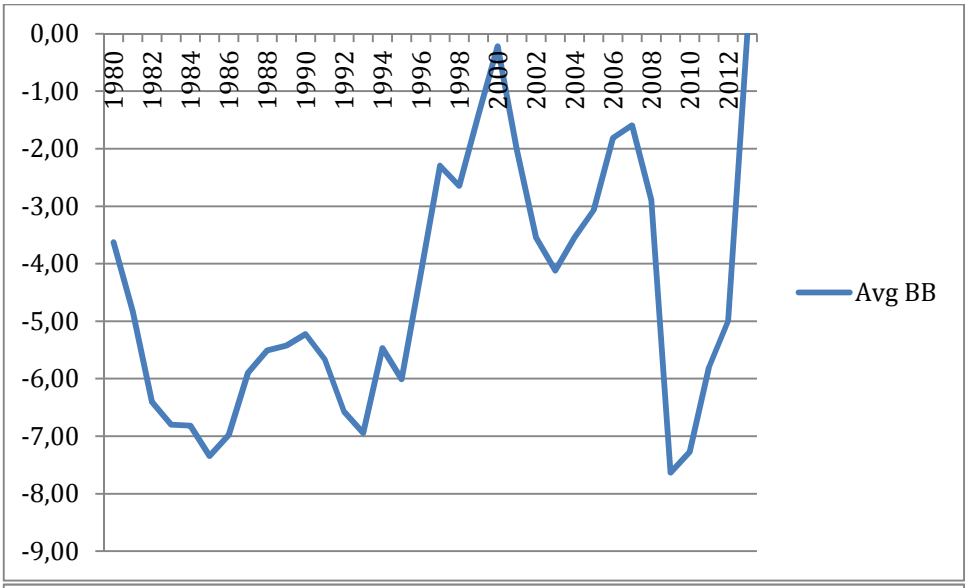
5. Graphical Illustration of Data

G7 Countries





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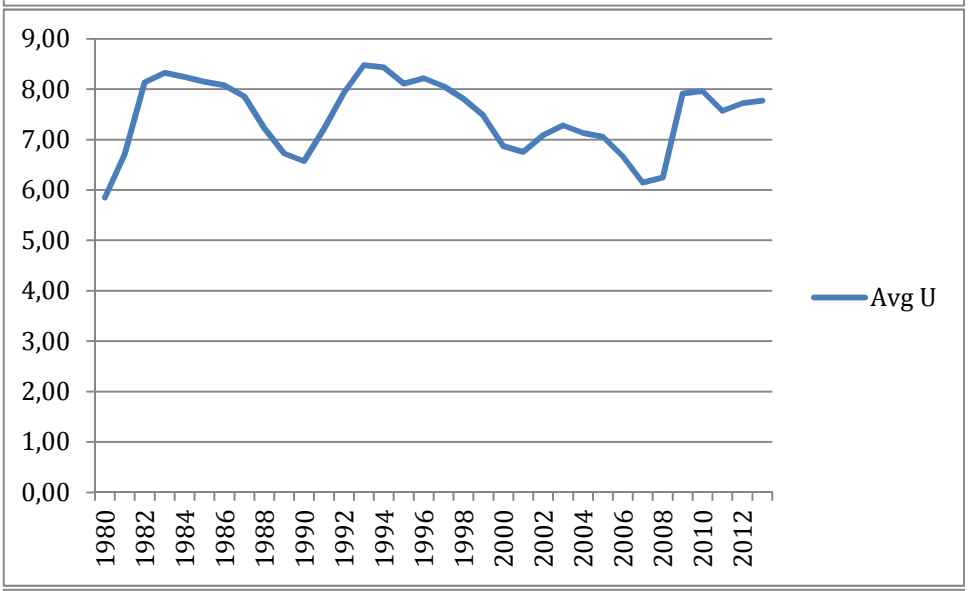
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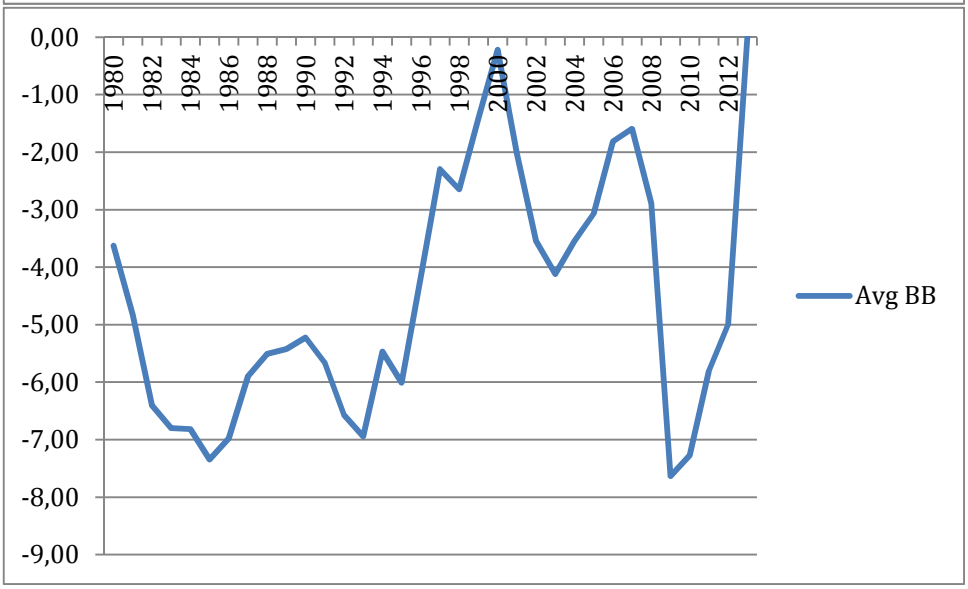
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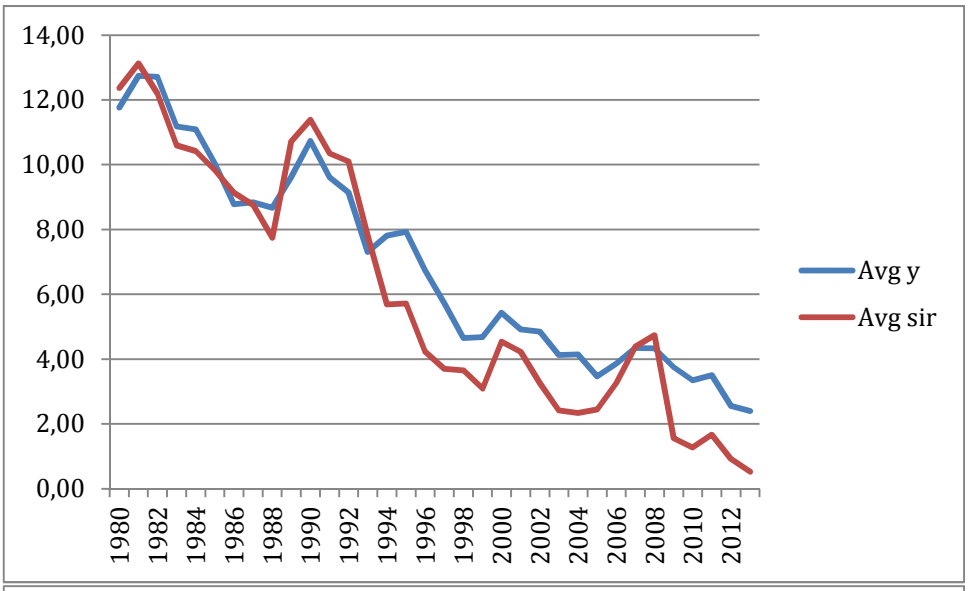
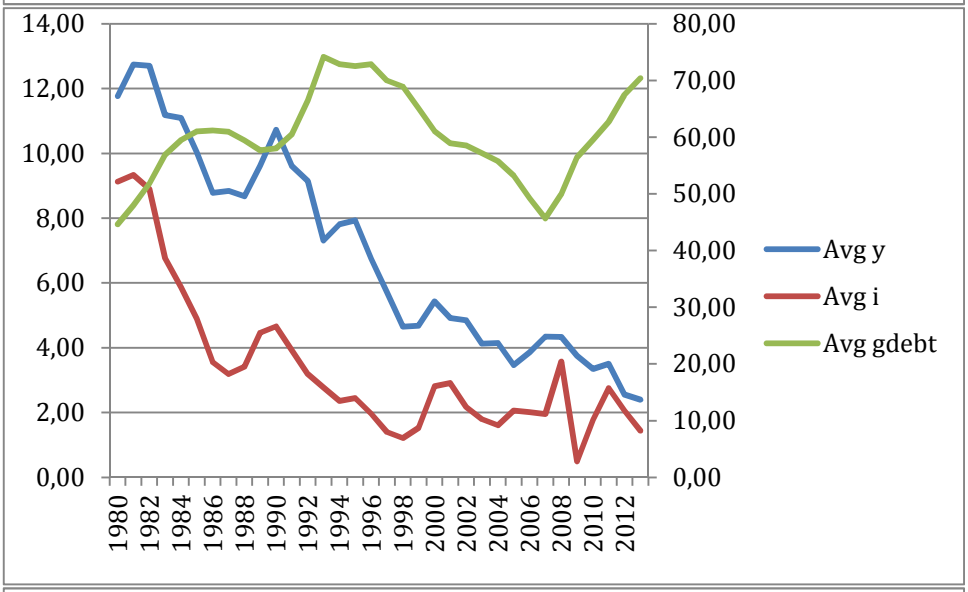
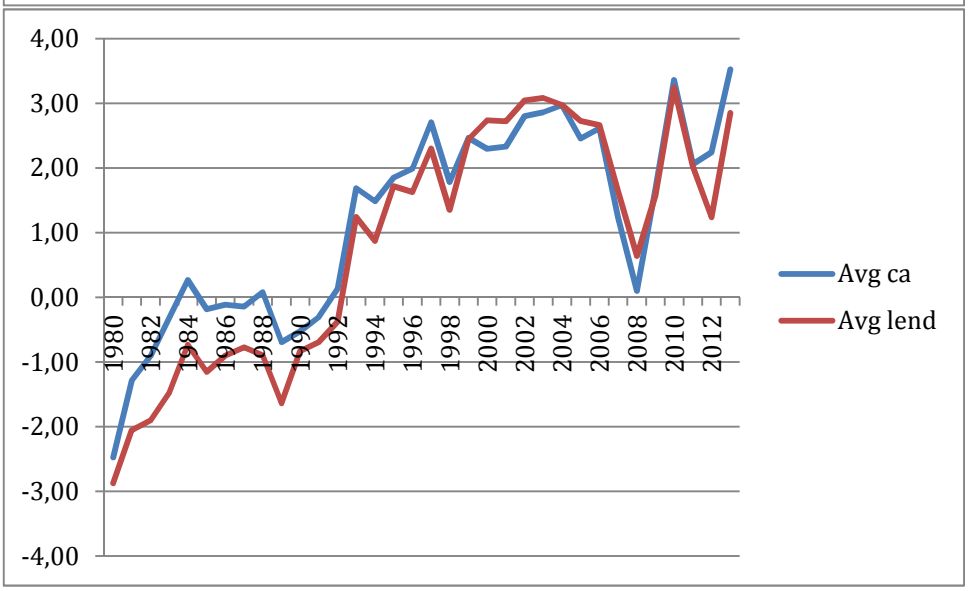
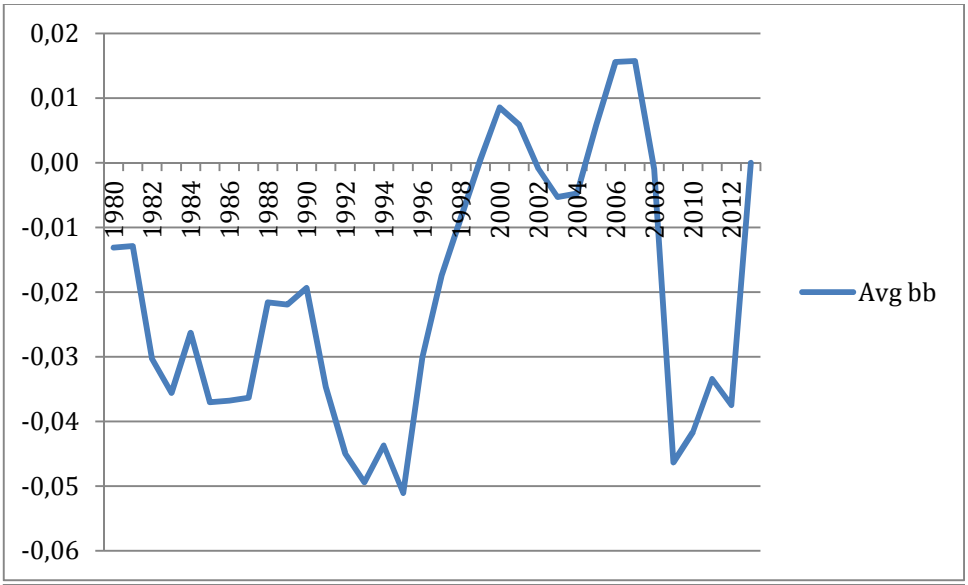
Small OECD Countries





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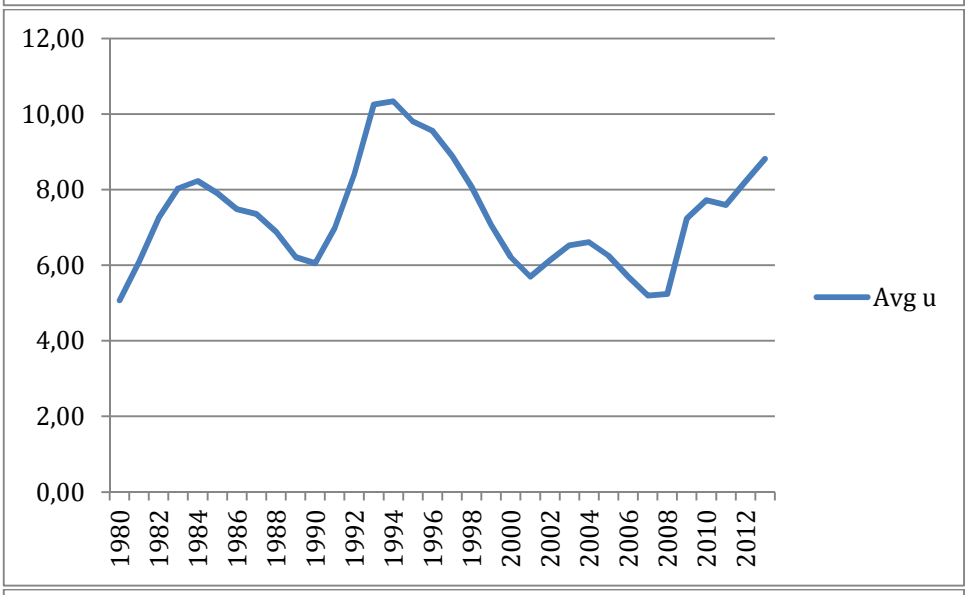
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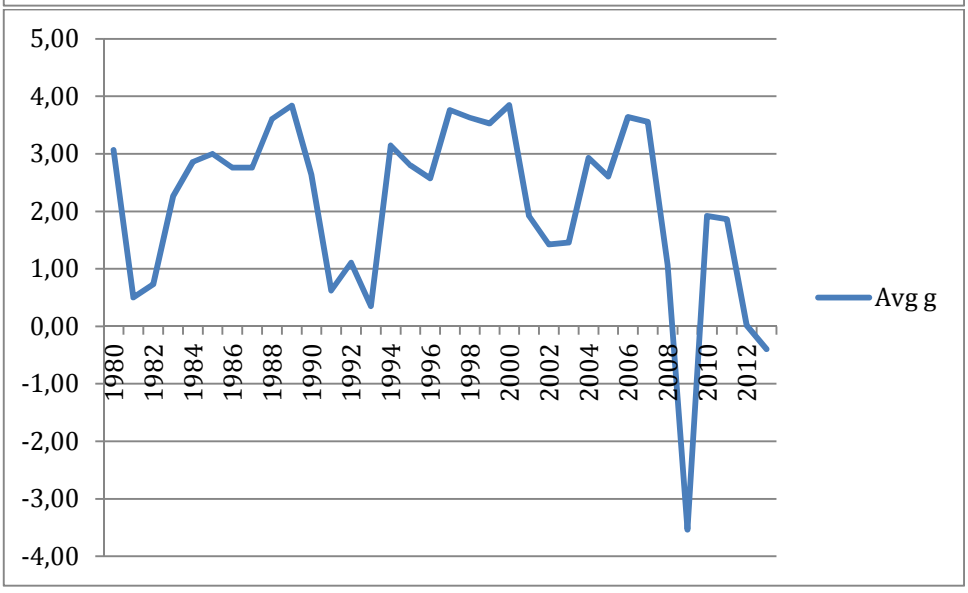
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