Has EMU Led to Higher Debt Levels? 
-A Dynamic Panel Data Estimation

MATILDA EVALDSSON

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Matilda Evaldsson
Abstract

Europe is in the midst of its deepest crisis since the 1930s where unsustainable debt-to-GDP levels are among the most alarming issues. It is so critical that it is unsure if the Euro can be saved. The risk of moral hazard increases within EMU when governments are taking too much risk in their public debt policies due to the anticipation that ECB or other Member States would eventually bail them out. Moreover, the SGP imposes restrictions on government deficits and debts but have previously failed to enforce them. The weakness seen in the past is that no sanctions have been put in place once the limits have been breached and the SGP is therefore incredible. Previous research on common pool and debt spillovers in a monetary union point to an upward drift of public debt as countries join the EMU. Does this argument hold true? In order to find out, 25 OECD countries between the years of 1995 and 2010 are analyzed using System GMM Arellano-Bover/Blundell-Bond one-step estimator. The primary balance, the interest payments, and GDP growth are regressed respectively in order to see through what channel EMU displays its effect. One regression will cover the entire time period and another will only cover the years from 1995 to 2007 in order to isolate the effects of the current crisis. The results, based on the years over the entire time period (including the crisis) suggest that the effect of an EMU Membership goes via the Interest payments which it is connected to positively. By using the equation of debt dynamics, the fact that net debt interest payments are higher for a country within EMU indicates, all else equal, that they have on average higher levels of debt. Nevertheless, this realization might be a crisis phenomenon and the implication of this is not clear. However more importantly, the regressions based on the years of 1995 and 2007 (prior to the crisis) did not display any significant results. These results indicate that there is no significant relationship between a country’s membership in EMU and its level of debt prior to the crisis.

Key-words
Economic and Monetary Union, Stability and Growth Pact, Government Debt, Dynamic Panel Data Estimation, Arellano-Bover/Blundell-Bond, System GMM
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1. Introduction

"The current economic situation is entering a dangerous phase. This heavy debt of sovereigns, households and banks represents risks that could actually suffocate the recovery."
-Christine Lagarde, Managing Director, International Monetary Fund

Along with global warning, national debt levels are among the most alarming issue that Europe is facing today. The financial and economic crisis that hit all advanced economies between 2008 and 2010 severely damaged the public finances of most EU Member States. The government budget balances deteriorated sharply and the debt-to-GDP ratio increased. In some Member States, the situation of the public finances has become so critical that their financial sustainability is at risk (European Commission 2011). Large financial assistance packaged from the European Union and the IMF has been negotiated for the most severely affected euro countries, but still there are ongoing debates of whether or not Greece should leave the Monetary Union or if a bail-out is an option. It is safe to say that the European economy is in the midst of its deepest crisis since the 1930s.

The crisis has highlighted the issue regarding sovereign countries’ unsustainable debt and deficit levels. The Stability and Growth Pact (SGP) adopted in 1997 imposes restrictions on government deficits and debt and limits the deficit-to-GDP ratio to 3 percent and the gross debt-to-GDP ratio to 60 percent. These restrictions also serve as entry requirements for EMU, however; once a country has entered it cannot be forced to exit. Therefore, the original debate of EMU was concerned with the possibility that ECB may be forced to prevent a sovereign debt default by either relaxing its monetary stance at the cost of raising union-wide inflation or by buying the debt of governments under financial distress. This would lead to that the European taxpayer would end up paying for the recapitalization of the ECB. The risk of moral hazard therefore increases when governments are taking too much risk in their public debt policies due to the anticipation that ECB would eventually step in (Beetsma & Guilliodori 2009).

According to Paulus (2006) previous research on common pool and debt spillover problems in a monetary union point to an upward drift of public debt for countries joining EMU. This could, therefore lead to the expectation that, the more countries joining the EMU, the more pressure will develop on the already battered SGP. Tornell and Velasco (1995 and 1996) argues that not all fixed exchange rate regimes help to stabilize fiscal balances, on the contrary, they seem to more often lead to rising government debt. Does this argument hold true for the EMU? Has the participation in EMU led to higher debt levels among the Member States?
The focus of this thesis is on the budget balance development of 25 OECD countries where 13 are EMU members between the years of 1995 and 2010. The crisis since 2008 will be isolated by conducting regressions on two separate time periods. The monetary union can display its effect on debt through three different channels: the primary balance, the net debt interest payments, and GDP growth. Therefore three equations based on theory of debt dynamics are constructed and tested using System GMM Arellano-Bover/Blundell-Bond one-step estimator. Great emphasis will be placed on an Economic and Monetary variable which is displayed as a dummy. The dummy takes on the value of 1 if and when the country entered the monetary union and 0 otherwise. Also, by comparing the time-series behavior of determinants of the debt-to-GDP and deficit levels in all countries will allow us to see which effects of the euro are and are not evident. Many previous researchers have claimed that it is too early to draw relevant conclusions of whether or not being part of EMU has led to increased debt. This thesis’ contribution to the literature is to update earlier papers and to test it in a more advanced econometric setting. In addition, it tries to find out through what macroeconomic channel EMU displays its effect. The equations have been scaled down so that the effects of the euro receive greatest attention. This has not been tested previously, what I am aware of, and will therefore be a great support to the literature. Furthermore, the current European debt crisis is highlighted and more deeply discussed. Also, this research might come across as rather negative to the Economic and Monetary Union where the downside of the union is primarily discussed. This is just to highlight the problems that Europe is facing today which is important at times like this.

1.2 Purpose of the study
The purpose of this study is to test econometrically whether the participation in the Economic and Monetary Union has had any significant impact on countries’ debt levels. This will be analyzed by testing if and through what channel the monetary union displays its effect. Therefore, the impact of the euro will be assessed on the primary balance, the net debt interest payments, and GDP growth respectively. Consequently, the two research questions are:

- Has the participation in EMU led to higher debt levels among Member States?
- Through what channel does the monetary union display its effect?

1.3 Method
In order to attain the purpose of this thesis, a dynamic panel data estimation is performed using Arellano-Bover/Blundell-Bond one-step estimator based upon System Generalized Method of Moments i.e. System GMM. Since we are now entering the thirteenth year since the launch of the euro it is possible to conduct time series analyses. The econometric model will be based on a panel
data of 25 countries participating in OECD, where 13 countries are members of EMU covering the period between 1995 and 2010. One regression will cover the entire time period and another will only cover the years from 1995 to 2007 in order to isolate the effects of the current crisis. Three separate regressions will be made based on debt dynamics equations. The dependent variables will be the primary balance, net debt interest payments, and GDP growth. These three are chosen to find out if and how the euro can impact budget balances.

There will be one dummy variable for the monetary institution incorporated in the model. The EMU-dummy will be assigned the value of 1 if and when the country became a member of EMU and 0 otherwise. By comparing the time-series behavior of determinants of the debt levels in all countries will allow us to see which effects of the euro are and are not evident. Furthermore, various factors affecting government debt and deficits will be presented and discussed.

The econometric analysis will be based on a relevant theoretical framework of debt-and deficit levels retrieved from books and publications. Secondary data for these examinations will be retrieved from OECD, the International Monetary Fund (World Economic Outlook Database and International Financial Statistics), Eurostat, and CIA-the world factbook. A list of the variables used and their source is displayed in table 2 in Appendix B.

1.4 Limitations
The empirical analysis will cover the period between 1995 and 2010 and contain only 25 out of the 34 OECD countries. This limitation is due to lack of data on several countries before and during the given time period. The lack of data will affect the econometric analysis negatively, however, by using the method of dynamic panel data estimation we hope to be able to draw valuable conclusions.

1.5 Previous research
Paulus (2006) examines empirically the effects of both public debt demand and supply factors on the budget balances in eight EMU candidate countries from CEE, including old EU members and major non-EU economies from 1994 to 2005. His analysis is conducted using a pooled regression analysis with fixed effects for 30 countries to measure the impact of various factors on budget balances. Although most of the SGP literature assumes that EMU will cause a bias for higher debt due to spillover effects between EMU members, the author’s results suggest a more positive budget balance during the EMU phase. However, he concludes that it is too early to tell from an empirical investigation exactly what impact EMU has on government debt which suggests further research.

Heinemann (2000) empirically studies EMU’s effect on primary balances, despite the lack of data, and finds a positive impact on the balances. As Paulus (2006), he uses a pooled least square
regression and analyses the primary balance reaction to various factors. On the contrary, Hughes Hallet, Lewis, and von Hagen (2003) as well as Hughes Hallett and Lewis (2005) finds evidence of a “consolidation fatigue” implying that the fiscal stance of countries are slackening after entry into EMU. However, Wyplosz (2006) finds evidence of some improvement for fiscal discipline among EMU members.

According to Beetsma and Guilliodori (2009), since the first group of countries joined the EMU, sovereign debt interest rate differentials have fallen to very low levels. Even during the financial crisis of 2009, interest rate differentials were low by historical standards. The authors argue that this observation could be a reflection of market participants expecting that EMU members’ fiscal policies will be disciplined. However, it could also be a sign of that the ECB no-bail-out-clause is imperfectly credible.

1.6 Outline of the thesis
The following chapter will provide the reader with sufficient background about the Economic and Monetary Union (EMU) where the Institutional framework and the costs and benefits that are associated with a monetary union will be discussed. Furthermore, background facts about European debt and deficits will be provided followed by the causes and effects of the European debt crisis. Chapter 3 presents the theoretical framework necessary for the empirical results and the critical analysis. Chapter 4 contains the econometric model followed by the empirical results in chapter 5. Lastly the study is summarized and conclusions are drawn in chapter 6.
2. Background

This chapter aims to give basic knowledge about EMU, its structure, and its economic history. The information presented in this chapter provides the reader with the necessary facts about the monetary union and its members which is required in order to understand the rest of the thesis.

2.1 Costs and Benefits of a Monetary Union

Research on the costs and benefits of a monetary union stems from the literature of Robert A. Mundell (1961) where he evaluates the theory of an optimum currency area (OCA). Here, the argument goes that a group of countries form an optimum currency area if the benefit of eliminating currency conversion costs outweighs the costs of not being able to stabilize country-specific shocks under unification. In the case of the EMU, the original paper by Mundell (1961) gives rather weak intuitions. This is because the currency conversion costs in Europe are thought to be relatively small. Nevertheless, the move to a single currency area removes the use of the exchange rate as a tool for stabilizing country-specific shocks. Therefore, it limits the set of feasible economic allocations (Beetsma and Guiliodori 2009). As a result, the benefits of being a part of a monetary union is usually at the microeconomic level while the costs are at the macroeconomic level (Horvath and Komarek 2002).

The most common benefits seen in the literature consist of four elements. The first benefit is the reduction in transaction cost of changing currency. The second benefit is the reduction of exchange risk. According to Minford (2002) the elimination of the exchange risk is equivalent to removing a trade barrier which has promoted trade, increased FDI, and reduced the cost of capital. De Sousa and Lochard (2005) suggest that the euro has raised intra-EMU trade by 62 percent. Furthermore, evidence points to that the euro has led to a deepening of bond markets, making it easier to attract funds for investments (Lane 2006). In addition, the euro has led to an increase in corporate value, especially for firms from countries with originally weak currencies. The third benefit is the increased transparency in price comparison. The fourth and final benefit is the political gains from increased cooperation in a closer union originated from the economic relationships within the EMU (Minford 2002).

The benefits are fairly straightforward and do not need any further discussion. We therefore turn towards the more problematic costs. The costs in the connected literature can be divided into three main parts that receives greater attention below. What is considered to be the most important cost of a monetary union is the loss of a country’s ability to use the exchange rate and monetary policy for stabilization. However, instead of devaluation, a country within EMU can use fiscal policy such as a government expenditure reduction to stabilize asymmetric disturbances. De Grauwe (2000)
concluded after analyzing a potential demand shock that the two policies lead to the same effect on output and the trade account in the long run. His conclusion is in line with classical economics that in the long run, manipulating money cannot solve problems that arise in the goods market. However the difference lies in the short run dynamics. De Grauwe (2000) argues that when a country devalues it avoids the severe deflationary effects on domestic output during the transition period, however the cost is inflation. When a country, on the other hand, uses fiscal policy by reducing government expenditure, inflation is avoided but the cost is decline in output. Moreover, the second policy may take a long time to be successful if the wage and price flexibility is limited. Therefore, in the short run the loss of the first policy instrument is the main cost of a monetary union.

The second cost associated with the monetary union is the effects of the harmonization initiatives linked with EMU. A monetary union will be successful if three conditions are met; symmetry (of shocks), flexibility, and integration. This implies that the macroeconomic shocks that one member experiences should be sufficiently correlated with those experienced by the rest of the monetary union. In order to adjust to asymmetric shocks, the countries should have sufficient flexibility in labor markets (De Grauwe 2006). According to Minford (2002) in order to avoid instability in the economy as a result of losing control of monetary policy is greater wage flexibility. However this has gone unnoticed and instead economists argue that “harmonization” of taxes and other institutions should be the main concern. Minford (2002) argues that this would imply high costs for the union and will not itself provide any help for the EMU, it would rather be a step towards more centralized federal institutions.

The third cost of being a part of the monetary union regards the high probability of stabe EMU countries having to “bail-out” other EMU countries in financial distress. The main arguments in the literature concern the ageing population and Member States’ large state pension deficits. Since EMU is becoming more integrated, the costs of letting a fellow member default on its debts are too high. The current economic debt crisis in Europe has lifted the debate of “bail-out” and has placed the member countries in a pecuniary situation when trying to save the Euro. This cost is further discussed in the theoretical section 3.1.3.1.

2.2 The Stability and Growth Pact
The Maastricht Treaty and, subsequently, the Stability and Growth Pact (SGP) adopted in 1997 imposes restrictions on EMU Member States’ government deficits and debt and limits the deficit-to-GDP ratio to 3 percent and the gross debt-to-GDP ratio to 60 percent (Beetsma & Guiliodori 2009). EU countries are, through the Pact, bound to have control over their financial balances in order to obtain long-term fiscal positions and be insured against shocks. The SGP consists of a preventive arm
aimed at avoiding excessive deficits and a dissuasive arm aimed at managing excessive deficits once they have occurred. The preventive arm consists of annual stability programs for the EMU members and convergence programs for the non-EMU members aimed at entering the EMU in the future. In these programs, countries plan how they intend to achieve or safeguard sound fiscal positions in the medium term. The dissuasive arm can possible lead to financial sanctions which take the form of the country having to submit a non-interest bearing deposit which becomes a fine if the country persists on running an excessive deficit (Beetsma & Guiliodori 2009).

2.2.1 Evaluation of the SGP
National fiscal policies within EMU have to learn to adapt to two concerns. The first concern has to do with flexibility in budgets. Since the exchange rate instrument as a tool to confront asymmetric shocks is eliminated, the national government budgets have to continue to play some role of automatic stabilizers when countries are hit by recession. A second concern is related to the negative spillover effects from unsustainable debts and deficits between countries. These spillovers can not only harm countries within the EMU, but it can also put severe pressure on the SGP (De Grauwe 2000).

The SGP has to find a balance between flexibility and deficits and it is clear that the pact has been more guided by the fear of deficits than flexibility in the past. According to De Grauwe (2000) the 1990s recession in the EU countries showed an increase in the budget deficit for several countries that exceeded the allowed limit set by the SGP of 3 percent of the country’s GDP. These countries could have been subjected to sanctions which could have led them to apply a more restrictive fiscal policy during the recession. Furthermore, since the limit is set at 3 percent, countries would have to run budget surpluses on average in order to have sufficient flexibility during recessions.

The lack of budget flexibility during recessions will create tension between national governments and European institutions in two different ways. First, since countries will not be able to use the automatic stabilizers in their budget to dampen recessions; pressure will be put on ECB to relax its monetary policies. The second tension comes from the possibility of sanctions once the limits in the pact have been breached. Obviously, when a country is in a recession it struggles with economic problems. The SGP might even intensify those problems if they would hand out fines and penalties when countries need help at the most (De Grauwe 2000). Beetsma and Guiliodori (2009) argue that since deficits tend to be high when the business cycle is unfavorable, imposing sanctions under those circumstances would actually be counterproductive. Evidence from the ongoing European debt crisis

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1 Finland, France, Sweden, Spain, Portugal, and the UK saw their budget deficits increase by more than 3 percent during the recession. Finland, Sweden, and the UK could invoke exceptional circumstances which imply a decline in GDP of 2 percent per year. However, France, Portugal, and Spain could not (De Grauwe 2000).
from 2009 can shed some light into the matter. According to the European Commission report of 2011, one of the reasons that no urgent corrective action were taken by the countries with large deficits and debts was because no punitive financial sanctions where put in use when the limits were breached. This has further weaken the already battered pact as countries may feel that it does not matter if the limits are breached in the future since no direct negative consequences will come from this.

Another critic that has been raised is about the fact that the restrictions of the SGP also serve as entry requirements for EMU. This is supposed to ensure that countries have sufficient stable government financial balances when entry occurs. However, there is a possibility that these requirements are met in the pre-entering period and once the country has entered the fiscal restrictions will be relaxed. These arguments clearly show that the solution is not straightforward but critics have been raised that the content and format of the SGP is vague and needs to be revised.
2.3 Debt and Deficits

2.3.1 The Record
In order to provide some background about the economic situation of the OECD countries that are analyzed in this thesis, some descriptive statistics on average national government balances and gross debt are provided in table 1.1 in Appendix A. The statistics have been divided into three time periods; 1995-2001, 2002-2007, and 2008-2011. The period has been divided such that in the first period, almost all OECD countries in the sample, except the Slovak Republic and Slovenia, have entered the monetary union. The second period can give us intuitions about the change in the levels after the entry period and before the financial crisis. The third period will isolate the special circumstances regarding the European debt crisis that followed the financial crisis. Of the 29 OECD countries analyzed, 14 are part of EMU. The numbers in table 1.1 that are colored red indicate that they do not comply with the restrictions imposed by the SGP, more specifically that the deficit/GDP ratio exceeds the 3 percent limit and that the gross debt-to-GDP ratio exceeds the 60 percent limit. The countries within the monetary union are marked blue in the table.

Column (a) and (b) from table 1.1 displays the government balances as percentage of GDP for the time periods 1995-2001 and 2002-2007. By looking at the overall EMU average for these two time periods, one can see that the deficit has increased slightly, however, the majority (7 out of 12) of the EMU countries have decreased their average deficits from period 1 to period 2 implying that the SGP might have had effect. Nevertheless, for the non-EMU members, their overall average decline in deficits was approximately 1.2 which gives evidence that EMU countries have been worse off in regards of budget balance than non-EMU countries during these periods. As predicted, the period between 2008 and 2011, column (c), displays a large increase in deficits for all EMU countries except Finland and Germany. Germany has actually improved its deficit during all three periods. By comparing the overall EMU average and the overall non-EMU average, the EMU-average is almost double that of non-EMU.

Figure 1 shows the average budget balance for EMU members and non-EMU members respectively. From this figure one can see that the average budget balance for EMU members was slightly better than non-EMU members in the early years of the euro. However, since then the budget balance has deteriorated and countries within EMU have had greater deficits on average than non-EMU countries after 2003 and forward.

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2 Even the countries not part of EMU are marked red if they exceed the levels; this is just to show the economic situation of these countries as well.

3 Slovenia and Slovak Republic are marked as blue because they are part of EMU, however, they did not enter until 2008 and 2009 respectively implying that they are not part of the EMU average during the first two periods and therefore fall under the category “all” in the first two columns; (a) and (b).
Turning to the gross debt as percentage of GDP, one can see going from column (d) to (e) that the results are similar to the previous section. 7 out of 12 EMU members have experienced a decrease in debt-to-GDP ratio. Moreover, the overall EMU average declined rather sharply between the first two periods, going from app. 60.07 in 1995-2001 to 54.5 in 2002-2007. These statistics can be compared to the non-EMU average where the decreased was relatively small, going from app. 39.5 to 39.3. As predicted here as well, the third period displayed in column (f) shows that all countries, except Sweden, Denmark, and New Zealand, have increased their debt levels. The average increase among EMU members has been 9.47 since the previous period in column (e). This can be compared to an average increase of 16.07 for the non-EMU countries. These numbers are confirmation of the fragile economic situation of all the analyzed countries and illustrate a sharp increase in global debt levels.

The primary balance is regarded as a target for policy intervention in order to secure financial sustainability. If the debt level increased then the primary balance must increase in order to ensure that the intertemporal budget constraint holds. Figure 2 in Appendix A display the primary balance as percent of GDP and the debt-to-GDP ratio of the 24 countries of the sample where 13 are part of the Euro area. As one can see, the debt-to-GDP ratio has been relatively stable up to the beginning of the economic crisis where it then points to an upward drift. The primary balance displays roughly the same results but with a downward trend since the crisis begun. However, France and Germany shows a slight upward drift in debt-to-GDP ratio during the whole time period. Japan can be viewed as an outlier; however, removing the country may cause a bias. The OECD countries were chosen in

Source: Own calculations based on data retrieved from OECD and Eurostat.
the first place because they are fairly similar when it comes to economic indicators. Therefore, in this case, the outliers make the sample and it is important to include all. Based on these graphs we cannot see a trend of neither a significant increase in budget deficit nor an increase in government debt that can be connected to the EMU-membership. Instead we have to turn to the analysis of the empirical results in section 5.

2.3.2 Causes and Effects of the European Debt Crisis

The European debt crisis was the second wave of the financial crisis developed with remarkable speed in the United States in 2008 when mortgage backed securities, spread through the U.S. and global financial system, suddenly collapsed in value (Nanto 2009). It continued in 2009 when fears of a European sovereign debt crisis started to arise among investors. This fear was a result of government debt levels across the globe increasing together with the downgrading of government debt of certain European states. This made it difficult or impossible for Greece, Ireland, and Portugal to re-finance their debts (Buiter 2010).

The massive depth of the crisis influenced some countries more dramatically than others. Although the aggregate output was recovered in the beginning of 2011, the overall economic situation remains fragile. The economically difficult times in the period between 2008 and up to today have shifted focus towards policy on long term challenges. Since 2011 the consolidation of public finances has increased where Member States of EU and the euro zone are improving their budget balance through fiscal tightening (European Commission 2011).

The crisis has highlighted major weaknesses of the European public finances. Higher public deficits and weak support for the financial sector have driven up public debt. According to the European Commission report of 2011, the increase in government debt is a result of both the policies that were introduced during the crisis years and the underlying fiscal positions that developed during that period. Experts claim that the automatic stabilizers have been responsible for about half of the deterioration in budget balances that can be seen in figure 1. In addition, temporary support measures contributed to the increase in debt levels (European Commission 2011).

However, the crisis was not only a result of policy decisions after 2007 but was also influenced by decision making in EMU before the crisis. Asset booms, specifically real estate, occurred in some member countries which led to an increase in private debt. These booms disguised a fiscal weakness that tax receipts depended heavily on debt fuelled consumption which had a negative impact on the fiscal position when these assets plummeted. These windfall profits were often used to fund expenditure programs and a lasting deficit appeared when the revenues dried up. Another underlying reason of the high debt levels was the pre-crisis finance of government expenditure.
Evidence show that positive revenues that many countries experienced during the time was not used to reduce borrowing debt but was rather used to increase government expenditure. As a consequence, the underlying budget position was weakened which made it difficult to reduce expenditure once it was implemented (European Commission 2011).
3. Theoretical framework

This theory chapter examines the relevant basic theoretical background that is required for the following analysis. The chapter will start by presenting the main theories regarding the dynamics of debt in countries in and outside of EMU followed by factors influencing the demand for government debt and subsequently the institutional causes. Thereafter the Arellano–Bond dynamic panel estimation will be presented and explained.

3.1 Factors influencing government debt levels inside and outside EMU

3.1.1 Debt dynamics

The government is assumed to finance its expenditure through two channels; taxation and public debt issuance. The simplified budget balance is assumed to have the following form:

\[
\text{Budget balance} = T - TG
\]  

(1)

Where T is taxes, TG is the total government expenditure including expenditure on goods and services, transfer payments, and the interest payments on government debt i.e. revenues less expenditures. A budget surplus implies an excess of revenues over expenditures while a budget deficit is the opposite.

The relationship between debts and deficits can be derived using the government budget constraint:

\[
G - T - iD = \frac{dD}{dt} + \frac{dM}{dt}
\]  

(2)

where G is the level of government spending excluding interest payments of government debt, T is the tax revenue, i is the interest rate on all outstanding government debt D, and M is the level of the monetary base. The left hand side of the equation is the government budget deficit where (G-T) is the primary deficit; the deficit derived after deducting interest payments. The deficit can be seen as a one year’s shortfall that has to be made up for by borrowing. The right hand side of equation (2) is the financing side. The budget deficit can be financed by issuing debt (dD/dt) or by extending the monetary base (dM/dt) which is called seigniorage. However, we assume that the monetary part of the financing side constitutes of such a small part and can therefore be disregarded\(^4\). To be able to compare debts and deficits between countries, it is convenient to express the variables as ratios to GDP. We therefore define:

\[
d = \frac{D}{Y}
\]  

(3)

\(^4\) It is clear from economic history that the systematic use of seigniorage as a source of finance will lead to inflation and is therefore not commonly applied. Moreover, member countries of EMU cannot use the monetary base as a tool for deficit financing due the fact that they share currency.
where $Y$ is GDP so that $d$ is the debt-to-GDP ratio. Changes per unit of time will further be represented by putting a dot above each variable, thus $dD/dt = \dot{D}$. We can therefore write:

$$\dot{d} = \frac{\dot{Y}}{Y} - \frac{\dot{Y}}{Y^2}$$

By using (3) and manipulate we can write:

$$\dot{D} = \dot{d} Y + d\dot{Y}$$

We can then substitute (5) into the government budget constraint (2) to get:

$$\dot{d} = (g - t) + (i - y)d$$

where $g = G/Y$, $t = T/Y$ and $y = \dot{Y}/Y$ (the growth rate of GDP).

Equation (6) shows the dynamics of government debt. The formulas related to debt dynamics assumes that changes in liabilities are due to above-the-line budgetary operations. This implies that the debt path is determined by the path of the fiscal balance, hence deficit or surplus. It shows that when the nominal interest rate ($i$) exceeds the nominal growth of the economy ($y$), the government must make sure that the primary budget ($g - t$) has a surplus. If this condition is not met, then the debt will increase without bound which is formally known as the “snowball effect”. Eventually, this would lead to a default on government debt. In order for the government to obtain solvency, the following condition must be met:

$$\dot{d} = 0 \text{ or } (i - y)d = t - g$$

A rise in real growth and/or inflation, combined: nominal growth, could lead to both higher revenues and expenditure of a government, depending on its revenues and expenditure structure. Since these two factors influence the budget balance and accumulated government debt through many channels, it affects the default probability. Accumulated gross debt can be reduced by nominal growth since a country can, through its central bank, boost inflation. On the other hand, raising real growth in the short run is only achievable by deficit spending in conditions of weak domestic demand. However, if a country is a member state of EMU, the European Central Bank (ECB) will not allow individual countries to deal with the inflation level. In this case, when the economy is experiencing deteriorating real growth and when revenues are declining faster than mandatory expenditure such as public wages, it will lead to a real devaluation of government debt as the default risk rises (Paulus 2006).
According to Paulus (2006) the interest paid on government debt denoted \( i \) in equation track the overall interest rate conditions in the respective countries. A monetary union may lead to overall lower interest rates as the exchange rate risk vanishes which in turn boosts real growth.

### 3.1.2 Demand for government debt

A government can demand debt for many reasons, some economic and others political. One of the reasons is so that the government can provide public goods with public investments. Another reason is that the government might want to smooth tax income in the situation where the macroeconomic volatility is high. Since monetary policy cannot be adopted in the EMU, as the monetary autonomy is abandoned, the use of fiscal policy to stabilize the domestic business cycles has become increasingly important. Furthermore, automatic stabilizers such as the social security system reacting to changes in unemployment will likely affect the decision to increase or decrease new government debt. In addition, the government might want to increase debt in order to dampen the structural tax system change (Paulus 2006).

The demand for government debt may also reflect the preferences of the individuals in the countries, a phenomenon that is defined by Wagner’s Law. Wagner suggests that the share of the public sector in the economy will rise as economic growth proceeds. He argues that social progress has led to increasing state activity which has resulted in higher government expenditure. This situation does not necessarily result in higher debt by itself, but because of political reasoning it might be the case. As public expenditure rises, politicians may find it easier to increase government revenues through new debt-making than by raising taxes (Paulus 2006).

Political motives can affect the debt level significantly. Governments may want to “buy” voters’ support where expensive elections may result in higher budget deficits. They may also want to participate in prestige projects which generally raise government consumption. In addition, they might want to leave the government balances in a worse state once they are elected out of office so that their successors will have a rough beginning and thus loose voters’ support (Paulus 2006). The lack of responsibility for government expenditure by officials and politicians may result in the behavior mentioned above which is also referred to as common pool problems. If government revenue and the ability to raise debt are seen as common pool resources, the government in authority will have an incentive to use as much of these resources for their own purpose. This behavior can result in a debt bias. The more severe the common pool problem, the greater the divergence between the marginal social utility and the marginal social cost of public policies. Empirical studies show that this will lead to excessive level of spending, deficits, and debt (von Hagen 2002). In this case, national institutions designed to tackle these problems play an important role.
The common pool problem is different for Member States of EMU because inflation is no longer a tool to devalue debt. However, countries may free ride on inflation externalities caused by debt making of the countries within EMU.

3.1.3 Institutional factors
A monetary union such as the EMU can have an impact on sovereign government debt in several ways. When a country finds itself on a path towards an unsustainable increasing level of government debt, negative spillover effects are created for the rest of the monetary union. Continuously higher sovereign debt will be reflected in a lower credit supply as a result of the increasing recourse to the capital markets of the union which would drive the union interest rate upwards. This increase in the union interest rate will in turn increase the burden of the government debt of the other countries (De Grauwe 2000). This effect is however present in all exchange rate regimes and reflects that increasing demand leads to higher prices. However, this practice can also lead to that credit rating companies lower the credit rating of other countries due to similarity which could lead to a contagion effect like an overall depreciation of the euro. This is however not just the case of EMU but can be seen outside as well (Paulus 2006).

3.1.3.1 Risk of default and a bailout in the EMU
Many economists have debated over the years about whether fiscal discipline will increase or decrease as countries join the EMU. There are two factors in the literature that lead to a change in incentives for countries regarding the size of their budget deficits when they join the monetary union (De Grauwe 2000).

The first factor leads to less discipline i.e. larger deficit and can be summarized as follows. When a sovereign country issues debt denominated in domestic currency, the interest rate the country has to pay reflects a risk premium consisting of two components, the risk of default and the risk that the country will devalue its currency in the future. If the debt is issued in a foreign currency this risk is eliminated and the only risk present is the default risk, also known as the credit risk. This is also the case when a country enters the EMU. The governments of the Member States have to issue debt in what is equivalent to a “foreign” currency and hence the risk premium reflects the probability of the government not being able to fully service its debt in the future. However, the lenders may have difficulties in estimating this default risk due to the bailout guarantee that other Member States offer. The possibility of a bailout gives an incentive to Member States to issue unsustainable amounts of debt (De Grauwe 2000). This factor reflects a moral hazard problem. Even if the European authorities declare that they would not bailout any member in financial distress it would not be

5 Although important to note, the issue of debt accumulation due to elections will not be addressed in this thesis and hence will not be a part of the regressions.
credible. A member state’s default will affect the entire financial system of EMU and might necessitate a bailout by the ECB, regardless of the bailout clause in the EU treaty. The primary goal of ECB is to retain price stability, however, in the case of financial turmoil and when banks, the main creditor of debt, are weakened in transmitting monetary impulses from the ECB to the EMU economy, this stability cannot be held constant. As a consequence, this situation would be anticipated by markets which would tolerate more debt (Paulus 2006).

In contrast, the second factor in the literature tends to reduce the incentive to run excessive deficits. Since governments in EMU cannot use monetary creation to finance their budget deficit, Member States face a “harder” budget constraint than sovereign states and will therefore uphold fiscal discipline (De Grauwe 2000).

Even if the fiscal discipline will not deteriorate after entering the EMU, other concerns are raised when assessing member countries’ probability to default. Sovereign nations can default on their debt by either stopping payments of interest on the outstanding debt or by creating surprise inflation and devaluation. However, as a member of EMU with a common currency the second option is not available. This can create pressure on governments to organize an outright default which according to McKinnon (1996) is more likely to happen in the EMU. The level of debt is so high among Member States that the probability of outright default increases (De Grauwe 2000).

3.2 Dynamic Panel Estimation
The Arellano-Bond (1991) and Arellano-Bover (1995)/Blundell-Bond (1998) dynamic panel estimators are widely used in empirical research. The method was first introduced by Arellano and Bond and then improved by Arellano-Bover/Blundell-Bond. Both are general estimators that are appropriate when the equation has: 1) short time periods and larger country dimensions; 2) a linear functional relationship; 3) a single left-hand side dynamic variable; a variable that depends on its past values; 4) independent variables that are not strictly exogenous, which implies that they are correlated with past and possibly current values of the error; 5) fixed effects; and 6) heteroscedasticity and autocorrelation.

The Arellano-Bover/Blundell-Bond makes an additional assumption that the first difference of instruments should be uncorrelated with the fixed effects. This allows the introduction of more instruments which dramatically improve efficiency. This is known as System GMM. The main methodology of System GMM is that it uses the levels equation to obtain a system of two equations: one differenced and one in levels. Thus the variables in levels in the second equation are instrumented with their own first difference.
The general model looks like:

\[ y_{it} = \alpha y_{i,t-1} + x'_{it} \beta + \varepsilon_{it} \quad (8) \]

\[ \varepsilon_{it} = \mu_{it} + v_{it} \quad (9) \]

\[ E(\mu_{t}) = E(v_{it}) = E(\mu_{t}v_{it}) = 0 \quad (10) \]

Here the disturbance term has two orthogonal components: the fixed effects \( \mu_{i} \) and the idiosyncratic shocks \( v_{i} \). We can rewrite equation (8) as:

\[ \Delta y_{it} = (\alpha - 1)y_{i,t-1} + x'_{it} \beta + \varepsilon_{it} \quad (11) \]

So the model can be thought of as being for the level or increase of \( y \).

Furthermore it does not assume that good instruments are available outside the immediate data set and therefore assumes that the only available instruments are “internal” i.e. based on the lags of the instrumented variables. This assumption can also eliminate the bias caused by potential endogenous variables.
4. The Econometric Model

This chapter presents the econometric model and the data from which it is derived. In addition, the dependent and independent variables are demonstrated and their predicted signs.

The data used in the econometric model covers the period from 1995 to 2010. One regression will be conducted that covers the entire period and another will only cover the period starting from 1995 to 2007 in order to see the effect of the ongoing financial crisis from 2008. The reason why the period starts with the year of 1995 is due to lack of data on several countries prior to that date\(^6\). In addition, Mexico, Chile, Israel, Turkey, Estonia, Iceland, Switzerland, Poland and Slovenia are excluded from the sample because of large amounts of missing values during the whole time period. Therefore, 24 OECD countries are analyzed using level and dummy data covering the time period mentioned above. There are 13 EMU Members in the sample which roughly ascertains that half is directly affected by EMU. Data is retrieved from OECD, IMF, the World Bank, and Eurostat. An overview of the variables used and their source are displayed in table 2 in Appendix B.

The regressions will determine whether the EMU variable can be used to explain the independent variable using linear dynamic panel data estimation known as System GMM. Three separate regressions will be conducted to see through what channel the EMU variable has its effect. The base model tries to reflect equation (6) in section 3.1.1 and consists of the lagged dependent variable, GDP growth, net debt interest payments as percentage of GDP, the primary balance, and a dummy for the monetary union.

The lagged dependent variable was introduced to account for dynamic effects. For example, in one of the regressions, this year’s change in government primary balance is highly affected by last year’s change in balance and therefore it is important to incorporate this into the model. However, using the lagged dependent variable in panel data regressions is not without complications since the lagged endogenous variable and the disturbance term may plague the analysis and cause a bias. This is one of the reasons why linear dynamic panel data estimations were performed.

The empirical model can be written as:

\[
PD_{it} = \alpha + \beta_1 PD_{it-1} + \beta_2 EMU_{it} + \beta_3 y_{it} + \beta_4 i_{it} + \delta_{it} + \epsilon_{it} \tag{12}
\]

\[
i_{it} = \alpha + \beta_1 i_{it-1} + \beta_2 EMU_{it} + \beta_3 y_{it} + \beta_4 PD_{it} + \delta_{it} + \epsilon_{it} \tag{13}
\]

\[
y_{it} = \alpha + \beta_1 y_{it-1} + \beta_2 EMU_{it} + \beta_3 PD_{it} + \beta_4 i_{it} + \delta_{it} + \epsilon_{it} \tag{14}
\]

\(^6\)Czech Republic, Estonia, Mexico, Chile, Turkey, Israel, Greece, Hungary, Luxembourg, New Zealand, Poland, Slovak Republic, Slovenia, and Switzerland were missing data between the years of 1980-1995. Therefore, the analysis only covers the period after 1995.
where,

\[ e_{it} = \mu_i + v_{it} \quad (15) \]

\[ E(\mu_i) = E(v_{it}) = E(\mu_i, v_{it}) = 0 \quad (16) \]

where \( PD_{it} \) is the primary balance as percentage of GDP, \( EMU_{it} \) is the monetary-dummy which takes the value of 1 if and when the country became a member of EMU and 0 otherwise, \( y_{it} \) is the real GDP growth in percent, and \( i_{it} \) is the net debt interest payments as percent of GDP. The coefficient \( \alpha \) is the overall constant and \( \beta_{it} \) pertain to the effect the various independent variables and the lagged dependent variable are estimated to have on the dependent variable. \( \epsilon_{it} \) is the overall error term for the 24 countries observed over the time period. \( i \) and \( t \) denotes the time and country respectively. Apart from the EMU-dummy, time dummies (\( \delta_{it} \) in the model) are introduced because when estimating dynamic panel data the autocorrelation test and the robust estimates of the coefficient standard errors assume no correlation across individuals in the idiosyncratic disturbances. Time dummies make this assumption more likely to hold. However, no country dummy is introduced because when performing panel data estimations, the estimator automatically control for country differences.

4.1 The Dependent Variables

There are three dependent variables that will be estimated. These variables represent the three channels through which the EMU-dummy can display its effect. They are primary balance, net debt interest payments, and GDP growth. All of them are based on the same equation but simply moved around to see the effect of the monetary union.

The dependent variable in equation (12) is the primary balance. The variable is said to provide an indicator of current fiscal efforts since interest payments are predetermined by the size of previous deficits. For countries that are struggling with a large outstanding public debt to GDP ratio, achieving a primary surplus is important and is usually necessary for a reduction in the debt level.

The dependent variable in equation (13) is the net debt interest payments as percentage of GDP. On one hand, Institutional changes like a monetary union may lead to overall lower interest rates as the exchange rate risk vanishes which in turn will boost real growth. On the other hand, continuously higher sovereign debt will be reflected in a lower credit supply as a result of the increasing recourse to the capital markets of the union which would drive the union interest rate upwards.

In equation (14) the dependent variable is the real GDP growth measured by the annual growth rate of the GDP implicit deflator. This variable shows the rate of price change in the economy as a whole.
The GDP implicit deflator is the ratio of GDP in current local currency to GDP in constant local currency.

### 4.2 The Independent Variables

Apart from the dependent variable five other variables were chosen based on the theoretical framework, see table 2 in Appendix B for an overview. The EMU dummy was introduced which was assigned the value of 1 if and when the country entered the monetary union and 0 if the country did not enter at all. In all of the above equations this is the variable of which the magnitude and the sign we are most unaware of and the results will be a large conclusion of the thesis.

The lagged dependent variable was introduced to account for dynamic effects. It also addresses the serial correlation of the time series. In equation (8) to (10) the lagged dependent variables should display a positive sign. These positive relationships simply show the dynamics of the model. Time dummies are included in the three equations in order to control for potential common time related shocks. The first regression that covers the whole time period contains an economic crisis and the need for these dummies is therefore larger.

In equation (12) an increase in GDP growth should lead to an increase in government revenue and therefore a lower debt level, hence it is expected to have a positive sign. In addition, the net debt interest payments should have a positive sign. In equation (13) an increase in GDP growth is perceived to be potentially inflationary if the economy is close to full capacity; this, in turn, causes bond prices to drop and yields and interest rates to rise. Therefore, the GDP growth is expected to have a positive sign. The primary balance should have a positive sign implying that when the primary balance increases, the interest payments would also increase. In equation (14) a rise in the primary balance should lead to an increase in GDP growth. Furthermore, a rise in interest paid on government debt should have a negative effect on GDP growth.
5. The Empirical Results

The empirical chapter presents the technique of how the econometric method was chosen. Furthermore, the regression results and its implications are discussed.

OLS estimation of dynamic panels with a lagged endogenous variable as an explanatory variable generally leads to inconsistent coefficient estimates, even when cross-section fixed effects are used. This is the reason why the model is estimates using the System GMM Arellano-Bover/Blundell-Bond one-step estimator. It involves a system of moment restrictions exploited in the transformed equation plus those in the original level one. Why System GMM is preferred over Difference GMM is not only that it allows for dummy variables but also that it is more relevant when the dependent variable is close to a random walk. Then past changes may be more powerful in predicting current levels compared to past levels in approximating current changes (Roodman 2006).

Several other factors led to the use of System GMM. First, the Hausman test showed that the fixed effects model was more suitable than the random effects model. Hence, it is assumed that something within each entity may impact or bias the predictor or the outcome variables and we need to control for this. Including fixed effects will remove the effects of those time-invariant characteristics from the predictor variables so that the predictor’s net effect can be assessed. Second, the White test showed signs of heteroscedasticity. Third, the appropriate test indicated that autocorrelation was present in the data, and lastly some of the variables are endogenous. As a result of these tests, many of the problems connected with equations (12)-(14) could be solved by using System GMM, see section 3.2 for a closer discussion of the underlying assumptions.

The fact that many of the independent variables are viewed as being potentially endogenous can be regarded as the biggest problem of this estimation. It is not only the lagged dependent variable that can cause an issue, but also the rest of the independent variables except for the EMU-dummy and the time-dummies. In other words, all the independent variables are treated as endogenous except for the dummies that are treated as exogenous. However, the System GMM method mitigates this problem by introducing the lagged values as instruments. Roodman (2006) argues that to remove the presence of endogeneity it is practical to include all valid lags of the untransformed variables as instruments, where available. For endogenous variables, that means lags 2 and up. This is set by default when performing Arellano-Bover/Blundell-Bond System GMM.

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7 The command xtserial in Stata 11.2
8 The command xtabond2 in Stata 11.2.
Of course, one can always question whether instruments internal to the system will solve the problem of endogeneity. However, when it is difficult to find instruments external to the model that fulfills the necessary requirements of being relevant, this is a valid option. In addition, some data are expressed as % of GDP; the primary balance and the government net debt interest payments, and are thus linked to GDP. By cross correlating the data, however, it gave no indications of correlation in excess of 80-90 %, a rule of thumb when suspecting multicollinearity (Carter Hill et al 2008).

Turning to the results of the regression, table 3 displays the estimation of equation (12)-(14) that covers the entire time period; 1995 to 2010. By looking at the first column where primary balance is the dependent variable, the lagged dependent variable and GDP growth show significant results, although the latter is only weakly significant. The coefficient of interest payments on government debt is insignificant which implies that it does not have an effect on primary balance. Furthermore, the EMU-dummy also displays an insignificant value which indicates that it has no statistical meaning and does not contribute to the model’s explanatory power. In other words, the results show that a country’s possible membership in EMU does not have a significant effect on a country’s primary balance. As mentioned, the GDP growth was found significant only at the 10 percent significance level but it displays a positive relationship with the primary balance as predicted. It is rather straightforward that as the economy experiences economic growth it would be reflected positively in the budget balances.

Column two in table 3 demonstrates the regression result of equation (13) where the net debt interest payment is the dependent variable. These results, from an EMU-perspective, are more interesting. The lagged interest payment is significant and positively connected to the interest payment which just confirms the dynamics of the model. GDP growth was also strongly significant with a small negative estimate. This implies that as the economy grows, the interest payment will fall by a very small amount. This can refute the theory that GDP growth is potentially inflationary if the economy is close to full capacity which can cause bond prices to decrease and interest rates and yields to increase. The most interesting result from this regression is the EMU-dummy which was found significant at the 10 percent level. It evidently shows that the effects of the monetary union go via the interest payments. The dummy is positively related to the interest rate and indicates that as a country enters the EMU, the interest payments will rise. The theory predicting higher interest rates for union members as sovereign debt increases due to lower credit supply might be valid. However, since there is a crisis during this period, the results should be cautiously interpreted.

Column three in table 3 displays the results where GDP growth was the dependent variable. The lagged GDP growth was, not surprisingly, found strongly significant indicating that past values of
growth influence future values. The interest payments present an insignificant result. Furthermore, the primary balance was found strongly significant which shows that as primary balance increases, GDP growth will also increase. It is rather reasonable that as the budget balance is improving, the economy is improving as well. In addition, the coefficient of the EMU-dummy is insignificant and does not add to the explanatory power of the model. One can draw the conclusion that in this case, a country's membership in EMU does not have an effect on GDP growth during this period.

Turning to the regressions that cover the period up to the crisis i.e. 1995-2007 in table 4 we see different results. The first column where the primary balance is the dependent variable displays similar estimates to the entire time period but the significance has shifted. GDP growth went from being weakly significant to strongly significant and just shows that as the economy grows, the primary balance will improve. The net debt interest payments went from being insignificant to weakly significant and implies that interest payments have had a positive influence on the primary balance during this period. The EMU coefficient was not found significant and it therefore indicates that a country's level of primary balance does not differ by being a member of EMU or not.

Column two in table 4 shows the regression results when the dependent variable was net debt interest payment. Compared to table 3, one can see that GDP growth has gone from being highly significant to insignificant. This implies that, between the years of 1995 and 2007, there is no significant relationship between GDP growth and the interest payments. The primary balance was also found insignificant as the previous period. Furthermore, the coefficient of the EMU-dummy turned up insignificant as well.

The last and third panel of table 4 shows the regression result that covers the years before the crisis where the dependent variable was GDP growth. Here, the lagged dependent variable was found strongly significant with a positive sign as predicted. Also, the primary balance was found strongly significant with a positive sign, just like in the entire time period. Even in this regression, the EMU dummy displayed an insignificant result which just shows that a potential membership of EMU does not have a significant relationship with GDP growth.

We conclude this chapter by looking at the coefficient we are most interested in; the EMU dummy. We can see that the only time the dummy was found significant was in the regression that covered the entire time period where the net debt interest payments was the dependent variable. In all of the other regressions, the dummy displayed insignificant results. What this indicates is rigorously discussed in the following chapter.
6. Conclusions

This final chapter draws conclusions from the empirical result based on the theoretical framework.

There are a lot of speculations about what effect the EMU-membership has on several factors, especially debt levels, in the literature. Many of the previous papers on the subject find a positive relationship between EMU and sovereign debt levels but they also conclude that it is too early to tell empirically the effects of a membership. These papers also have econometric flaws that might bias the results. Although, dynamic equations with dummy variables generally call for more advanced econometric computation that can be difficult to interpret.

The aim of this paper was to investigate if it exist a significant relationship between a membership in the Economic and Monetary Union and the primary balance, the net debt interest payments, and GDP growth respectively. This, in turn, could be used to estimate the effect on countries’ debt levels. Equation (6) in section 3.1.1 which the econometric model was based upon can be used to assess the impact of the EMU variable on the three dependent variables and on the overall change in debt. Since all of the coefficients were found insignificant except the one where the interest payments was the dependent variable and where the time period was 1995 to 2010, we can only focus on that. Since the EMU-variable was positive in the regression it implies, all else equal, that the countries within EMU have on average higher net debt interest payments than countries not within EMU during this time period. This in turn may lead, according to equation (6), to a higher change in debt among member countries.

Therefore, the results of this thesis point to that, during the entire time period, the monetary union displays its effect through the net debt interest payments. Higher interest rates may be a result of negative spillover effects. When a country finds itself on a path towards an unsustainable increasing level of government debt, negative spillover effects are created for the rest of the monetary union. Continuously higher sovereign debt will be reflected in a lower credit supply as a result of the increasing recourse to the capital markets of the union which would drive the union interest rate upwards. This increase in the union interest rate will in turn increase the burden of the government debt of the other countries. This theory might be a realization but since the regression based on data before the crisis did not give us any significant results, it indicates that it is a crisis-phenomenon. Nevertheless, negative spillover effects might be a contributor or an enhancer of the European debt

Paulus (2006) for example finds a positive effect from an EMU-dummy on primary balance but he does not take into account the endogeneity problem of his model and his results might therefore be biased.
crisis but since the EMU-dummy was insignificant in the primary balance regressions, we cannot draw any conclusions.

As previously mentioned, earlier research has concluded that it is too early to draw any direct conclusions from an EMU membership. They argue that since the Euro is young and that Europe is in the midst of the deepest crisis since 1930, researchers have to wait a few years before analyzing. This might be true, but the regressions conducted in this thesis have enough observations and should therefore be valid. The fact that an economic crisis is in the middle of the time period may make the interpretations more difficult. However, there will always be another future economic crisis to take into consideration. With this said, this thesis has in fact displayed important results which one may indeed draw valuable conclusions from.

Obviously one of the important results of the regressions is the EMU-variable’s effect on the net debt interest payments during 1995-2010. However, the most important conclusions can be drawn from the other five regressions conducted. In none of the five regressions the EMU coefficient displayed significant results. The regressions that covered the entire time period in table 3 shows that there is no relationship between the EMU-variable and the primary balance and the GDP growth respectively. Similarly, the regressions that covered the period prior to the crisis shows that there is no significant relationship between a country’s membership in EMU and the primary balance, the net debt interest payments, and the GDP growth respectively.

There is an ongoing debate about whether or not countries in Europe should abandon the Euro. According to a poll conducted by Ifop-Fiducial in 2012, 39 percent of the Germans are in favor of leaving the Euro versus 28 percent if the Italians, 26 percent of the French, and 24 percent of the Spaniards (Ross-Thomas 2012). Here the results of this thesis are of great importance. They mainly show that countries within the EMU are overall not worse off in their debt levels than countries not part of EMU. The crisis seems to be a more world-wide phenomenon and not just confined to the European Monetary Union.

The Economic and Monetary Union has brought benefits to all Member States in the form of increased trade, increased FDI, and reduced cost of capital. Still there are reforms that need to be made. First the Stability and Growth Pact should be made clearer so that countries know what to expect when breaking the rules. Second, the ECB must stick to their “no-bail-out-clause” in order to become credible. It is today, as Greece might leave the union, when the ECB and the SGP are really put up to the test.
References


## Appendix A

### Table 1 National Government Headline Budget Balances and Debt to GDP ratio

<table>
<thead>
<tr>
<th>Country</th>
<th>Deficit/Surplus 95-01 (a)</th>
<th>Deficit/Surplus 02-07 (b)</th>
<th>Deficit/Surplus 08-11 (c)</th>
<th>Debt-to-GDP 95-01 (d)</th>
<th>Debt-to-GDP 02-07 (e)</th>
<th>Debt-to-GDP 08-11 (f)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>0.323579381</td>
<td>2.056255357</td>
<td>-2.911203703</td>
<td>15.203</td>
<td>6.68233333</td>
<td>11.72475</td>
</tr>
<tr>
<td>Austria</td>
<td>-2.699742475</td>
<td>-1.934172443</td>
<td>-3.222080155</td>
<td>59.4848571</td>
<td>60.6506667</td>
<td>65.58</td>
</tr>
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<td>Belgium</td>
<td>-1.734831298</td>
<td>-0.633317734</td>
<td>-3.721628637</td>
<td>102.005375</td>
<td>91.7905</td>
<td>94.08425</td>
</tr>
<tr>
<td>Canada</td>
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<td>0.848261826</td>
<td>-3.962837888</td>
<td>49.0227143</td>
<td>31.5675</td>
<td>46.137</td>
</tr>
<tr>
<td>Czech Republic</td>
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<td>-3.731044827</td>
<td>-4.14036221</td>
<td>11.1312857</td>
<td>21.5955</td>
<td>34.3375</td>
</tr>
<tr>
<td>Denmark</td>
<td>-0.145806814</td>
<td>2.820517682</td>
<td>-1.495237723</td>
<td>64.0697143</td>
<td>41.3268333</td>
<td>38.5315</td>
</tr>
<tr>
<td>Finland</td>
<td>0.61552895</td>
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<td>-0.827815074</td>
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<td>-5.920651753</td>
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<td>51.9843333</td>
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<td>-2.19157486</td>
<td>29.0204268</td>
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<td>52.70025</td>
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<td>106.292571</td>
<td>107.920167</td>
<td>137.75925</td>
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<tr>
<td>Hungary</td>
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<td>-7.18033464</td>
<td>-2.121221606</td>
<td>62.1814286</td>
<td>57.8388333</td>
<td>72.62</td>
</tr>
<tr>
<td>Iceland</td>
<td>-0.401130436</td>
<td>1.878889084</td>
<td>-9.733313104</td>
<td>42.4837143</td>
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<td>78.5255</td>
</tr>
<tr>
<td>Ireland</td>
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<td>1.026576217</td>
<td>-15.79186724</td>
<td>50.2358571</td>
<td>23.9476667</td>
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</tr>
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<td>NON EMU</td>
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Figure 2 Primary Balance as percent of GDP and the Debt to GDP ratio of 24 OECD countries
### Appendix B

#### Table 2 Overview of variables used in the regression, their source, and sign

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<thead>
<tr>
<th>Equation (12)</th>
<th>Dependent Variable</th>
<th>Variable</th>
<th>Label</th>
<th>Source</th>
<th>Sign</th>
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<td>IMF</td>
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<td>L.pribal</td>
<td>Lagged Primary Budget Balance, % of GDP (1 year)</td>
<td>IMF</td>
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<td>interest</td>
<td>General Government Net Debt Interest Payments, % of GDP</td>
<td>OECD</td>
<td>Positive</td>
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<td>gdpgrowth</td>
<td>Real GDP growth, % of GDP</td>
<td>IMF</td>
<td>Positive</td>
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<td>EMU dummy, 1= EMU member</td>
<td>Eurostat</td>
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<td>interest</td>
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<td>OECD</td>
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<td>L.interest</td>
<td>Lagged General Government Net Debt Interest Payments, % of GDP (1 year)</td>
<td>OECD</td>
<td>Positive</td>
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<td>pribal</td>
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<td>gdpgrowth</td>
<td>Real GDP growth, % of GDP</td>
<td>IMF</td>
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<td>gdpgrowth</td>
<td>Real GDP growth, % of GDP</td>
<td>IMF</td>
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<td><strong>Independent Variables</strong></td>
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<tr>
<td>L.gdpgrowth</td>
<td>Lagged Real GDP growth, % of GDP (1 year)</td>
<td>IMF</td>
<td>Positive</td>
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<tr>
<td>interest</td>
<td>General Government Net Debt Interest Payments, % of GDP</td>
<td>OECD</td>
<td>Negative</td>
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<tr>
<td>pribal</td>
<td>Primary Budget Balance; General government primary net lending/borrowing, % of GDP</td>
<td>IMF</td>
<td>Positive</td>
<td></td>
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<tr>
<td>emudum</td>
<td>EMU dummy, 1= EMU member</td>
<td>Eurostat</td>
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</table>
### Table 3 Regression result

Sample 1995-2010 annual data (unbalanced) 25 countries

Dynamic panel data estimation model developed by Arellano-Bover/Blundell-Bond: System GMM

Standard errors are one-step estimates consistent in the presence of any pattern of heteroskedasticity and autocorrelation within panels.

<table>
<thead>
<tr>
<th>Equation</th>
<th>Dependent Variable</th>
<th>L.pribal</th>
<th>L.interest</th>
<th>L.gdpgrowth</th>
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<td>Eq.12</td>
<td>Primary Balance</td>
<td>0.7663068*** (0.1019763)</td>
<td>0.8815072*** (0.0279531)</td>
<td>0.4168758*** (0.109758)</td>
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<tr>
<td>Eq.13</td>
<td>Interest</td>
<td>-0.1217011* (0.0724451)</td>
<td>-0.0007745*** (0.000265)</td>
<td>-0.4638225 (8.845819)</td>
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<tr>
<td>Eq.14</td>
<td>GDP Growth</td>
<td>7.62443 (5.425241)</td>
<td>-0.0001642 (0.0003914)</td>
<td>0.2423676*** (0.0951218)</td>
</tr>
</tbody>
</table>

- Year dummies: Yes
- Obs.: 332
- Groups: 24
- No of instruments: 22
- Sargan test: 0.991
- Arellano-Bond test: 0.278

<table>
<thead>
<tr>
<th>Equation</th>
<th>Dependent Variable</th>
<th>gdpgrowth</th>
<th>pribal</th>
<th>emudum</th>
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</thead>
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<tr>
<td>Eq.12</td>
<td>Interest</td>
<td>-0.1217011* (0.0724451)</td>
<td>-0.0001642 (0.0003914)</td>
<td>0.0991285* (0.0522479)</td>
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<tr>
<td>Eq.13</td>
<td>Interest</td>
<td>-0.0007745*** (0.000265)</td>
<td>0.2423676*** (0.0951218)</td>
<td>-15.19493 (17.48569)</td>
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<td>Eq.14</td>
<td>Interest</td>
<td>7.62443 (5.425241)</td>
<td>-0.0001642 (0.0003914)</td>
<td>0.2423676*** (0.0951218)</td>
</tr>
</tbody>
</table>

- Year dummies: Yes
- Obs.: 336
- Groups: 25
- No of instruments: 22
- Sargan test: 0.000240
- Arellano-Bond test: 0.669

Notes: ***, **, * asterisks denote significance at the 1, 5 and 10% level respectively. Standard errors are listed below the coefficients. Regression includes time effect dummies that are not included. The Sargan/Hansen test has a null hypothesis of “the instruments as a group are exogenous”. The Arellano-Bond test for second order autocorrelation in first difference has the null hypothesis that the errors in the first difference regression exhibit no second order autocorrelation. The results have been “collapsed” in order to limit the amounts of instruments used in the regression. This is crucial for data with small T.
### Table 4 Regression result

Sample 1995-2007 annual data (unbalanced) 25 countries

Dynamic panel data estimation model developed by Arellano-Bover/Blundell-Bond: System GMM

Standard errors are one-step estimates consistent in the presence of any pattern of heteroskedasticity and autocorrelation within panels.

<table>
<thead>
<tr>
<th>Dependent Variable: Primary Balance</th>
<th>Dependent Variable: Interest</th>
<th>Dependent Variable: GDP Growth</th>
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<tr>
<td><strong>Eq.12</strong></td>
<td><strong>Eq.13</strong></td>
<td><strong>Eq.14</strong></td>
</tr>
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<td>L.pribal 0.8321335***</td>
<td>L.interest 0.8897108***</td>
<td>L.gdpgrowth 0.6446846***</td>
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<td>(0.1099246)</td>
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<td>(0.1060574)</td>
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<td>gdpgrowth -0.0004422</td>
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<td>(0.0601768)</td>
<td>(0.0003408)</td>
<td>(4.913749)</td>
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<tr>
<td>interest 6.394959*</td>
<td>pribal -0.0007101</td>
<td>pribal 0.359221***</td>
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<tr>
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<td>(0.0005821)</td>
<td>(0.1269777)</td>
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<tr>
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<td>emudum 0.05115</td>
<td>emudum 5.938002</td>
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<tr>
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<td>(0.0633196)</td>
<td>(8.78838)</td>
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Year dummies Yes                                 Year dummies Yes                                 Year dummies Yes
Obs. 300                                           Obs. 300                                           Obs. 300
Groups 25                                          Groups 25                                          Groups 25
No of instruments 19                               No of instruments 19                               No of instruments 19
Sargan test 0.517                                  Sargan test 0.113                                  Sargan test 0.688
Arellano-Bond test 0.442                           Arellano-Bond test 0.124                           Arellano-Bond test 0.135

Notes: ***, **, * asterisks denote significance at the 1, 5 and 10% level respectively. Standard errors are listed below the coefficients. Regression includes time effect dummies that are not included. The Sargan/Hansen test has a null hypothesis of “the instruments as a group are exogenous”. The Arellano-Bond test for second order autocorrelation in first difference has the null hypothesis that the errors in the first difference regression exhibit no second order autocorrelation. The results have been “collapsed” in order to limit the amounts of instruments used in the regression. This is crucial for data with small T.