AMERICAN UNIVERSITY OF BEIRUT

FISCAL CONVERGENCE AND PROSPECTS OF A FISCAL UNION IN THE EUROPEAN UNION

by
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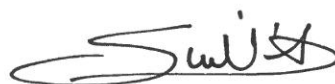at the American University of Beirut

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AN ABSTRACT OF THE THESIS OF

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The European Union's current ongoing economic crisis has caused the consideration by some European Union (EU) members to implement a fiscal union. A fiscal union would imply fiscal transfers which might help alleviate the effect of asymmetric shocks to the region. This thesis empirically tests for the possibility of a fiscal convergence already occurring in the EU by focusing on 2 key fiscal variables – general government debt (%GDP) and general government deficit(%GDP). This thesis is divided into 5 chapters. The first chapter introduces the EU, EMU, and provides a brief introduction. The second chapter discusses the conception of the EU and the level of economic integration. More specifically, it discusses monetary and fiscal policy in the EU, the consequences of a lack of a fiscal union, and provides a literature review. The third chapter presents the OCA model. The fourth chapter presents the results of the chosen tests and the last chapter provides a conclusion.

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CHAPTER I

INTRODUCTION

The European Union (henceforth the EU) has been the subject of a lot of debate in the recent few years. The European Sovereign Debt crisis has left Greece protesting austerity measures that have been imposed to rectify the economy. But Greece isn't the only European country that was affected. Greece was mostly notable due to its incredibly large debt to GDP ratio. This has left many European countries seeking to find a solution and to avoid a similar future occurrence. Monetary policy control lies with a central authority, the European Central Bank (henceforth ECB). However, fiscal decisions such as government expenditure and taxes remain at the hands of each individual member country. This is what has led to some European countries to demand a fiscal union, where a central authority could have some control over the fiscal policies of the member countries. The definition of a fiscal union or what that would entail varies. Some EU and Euro countries are stronger than others in the fiscal sense. The issue of fiscal convergence is a widely researched topic. In the EU, in light of the recent considerations to form a fiscal union, fiscal convergence in the EU and Economic and Monetary Union (henceforth the EMU) should be studied. This paper aims at analyzing the fiscal convergence through the use of 2 tests: The Johansen cointegration test and the Vogelsang β-convergence with structural breaks methodology. The Johansen cointegration test is limited to only testing the general government debt-to-GDP ratio convergence of EU countries. Instead, the Vogelsang method, inspired by its usage by Kočenda(2008) ,was employed. Beta and sigma convergence were both analyzed in order to get a clearer picture of the direction in which the countries are heading.

As stated by the official website of the EU, EUROPA, the first step towards European integration was taken post World War II when it was a main concern to avoid a future and costly occurrence. It began with the treaty establishing the European Coal and Steel Community with the founding members of France, Germany, Italy, Belgium, the Netherlands, and Luxembourg. Despite efforts to unify Europe militarily, efforts failed due to the fear of the return of German militarization. Instead, focus was put on integrating the countries economically (EEC Treaty, 1957). This treaty was followed by the treaties of Rome, the treaty of Brussels, the Single European Act, the Maastricht treaty, the treaty of Amsterdam, the treaty of Nice and the treaty of Lisbon. Today, the EU consists of 28 member countries. One main problem facing the EU and EMU is the occurrence of asymmetric shocks (Sørensen, Kalemli-Ozcan, & Yosha, 2004).

As further mentioned by EUROPA, the EMU was conceived in 1991 by the European Council. In an attempt to further integrate the region, in 1999, they created a common currency, the Euro. However, membership is consistent upon meeting certain convergence criteria discussed in the Maastricht treaty (Treaty on European Union, 1992). Today, the EMU consists of 19 countries. EU countries have the right to "opt" out despite meeting the criteria for joining the EMU (Eur-Lex, 2015). Denmark and the United Kingdom are two such countries. To prepare the countries to join the currency, the exchange rate fluctuations between the euro and the respective country's currency had to be stable (EUROPA, 2015). Since its conception in 1998, the European Central Bank (henceforth the ECB) has proved useful to the European economy. Its main objective is price stability (ECB, 2016). One of the recent tools used by the ECB is that of quantitative easing (henceforth QE). QE consists of increasing the money supply through the acquisition of government bonds and other securities with the use of "electronic cash" that previously did not exist. However, the ECB has limited control over the wellbeing of the European economy. The European Debt

crisis took many by surprise. Before the crisis, investor confidence in the Eurozone was high. As a matter of fact, the default of any of the Eurozone members was seen as an unlikely event. It was known that many Eurozone countries held high debt. However, this did not stop them from lending money at a low interest rate to those countries. When the global economic crisis hit, investor confidence shook. Many began selling the government bonds of the highly indebted countries, such as Greece. Unemployment rates skyrocketed and the region was thrown into a crisis. This led to bailout packages and austerity measures being imposed on countries in trouble (Financial Times, 2016). The Eurozone could not turn to the ECB to buy its bonds and the Eurozone did not even have a lender of last resort (Grauwe, 2011) .When the global 2008 crisis hit, many Eurozone countries attempted to individually stimulate their economies by lowering taxes and increasing public expenditures (Stark, 2009).This later created large deficit for the countries involved. This crisis and the Optimum Currency Area (henceforth OCA) theory lead us to wonder the feasibility of frequent fiscal transfers within the EMU. However, some political problems prevail when stronger countries are expected to bail out weaker ones. As a matter of fact, when Greece showed the need for a bailout, it was not given to it directly in fear of encouraging other countries to seek similar help.

When a shock hits one country but misses another, the ECB cannot implement policies that would affect the countries that are booming at the expense of those that are in a recession. One of the methods employed by unions that actually have some sort of fiscal integration is that of fiscal transfers. The EMU is considered by many to be a crucial example of an OCA. Economist Robert Mundell first brings forth the OCA theory in 1961, way before the conception of the EMU. Mundell focuses on the importance of free labor and capital movement among member countries (Mundell R. A., 1961) .One theory concerning the weakness of the EMU that led to the European Debt crisis is that the inability for citizens on the union to move freely has prevented the economy from self-adjusting through a floating

exchange rate system. Mundell (1961) argues that in order to be considered an OCA, a region has to satisfy the OCA criteria proposed by Mundell. Among those criteria is the free and efficient movement of labor and capital in the area as well as fiscal integration. The EMU has been considered by many to be a failed experiment. The EMU constitutes a group of countries that do not share the same language or culture, hence hindering the total free movement of capital and labor. It would be costly to relocate workers from one member country to another efficiently. The Eurozone is not entirely an OCA yet.

CHAPTER II

BACKGROUND AND LITERATURE REVIEW

A. The start of the European Union

By the end of World War II, European countries were left to rebuild their devastated economies. Millions of people were left homeless and much of the infrastructure was destroyed. Europeans were left with a desire to avoid a future World War III with similar destructive consequences. Back then, the coal and steel industries were vital, especially for the power of the German and French economies (ECSC Treaty, 1951). After tensions arose between Germany and France for control of the coal and steel industries, Jean Monnet, a French civil servant, political economist and diplomat, inspired an idea that would change the course of history. In 1950, this idea became a reality. He proposed Franco-German steel and coal production unity under a common High Authority which is open to other European countries as well (EEC Treaty, 1957). This proposal set pace for what we refer to today as the European Union.

From that point onwards, the integration between European countries simply grew more closely integrated, most notably through treaties. Among the most prominent treaties were: "Treaty establishing the European Coal and Steel Community", "Treaties of Rome", "Merger Treaty", "Single European Act", "Maastricht Treaty", "Treaty of Amsterdam", "Treaty of Nice", and "Treaty of Lisbon".

- **Treaty establishing the European Coal and Steel Community:** The "Treaty establishing the European Coal and Steel Community" was signed in 1951 (ECSC Treaty, 1951). The founding countries were France, Germany, Italy, and the Benelux countries (Belgium, Netherlands, and Luxembourg).

The Treaty establishing the European Coal and Steel Community (1951) discusses that the establishment of the European Coal and Steel Community (henceforth ECSC) was proposed with the aim of guaranteeing long-term peace after WWII especially between France and Germany. It was an economical as well as a political integration considering the importance of steel and coal in their economies. It was a first step towards the providing of free equal access to sources of production. One of the advantages seen in this treaty was the expected increase in employment. This eventually led to free market movement among member countries without imposing taxes or custom duties. As the European Community grew closer together, there were some notable bumps along the way. For instance, in 1954, a unified military Europe was conceived. According to the the research infrastructure on European integration, an Economic Defense Community (henceforth EDC) was planned but never carried forward. Consisting of the same members as the ECSC, the ECD was meant to provide the members with a common budget and military weapons. However, post-World War II, there was still concern surrounding the rise, once more, of the much- feared German military. The loss of French independence was also a main concern. These worries began shaking the European integration drive that had been previously slowly building up in the region. The negative outlook for integration began to subside when, in 1955, the foreign ministers of the 6 member countries came together to appoint a common High Authority for the ECSC. This meeting was dubbed the Messina Conference and brought about hope for an economic, rather than military, future unification of Europes (ECSC Treaty, 1951).

- **Treaties of Rome:** This persistent desire to keep pursuing European integration would later lead to the "Treaties of Rome". One treaty was related to the establishment of the European Economic Community (henceforth EEC) and the second treaty was related to the establishment of the European Atomic Community (henceforth Euratom). The main objective of the EEC was to achieve integration via trade with the end result being a more unified Europe (EEC, 1957).

- **The Treaty of Brussels:** The Treaty of Brussels or the Merger Treaty was launched in 1965.The Merger Treaty (1965) mainly merged the figures of authority of the EEC, ECSC and Euratom into one single Council and Commission.

- **The Single European Act:** The Single European Act (1987) was signed in 1986 by the 12 member states (Belgium, Luxembourg, Netherlands, Denmark, France, Germany, Greece, Ireland, Italy, Portugal, Spain, and the United Kingdom). It was the first major adjustment to the Treaty establishing the EEC. It played a crucial role in European integration by establishing a Single Market, which entailed the intra-regional free movement of goods, services and people. It mainly amended institutional decision making powers. At the level of institutions, the council was allowed more frequently to make decisions based on majority voting rather than postponing until reaching a common agreement among all member states. It also established the European Council.

- **The Maastricht Treaty:** The Maastricht Treaty (1992) (aka the Treaty on the European Union) became active in 1993. It is one of the most discussed treaties nowadays. Its main purpose was to set the pace for the EMU and

establish European citizenship. It aimed to prepare the region for the adoption of the single currency, among other things. Some of the changes involved a common regional concern regarding the monetary policies undertaken by each member state. Member states were even required to consult the commission regarding any monetary policy decisions taken. Also, if a member state is facing economic difficulties due to circumstances that are out of its control then the council may unanimously provide financial help to the member state in need. The treaty also sets criteria for joining the European Union. For example, member states have to avoid incurring large amounts of government deficits. In particular, the ratio of the planned or actual government deficit-to-GDP should not exceed 3%. However, if the ratio has been decreasing significantly and is almost close to 3% or the ratio is usually close to 3% but only for a temporary period of time diverges from 3% then it is also acceptable. Also, the government debt-to-GDP ratio should not exceed 60% unless the ratio has been decreasing and approaching 60%. If the country is already a member state and does not fulfill the criteria or is at risk of incurring high deficits then the Commission prepares a report to determine whether a deficit actually exists or not and if it does then the Council makes recommendations to the Member State in order to rectify the situation. This treaty set pace for the EMU which eventually lead to the creation of the Euro.

- **The Treaty of Amsterdam:** The Treaty of Amsterdam (1997) entered into force in 1999. It created a framework for the then new member states. It also led to the opening of borders across 12 of the member states. Moreover, it

expanded further the number of decisions that can be made through Qualified Majority Voting (henceforth QMV) (Civitas, 2014).

- **The Treaty of Nice:** The Treaty of Nice (2001) came into effect in 2003. Similarly to the Treaty of Amsterdam, the Treaty of Nice was preparing the European Union for the addition of 10 new member states. The Treaty of Nice created a lot of arguments between Member States over the future of the European Union and the amount of power in the hands of the Commission and Council. The treaty was mostly concerned with the decision making process of the EU. It further extended the QMV but also gave more voting power to the largest Member States (Civitas, 2014).

- **Treaty of Lisbon:** Finally, the Treaty of Lisbon (2007) became effective by the end of 2009. Its aim was to amend the Treaty on European Union and the Treaty establishing the European Community. The latter two treaties form the constitutional basis of the European Union. The most significant innovations proposed by the Lisbon Treaty dueled on more centralized EU power, giving a legal personality to the EU, appointed a new president and a single Foreign Policy post. Furthermore, it granted extended powers to the European Parliament (Civitas, 2014) .

As of today, the European Union consists of Austria (joined in 1995), Belgium(1958), Bulgaria(2007), Cyprus(2004), Croatia(2013), Czech Republic(2004), Denmark(1973), Estonia(2004), Finland(1995), France(1958), Greece (1981), Hungary(2004), Ireland(1973), Italy(1958), Latvia(2004), Lithuania(2004), Luxembourg(1958), Malta(2004), Netherlands(1958), Poland(2004), Portugal(1986), Romania(2007), Slovakia(2004), Slovenia(2004), Spain(1986), Sweden(1995), and the United Kingdom(1973). Furthermore, some

countries that are on the road to obtaining EU membership include Albania, the

Former Yugoslav Republic of Macedonia, Montenegro, Serbia and Turkey. Crucial

to the history of the European Union is the founding of the currency area within this

union.

B. Monetary and Fiscal Policy in the EMU

In 1991, in Maastricht, the European Council (hereafter EC) took a decision that would

greatly influence the future of the Union: the creation of the EMU (European Commission,

2015). This topic was also of great importance in the Treaty on European Union (aka the

Maastricht Treaty). It was mainly aimed at economic stability, coupled with an increase in

growth and employment (The Maastricht Treaty, 1992). It would entail cooperation between

countries to develop economic policies for the Euro-area, for member states to stick to their

debt and deficit limits (as stated previously in the Treaty of Maastricht), independent

monetary-policy decisions taken by the European Central Bank (ECB), increased supervision

and regulations, and last but certainly not least, a single common currency (European

Commission, 2015). The countries that met the criteria to join the Euro-area and share a

common currency are today 19: Belgium, Germany, Ireland, Greece, Spain, France, Italy,

Cyprus, Luxembourg, Malta, the Netherlands, Austria, Portugal, Slovenia, Slovakia, Finland,

Estonia, Latvia, and Lithuania. Denmark and the United Kingdom currently do not wish to

join the Currency area and have "opted" out. However, they reserve the right to change their

decision in the future. In the EMU, the decision-making responsibility is divided among the

European Council, the Council of the EU, the Eurogroup, the Member States, the European

Commission, the European Central Bank, and the European Parliament (European

Commission, 2015). The euro currency was first launched at the start of 1999. The euro has

evolved to become the second most important currency after the American dollar. Some

advantages shared by the Member States for acquiring the euro as their currency include the elimination of risks in fluctuations of exchange rates. Also, a main advantage is the decrease in transaction and exchange costs involved when dealing with different currencies with their European neighbors. It promotes tourism as well as purchases among the Member States (European Commission, 2008). At the center of the euro lays the ECB with crucial monetary policy power. The ECB works with one main aim in mind: Price stability in the region. At the fiscal level, each country retains its sovereignty through its own decision concerning taxes and expenditures. However, they are expected to remain within the limits imposed by the Maastricht treaty. Prior to the decision of adopting a single European currency, several advances had already been made in that direction. In 1972, a "currency snake" system was developed (CVCE, 2012). However, back then, the only countries involved were 6 (France, Germany, the Netherlands, Belgium, Italy and Luxembourg). In this "currency snake" system, there was a limit of 2.25% to currency fluctuation among the countries involved (The Guardian, 2001). In 1979, an exchange rate mechanism (henceforth ERM) was established and the ecu, which was a currency unit determined by a basket of European currencies, also came to be. This was succeeded by the ERM II in 1999. According to EUROPA, it aimed to ensure that the exchange rate fluctuations between the euro and the rest of the EU currencies did not affect economic stability and also to prepare the rest of the EU for the potential joining of the Euro currency. The way in which the ERM II operates is by fixing the exchange rate of EU but non-euro area countries against the euro. At the heart of monetary policy decision making lays the ECB. Since its conception in 1998, the ECB has proved rather useful in stabilizing the European economy. The main points addressed in this section are going to be answering the following crucial questions: What tools are at the disposal of the ECB to use union wide and what scenarios can they respond to using monetary policy

tools? Furthermore, what does the monetary policy history of the ECB tell us about its potential in stabilizing the economy and reacting to a certain shock or economical event?

As previously stated, one of the ECB's main objectives is price stability. Prior to the 2008 crisis, when firms would cut down on investments, the central bank would adjust the overnight bank borrowing rate in order to create investment incentive by encouraging loans. The reverse happened if inflation was rising. But during the crisis, even when interest rates were cut down to almost zero, the economy wasn't recovering. This was when quantitative easing was introduced (Economist, 2015). Quantitative easing refers to the purchasing of government bonds and other securities with the use of "electronic cash" that did not exist before then with the aim of increasing money supply (Economist, 2015) .It is meant to encourage loans, increase stocks prices, decrease interest rates, increase investment, and boost investor confidence.

Quantitative easing has been ongoing in the Eurozone for a significant amount of time now. On March of 2016, the ECB actually released a package to stimulate the economy through further quantitative easing (Financial Times, 2016). How effective has quantitative easing been to the recovery of the European economy? We look at a few indicators for that answer. The main indicator watched by the ECB is Headline Inflation. In January 2016, after quantitative easing in the Eurozone had gone on for almost a year, inflation seemed to pick up. However, that would not stop the ECB from further cutting down rates since it was expected to be short lived. Therefore, the results of the ongoing quantitative easing are still unclear.

Since fiscal policy remains at the hands of the individual member governments, some countries fair better than others in this sense. Greece is one of the worst models for handling fiscal policies on its own in the EU. The Greek government spent more than it collected, had

a long record of tax evasion, and forged its debt statistics. Other more disciplined countries, such as Germany, managed to significantly reduce total government debt from its peak point in 2010. During the global crisis, Germany served as a role model in terms of fiscal policy in the EU.

C. Causes of the European Debt crisis

In a domino effect manner, the global financial crisis, which began in 2007, triggered a series of events that would eventually reach the Eurozone and affect its economy to unexpected lengths. It eventually contributed greatly to the European Debt crisis. Prior to the crisis, investors had high confidence in the Eurozone currency area. The default of any of the Eurozone member states was a highly unexpected event at the time. Although it was known that some Eurozone countries held high debt, investors still lent money at a low interest rate to any Eurozone member state. This made lending and borrowing cheap, easy, and tempting, especially to member states like Greece.

The global crisis shook investor confidence which prompted them to reconsider the acquisition of Greek bonds, given the high public debt held by the country. People began to sell Greek bonds which led to an increase in interest rates. With lack of strategies to tackle this sudden debt crisis, the Eurozone could not turn to the European Central Bank to buy back its bonds. Eurozone countries did not have a lender of last resort. Austria, a member of the EU since 1995 and of the Eurozone since 1999, currently holds a public debt-to-GDP ratio of 86.39% equivalent to over 288 million Euros (Burth, 2015). Austria ranks 13 in debt-to-GDP ratio in the European Union (Burth, 2015). It had an unemployment rate of 5.6% in 2014 (Eurostat, 2016). It might seem like a small number especially compared to the rest of the European Union, however, it was actually the highest unemployment has ever reached in

Austria ever. Austria has a relatively early retirement and a lot of vocational training programs that has helped keep the unemployment rate at this level rather than shoot up like in other EU countries (CIA, 2016). Similarly, like in many countries in the EU, austerity measures had to be imposed on Austria. These included expenditure cuts and new revenues. However, while the aim of austerity measures is to stabilize the economy, the austerity packages in Austria did not help stabilize public finances. Belgium, on the other hand, had a debt-to-GDP ratio of 101.5% by 2013 coupled with an unemployment rate of 8.5% (Eurostat, 2016). Even after the occurrence of the crisis, in 2014, Belgium's economy shed some hope when its GDP grew by 0.9% (CIA, 2016). As previously noted, Belgium has a very high public debt and its government has pledged to reduce the public debt and hence the budget deficit as well to improve the competitive position of Belgium. (CIA, 2016).This attempt to reduce the deficit might have a negative effect on economic growth. Cyprus also hit a rough patch when the crisis hit. In 2013, its GDP experienced a decrease of 5.4% (Eurostat, 2016). However, this improved in 2014 when it decreased by only 2.4% (Eurostat, 2016). Exports decreased mainly with Russia but imports increased causing a weakening in the current account balance. According to EUROPA, there was also a significant decrease in levels of investment namely in areas such as equipment and construction. Looking at Estonia, the fiscal situation seems rather good. There appears to be no excess deficit and public debt-to-GDP ratio is below the 60% (the threshold). Estonia has a notably low debt-to-GDP ratio at 10% for the year 2013 up from 4.5% in 2008 (Eurostat, 2015). This ratio is eexpected to remain below 10% for the coming years. The French economy has seen rising debt, low growth but low inflation. It accumulated a significant amount of debt during the crisis. This is coupled with low profits in the private sector that does not help the case with reducing the debt.

D. Consequences of the absence of a Fiscal Union

In response to the 2008 global economic crisis, governments in the euro area attempted to stimulate their individual economies by lowering taxes and increasing public expenditure.This attempt created larger fiscal deficits for the countries.When focus shifted in 2009 to the huge accumulated fiscal deficit, to help decrease Greek deficit, austerity programs were imposed on Greece. But Greece wasn't the only country with high public debt-to-GDP ratios. Other countries were being affected in an equal manner. While several solutions were proposed, increaasing inflation and GDP growth or austerity measures were two important ones (Blundell-Wignall, 2012) . On the other end of the crisis, countries, such as the US, were responding through the use of their fiscal tools. The public and media attention given to the unfolding crisis deteriorated the situation even further. It caused a severe loss of investor confidence and investors began to fear a spread of the crisis through a contagion effect. Eventually, governments began their attempts at fiscal tightening . An increase in exports was not helpful given the bad economic situation worldwide. Also, given the strong connection among European countries in terms of trade, if a country wasn't importing as much as before, the economy of the country it imports from would be equally.

Political problems arise when it comes to helping out a weaker country in need (Connolly, 2010). At the conception of the euro area, there was no common fiscal pool created to help out countries in need of financial assistance. Bail-out and even debt burden reduction were not allowed according to the previous European treaties. More fiscal integration is needed to more effectively manage crises in the euro area. Germany, along with the ECB, has been a major player in crisis management. Greece was not given a bail-out directly. It was believed that if a bailout was made easily available for Greece then this would encourage other member states to disregard the fiscal limitations imposed on them upon the joining of the euro area. Greece, as previously mentioned, had a high debt-to-GDP ratio. Its

government spent and borrowed a lot over the recent decades. Prior to joining the euro-area, Greece would devalue the Greek Drachma to help finance its borrowing. However, after joining the euro, that was not a useful or possible tool anymore. Furthermore, the increasing level of corruption in terms of tax evasion did not help government revenues. When it first entered the euro, Greece's debt-to-GDP level was not at the acceptable rate needed to be accepted into the union. It was later revealed that Greece cheated and misreported its statistics. In addition, even after joining the euro, Greece kept cheating in its reported statistics in order to remain in line with the fiscal limitations. After several warnings from the Eurostat to the Greek government to issue more reliable statistics, the real values were revealed in 2010 and it showed that Greece's deficit ratio was actually 15.5% in 2009 as opposed to the previously misreported value (OECD, 2016). Similarly, the Greek government debt-to-GDP ratio in 2009 was revealed to in truth be at a staggering 126.7% of GDP (Eurostat, 2015). Greece was given several economic adjustment or austerity programmes. The first one was issued in May 2010 and lasted until June 2011. Germany was initially reluctant to the bailout of Greece unless austerity progammes were imposed. This later led to a 3-year 110 billion euro loan plan conditional on implementing the austerity measures. After this occurrence, Greek bond ratings were lowered even further. The Greeks did not approve of the austerity measures imposed on them. The measures included government spending cuts and tax increases which caused resentment among the people of Greece. The second austerity programme is still active until today. In this programme, the euro area came to an agreement to prolong the loan repayment for Greece, Ireland, and Portugal .A new 109 billion euro package was issued and a large amount of Greek debt was written off. Despite public discontent, the austerity measures taken by Greece actually helped reduce the deficit down substantially. During this period of austerity measures, employment rates suffered greatly with a record high of 27.9% reached in September 2013 (CIA, 2015). Paul Krugman,

Professor of Economics at the Graduate Center of the City University of New York, suggested a solution to the Euro debt crisis through a Grexit or a Greek Exit. He proposed Greece return to its national Drachma currency. However, returning to the Drachma might be harder and more costly than anticipated. Even though Greece would be able to use the devaluation of its currency again as a crisis resolution tool, it would be tremendously hard as all the equipment needed to print has been destroyed as soon as they joined the Eurozone. Even if they were after all able to print the Drachma currency, there would still be time needed to readjust. Also, if a Greek exit were to happen, the confidence in the euro zone would tremendously decrease as well as trust between member states. When entering the Eurozone, it is firmly believed that their membership will be everlasting. A Greek exit could shake that confidence. Spain had the highest unemployment rate in the EU. Just like Greece, Spain's debt-to-GDP ratio is exceptionally high. Spain was also one of the countries to receive a bailout programme.

Belke & Gros (1998) suggests 2 mechanisms to target asymmetric shocks in a currency union. First, there are market mechanisms and secondly, institutional based mechanisms. Market mechanisms would include solutions such as a reduction in real incomes or labor and capital mobility. Institutional mechanisms include transfers from the EU central authority or some form of central funds pool or budget. As already mentioned, labor mobility in the region has its cultural barriers. I will be focusing on their discussion of the fiscal federalism solution. Back then, the fears of the current strong Euro area countries were echoed: if a member state is bailed out with central funds then the states won't be as careful in keeping inside the debt limits.

Fiscal federalism could refer to the system similar to that in the United States of America where central budget accumulated from taxation gets transferred from richer areas to poorer areas that are mostly affected by the shock. One of the main questions surrounding fiscal

prospects in the Eurozone is that of the need to have a "federal" fiscal union. Fatás (1998),

for example, explains that the benefits to creating a fiscal federation are actually smaller than

perceived and that interregional risk sharing would become a permanent transfer system from

rich to poor regions.

The Stability and Growth Pact (1997) was created in order to help maintain the stability

of the EMU. Basically, it entails the fiscal monitoring of the members by the European

Commission and the Council of Ministers as well as the issuance of recommendation reports.

If a member State indeed violates the rules of the Stability and Growth Pact (henceforth SGP)

and surpasses the deficit and debt limit, then the member state in question is then subject to

an Excessive Deficit Procedure (EDP). The main point of the pact was to make sure fiscal

discipline was maintained in the EMU. In 2010, at the start of the European sovereign debt

crisis, some reforms were made to impose penalties for crossing the deficit and debt limits. It

was named the "Euro plus Pact" and was a successor to the Stability and Growth pact. After

the crisis hit, the European Financial Stability Facility (henceforth EFSF) was created by the

Euro area. Its purpose was to maintain financial stability in the area by providing financial

assistance. Further actions were taken such as the Treaty establishing the European Stability

Mechanism (henceforth ESM) that was signed in 2012. It was aimed at being a permanent

crisis resolution mechanism. Finally, the Treaty on Stability, Coordination and Governance

(henceforth TSCG) was signed in 2012 by all leaders of the euro area and 8 other EU

member states. The "Six-Pack" consists of 5 regulations and one directive that entered into

force in 2011. They apply to 27 Member States with some specific rules for the Euro Area

Member States. The six-pack entails fiscal and macroeconomic surveillance. It ensures the

strict application of the fiscal rules. Similarly, the Two-pack package aims at further

strengthening the surveillance mechanisms in the euro area. However, it is only applicable to

euro-area Member States.

E. Literature Review

There exists a respectable amount of literature surrounding the prospects of a fiscal union in Europe as well as fiscal convergence. First, some journal articles and reports suggest or conclude that having a fiscal union is necessary for the Eurozone to function and some claim that a fiscal union will not really solve the Eurozone's problems.

As early on as 1999, papers, such as Guvtavsson(1999) ,discussed the sustainability of a monetary union without a fiscal union such as in the case of the EMU. One of the methods employed to study this case is that of comparing it with previous experiences such as US federalism. Interestingly, Guvtavsson(1999) argues that the common belief, that the EMU has no precedent and is unique as the first union of its kind, is actually not true. He describes the "integration staircase" as a staircase starting at the ground level of "Each country for itself" going up to "Free Trade Area", "Customs Union", "Common Market", "Monetary Union" and finally the biggest step towards "Fiscal Union". Back when this paper was written, the European Union had only reached the 4rth level. Now, however, we can say with certainty that is on the 5th level: a Monetary Union. He describes the last step of a Fiscal Union as having a centralized tax bases, convergence of tax levels, centralization of taxes and expenditures, and intraregional fiscal transfers. The last step is descriptive of federal states such as the United States, Canada and Germany. Even in 1999, this article warned that a monetary union without a fiscal union was not such a good idea and that if member states were to take the 5th step towards a monetary union then they had to eventually accept the emergence of a fiscal union. While Guvtavsson(1999) concluded that the Eurozone is in need for a fiscal union, others such as Keuschnigg(2012) did not arrive to the same conclusion. His paper titled "Should Europe Become a Fiscal Union?", as the title suggests, discusses the matter of whether Europe should become a federal fiscal union, referring to a centralized government with one taxes and a fiscal budget. He focuses on three main point of views: The

economic point of view, which also discusses the matter of which country should be included in the union; The political point of view, which deals with whether a political union should be established to increase worldwide European Political influence; The crisis resolution point of view, which would deal with whether a fiscal union is the ultimate solution to the euro crisis and if it will help keep the economy stable. There are several arguments in favor of centralization that are mentioned: First, the ability of centralization to internalize spillovers when a local government policy has spillover effects; Second, the ability to apply economies of scale to public goods that are needed in the whole union; Third, the facilitation of decision making especially when different countries have different interests; Fourth, it helps in dealing with asymmetric shocks. On the other hand, arguments for decentralization equally exist. For instance, the advantage of local governments implementing policies because they are better informed about local matters. Also, it encourages experimentation of policies. Moreover, fiscal competition is seen as desirable. In this point of view, it is mentioned that the Maastricht Treaty prevents any negative spillovers from one country to the next. However, before coming to his conclusion of whether or not he believes a fiscal union would be beneficiary for the European Union, Keuschnigg (2012) distinguishes between a transfer and fiscal union. He defines a transfer union as a system of long-term income transfers and redistribution across the region. Such transfers may come in the form of investment in the national infrastructure of less competitive economies to increase their competitiveness. Large and constant transfers can create tensions in both the donor and recipient countries alike. The donor country does not like the fiscal cost associated with the transfer and the recipient country dislikes the conditions that come along with the transfers. On the other hand, a fiscal union refers to the fiscal insurance of the union over time. This refers to transfers that are short-term. He went on to conclude that a fiscal union does not actually solve the problems of

divergence in Europe given the diversity in culture and preference of government policies among countries.

As for statistical analyses, several important journal articles and reports out there, since the conception of the euro until today, have attempted to analyze fiscal convergence .Some methods utilize time-series while others utilize panel data analysis. One paper that is of major significance to the later part of this thesis is that of Kočenda, Kutan & Yigit(2008). In their paper, they studied fiscal convergence in the European Union (EU) analyzing the convergence of the 10 then-new comers to the EU to the Maastricht criteria, core and periphery averages. They use the Vogelsang (1998) methodology that allows for structural breaks with quarterly data. Their chosen variables were the Maastricht criteria of the deficit-to-GDP and debt-to-GDP ratios. Their findings showed high heterogeneity in fiscal convergence, which led them to question the ability of monetary unions to undergo fiscal convergence. A more outdated but nevertheless equally important paper was done by De Bandt & Mongelli (2000). Similarly, their paper also studied fiscal convergence. More specifically, they study whether economic, financial, monetary integration and institutional factors play a role in the convergence of key fiscal variables in the Euro area by running cross-correlation, dispersion, and cointegration tests on government net lending and total and current expenditure. Their results show some evidence for cointegration for government net lending.

As previously mentioned, some studies studied European fiscal convergence using panel data analysis. For example, Apergisa and Cooray (2014) studied the convergence of sovereign debt accumulation in the heavily indebted countries at that time. The method utilized was the Phillips and Sul (2007) club convergence hypothesis. Their results show evidence for lack of debt convergence for Greece and Portugal. Another paper by Warin (2005) analyzes fiscal perspectives within the EMU by using panel data analysis. Their

methodology entails the usage of a country pair based analysis between 5 cross-sectional units. They compute country pairs among the 12 members of the euro area. The dependent variable is public deficit as a percentage of GDP and the country pairs for monetary and fiscal variables, proxies that measure the economy performance, and real long-term interest rates. They draw a cross-sectional time-series analysis. Their results showed also show a steady convergence of public deficits in the EMU.

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CHAPTER III

THEORETICAL MODEL

All around its 28 member states, the motto "United in diversity" appears in 24 different languages. These different languages highlight the meaning behind the motto itself: Diversity. It signifies different cultures, people, languages, and traditions that have all come together to bring about a more powerful and peaceful Europe. As mentioned in the official website of the European Union, EUROPA, the European Union is a union consisting of 28 members located in Europe. It was founded on a vision to create a powerful and peaceful Europe. This union, that once seemed so promising, has recently taken the spotlight in a negative way. The current debt crisis has raised attention to the possible need of the European Union to have some sort of fiscal integration. One thing to bear in mind when discussing the Eurozone and the European Union is that every country has a lot of economic, social, and political differences. Therefore, different responses to similar problems faced by the Member States are expected. The main problem faced by a monetary union with almost negligible fiscal power is the occurrence of asymmetric shocks. The ECB cannot act when only one country is facing a recession while the others are booming. Vetter (2013) argues that in the Eurozone, shock absorption in the market does not work too well. Therefore, fiscal or monetary action has to be taken to address these shocks. Furthermore, he discusses the various methods used by countries that already have fiscal integration, such as equalization and transfer systems in order to reduce disparities between countries as well as significant budgets with the option of pursuing stabilization policy if idiosyncratic shocks occurred. As mentioned by Vetter (2013), some fiscal policy instruments that are already in place in the Eurozone include budget and debt rules and the banking union cooperation. Due to a growing synchronization of business cycles, it is becoming easier for the central bank to carry monetary policies that are appropriate for every country.

The question of whether the Eurozone (or the then European Community) qualifies as an OCA has been the subject of debate since as early as 1979. In 1961, Nobel Prize-winning Canadian economist Robert Mundell published the article "A theory of optimum currency areas". Mundell considers the lack of an exchange rate mechanism to be the cost of a monetary union. For example, in cases of economic crisis, countries with floating exchange rates can devalue their currency to increase exports. However, a monetary union has a fixed exchange rate system so this type of adjustment is not attainable. Mundell foretells that the benefits of a monetary union will outweigh the cost only if there is a highly sufficient labor and capital cost transfer between the member countries. The EMU is considered by some to be the most prominent example of an OCA. However, it is important to note that the Maastricht criteria, which are criteria set in place to decide which country gets accepted into the union, are unrelated to the OCA criteria. This is most notably seen in the absence of the total free movement of labor and capital among the member countries. The European debt crisis might have been partially caused by this deficiency that could have substituted for the inability to adjust the economy through a floating exchange rate system. This would ultimately lead to the possibility of high unemployment in the affected member countries which might prompt them to exit the union in order to gain back the tool of currency devaluation to stabilize their economy. The main OCA properties include:

- The free and efficient movement of labor, capital and other factors of production in the area

- Price and wage flexibility

- Financial market integration

- Fiscal integration

- Political integration

- Similar inflation rates

- Consumption and production diversification

- Economic openness

In his theory of Optimum Currency Areas, Mundell best explains the scenario of an asymmetric shock and the role of monetary policy in stabilizing it by providing an example of 2 countries: country A and country B. Consumers begin to prefer the goods in country B over the goods in country A. So, country A would experience a downturn and country B would experience a boom. If the central bank would try to stabilize this asymmetric shock then it would not be able to do so. In order to fix this asymmetry in economic growth, the currency in country A would have to be devalued relative to country B. This would give country A its competitiveness due to lower real wages and prices. This would lead to a rise in demand in country A and fall in unemployment. However, this is not a possible solution to the Eurozone since the countries share a common currency. In this case, in country A, there would have to be either a decrease in nominal wages and prices, upward shift of the supply curve of the good through labor migration out of the country, or through an expansionary fiscal policy.

But is the Eurozone considered an OCA? Mongelli (2005) addresses this question by providing European evidence for the latter main properties of an OCA. He notes that Europe has low price flexibility due to low wage flexibility. One reason for that are the high unemployment levels due to adverse shocks. An important OCA theory property is that of labor market mobility. As noted by Mongelli (2005), this property would aid in adjusting permanent shocks if real wages are sticky. Labor mobility was found to be higher in US than He further explains that cross country migration is an unlikely response to economic shocks in the Eurozone. Moreover, there exists culture, language and even housing market barriers within the Eurozone. In 2011, things haven't changed so much with regards to labor mobility.
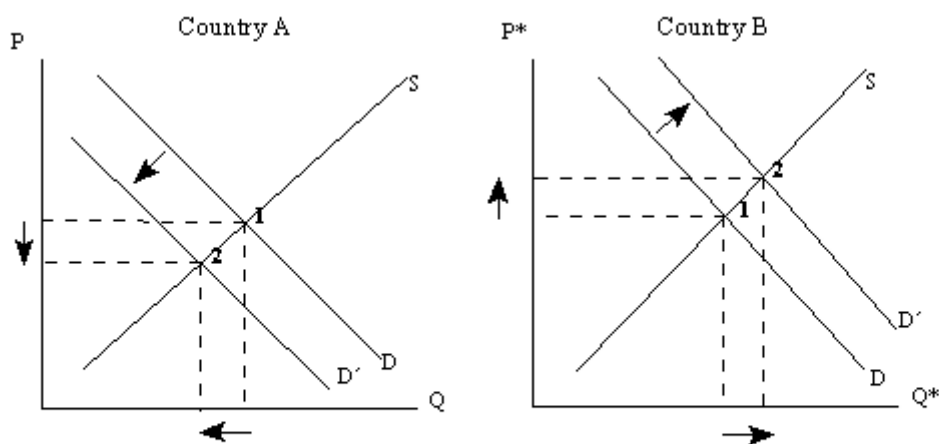
Graph 1: Demand shift originated by a change in the preferences from the good produced in A to the good produce B. (Asymmetric shock).
A lower demand in A reduces quantity (Q) and prices (P) while unemployment will raise
In B will happen the contrary.

Figure 1 Demand and Supply in countries A and B
Source http://www.europarl.europa.eu/

Contrary to the case of the USA, the percentage of intraregional immigration is low

for Europe, standing at a 0.2% only (Economist, 2013) .Under the property of factor market

integration, Mongelli (2005) notes that cross-country foreign direct investment has increased

among Euro area countries. Most recently, in the year 2013, the Euro area saw more

integration in some financial sectors such as the money market and some segregation in some

sectors such as bonds and corporate bonds (ECB, 2014). The degree of economic openness,

measured in Mongelli (2005) as the ratio of the export plus import of goods and services to

GDP, was shown to be quite high back then. Eurostat shows that EU Members ensembles

have traded more goods among each other than with outside countries. In 2013, there was an

overall decrease of this type of trade in the union since 2005, with the exception of one

Member State. With regards to political integration, Mongelli focuses on various aspects of

political integration. First, the EU Council and European Parliament are bringing together

some national laws. So, in this sense, the EU Members already share characteristics of a

supranational constitutional framework. Another aspect is the centralization of some

economic policy such as monetary and exchange rate policies. A third aspect is more

coordination such as in the case of spillover policies, economies of scale, and benefits from risk pooling. In 2015, all EU countries with the exception of Croatia, Hungary, Cyprus, Romania, and Bulgaria had almost similar interest rates. Only from these points, we can clearly conclude that the Eurozone cannot yet be considered an OCA. This conclusion is shared by Petreski (2007), who addresses the issue of if the Eurozone is an OCA by analyzing the properties and the change in the levels of these property variables before and after the implementation of a single currency

CHAPTER IV

EMPIRICAL MODEL AND RESULTS

A. Methodology and Data

- *Data*

General Government Gross Debt

      This variable is defined in the Maastricht Treaty as consolidated general government debt at face value, outstanding at the end of the year in the following categories of government liabilities (as defined in ESA2010): currency and deposits, debt securities and loans. The general government includes central, state, local governments and social security funds. I gathered quarterly data (measured as a %GDP) from the Eurostat database from 2002Q4 to the year 2015Q2. Malta and Croatia are not included due to missing data. The Eurozone average includes all countries except Malta. The PP and ADF tests were performed on this series to determine stationarity. PP testing showed all variables except Cyprus, Slovenia, and Sweden to be integrated of order 1. This implies that we can run the Johansen-cointegration test for all country variables with respect to the Eurozone average (since it is also I (1)) with the exception of Cyprus, Slovenia, and Sweden. Since these 3 variables are integrated of order 0 and the euro average is integrated of order 1, the most appropriate method to employ in these 3 cases is the ARDL cointegration method. The average of the main core countries were tested for cointegration against those of the periphery. By definition, core countries refer to the industrialized capitalist countries on which the weaker periphery countries depend. They are considered wealthy. Dunn, Kawana, Brewer(2000) considered the European core countries to be Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Portugal, Spain, Sweden and the United Kingdom. In 2007, Babones and Alvarez-Rivadulla(2007) added to that list by including Greece, Ireland,

and Luxembourg. However, in the wake of the recent crisis, it is safe to say that these lists cannot be deemed reliable anymore. So, instead we turn to a more recent listing of core and periphery countries. According to the Committee for the Abolition of Third World Debt, Germany and France, the UK, Italy and the former Benelux (the Netherlands, Belgium and Luxembourg) all form the current core countries of the EU. Greece, Ireland, Portugal, Spain are the periphery countries, also known as PIGS.

General Government Deficit

It is referred to as "general government net borrowing/lending" in the Maastricht Treaty (Eurostat, 2014). I gather the quarterly data from 2002Q1 to 2015Q1 from Eurostat. The PP and ADF tests were also performed on this variable for every country. The result was expected. Deficit is expected to be stationary and so it is found to be I (0) for most of the variables when performing the ADF test and I (0) for all countries when performing the PP test. This would imply that the Johansen cointegration test cannot be performed for this variable. The ARDL method, similarly, cannot be used as it can only be utilized when the average is I(1) if the variable if I(0) or I(1) and I(0) if the variable if I(1). The averages in this case are also found to be I(0). ARDL cannot be used when both of the variables are I (0). Therefore, I sought another method to give me a wider understanding of fiscal convergence in the European Union. I repeated the methodology proposed by Vogelsang(1998,1999).

- *Methodology*

It is essential to test for the existence of a unit root in order to determine the order of integration. There are several tests available out there such as the well-known augmented Dickey-Fuller and Phillips-Perron tests. These tests are used to determine whether a time series is stationary or non-stationary through the use of an autoregressive model. In all unit-root testing, the null hypothesis holds that a unit root does indeed exist. Some tests, such as the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) are used to complement these unit roots tests

in the case of smaller time series samples. As previously mentioned, one of the main reasons

unit root tests are done is to find the order of integration of our series. The motive for

knowing lays in the fact that running economic models with integrated variables may lead to

non-standard distributions and spurious relationships (Sj¨o, 2008) . Bo Sj¨o (2008)

recommends in the case of a data series that appears to be non-stationary, to assume that it is

non-stationary and integrated until the classification of the variable as stationary, integrated,

and so on has been determined. He states that after this has been done, you will end up with a

model that has more meaningful statistical inferences. In our study, we will be testing

stationarity using both the augmented Dickey Fuller and Phillips-Perron tests.

Dickey & Fuller (1979) explains that the ADF test assumes that the error terms are

not correlated and have a constant variance. The basic Dickey-Fuller unit root test uses the

following model:

Assume Y_t is a random walk process

$$Y_t = Y_{t\text{-}1} + \varepsilon_t \tag{1}$$

Dickey and Fuller proposed an additional version of their test called the augmented

Dickey-Fuller test. In this version, lagged terms of Y_t (the dependent variable) are added to

the right-hand side of the equation in order to correct for autocorrelation. (Dimitrios Asteriou,

2011) Since variables have a trend and intercept, an intercept, or none of the latter two, then

we also have three versions of this new augmented Dickey-Fuller test.

For variables with

No trend or intercept:

$$\Delta Yt = \pi Y_{t-1} + \sum_{i=1}^{p} \beta_i \, \Delta Y_{t-1} + \varepsilon_t \tag{2}$$

An intercept:

$$\Delta Yt = \propto_0 + \pi Y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta Y_{t-1} + \varepsilon_t \tag{3}$$

A trend and an intercept:

$$\Delta Yt = a_0 + a_1 t + \pi Y_{t-1} + \sum_{i=1}^{p} \beta_i \Delta Y_{t-1} + \varepsilon_t \qquad (4)$$

Enders (1995) suggests a method of deciding which one of the three equations to use when testing the variables. With the variables, I followed Enders' method along with the plotting of data and observation of graphs to decide the presence of a trend or constant. First, estimate the model by using equation (3). This would translate in E-views as choosing the option of "trend and intercept" at level. If we obtain that $\pi \neq 0$ then we stop and conclude the series is stationary. This would translate in E-views as if the probability is less than 10% then we can directly conclude it is stationary. If we obtain $\pi = 0$ (probability more than 10%) then we move on to check for a trend. This is done by checking if $a_1 = 0$. This is done in E-views by checking the significance of the coefficient that represents "trend". If $a_1 \neq 0$ then the presence of a trend is significant so we check if $\pi = 0$. If this is in fact true then we conclude that the series has a unit root and we would have to test for a unit root at the "trend and intercept" by taking the first difference. If, however, $a_1=0$ or the probability is more than 10% then we move on to estimate equation (2). Again, if we obtain $\pi \neq 0$ (probability is less than 10%) then we conclude that the series is stationary. If $\pi = 0$ then we move on to check for a constant. If $a_0 \neq 0$ (the intercept is significant) then we check again if $\pi = 0$. If this is true then we conclude the series has a unit root and proceed to check the presence of a unit root at the first difference in the presence of an intercept. On the other hand, if this is not the case then we conclude that the series is stationary at level. If $a_0=0$ then we estimate the final equation (1). If $\pi = 0$ then we conclude that the series is not stationary and check for stationarity at "None" and at the first difference. If $\pi \neq 0$ then we conclude that the series is stationary at level.

The main difference between the ADF and PP tests is the assumption of no error correlation. Instead of adding lagged variables to the right-hand side in order to correct for

serial correlation, Phillips and Perron (1988) develop a corrected t-statistic to account for the serial error correlation.

$$\Delta Y_{t-1} = a_0 + \pi Y_{t-1} + \varepsilon_t \tag{5}$$

The process of selecting "intercept", "trend and intercept", or "none" is the same one discussed previously for the ADF.

Johansen Cointegration

The Johansen test is named after Søren Johansen, a Danish Statistician and Econometrician. It is a well-known test used to check for the existence of cointegration relationships that was introduced in Johansen (1991). There are two types of Johansen cointegraiton tests: The trace and eigenvalue. Similar to the unit root test, the general VAR(p) or vector auto-regressive model can have either a constant, a trend, both or neither. Assume we have 3 endogenous variables: Z_t, X_t, and Y_t . Assume $W_t=[Z_t,X_t,Y_t]$. The VAR (vector auto-regressive) equation is expressed as:

$$W_t=A_1W_{t-1}+A_2W_{t-2}+\ldots+A_kW_{t-k}+u_t \tag{6}$$

In a vector error-correction model (VECM), it is expressed as:

$$\Delta W_t=B_1\Delta W_{t-1}+B_2\Delta W_{t-2}+\ldots+B_{k-1}\Delta W_{t-k-1}+\pi W_{t-1}+\varepsilon_t \tag{7}$$

Where $B_i = (I-A_1-A_2-\ldots-A_K)$ $(i=1, 2,\ldots,k-1)$ and $\pi=-(I- A_1-A_2-\ldots-A_K)$. The variable π tells us about the long-run relationship.

$$\Pi=\alpha\beta' \tag{8}$$

α = sped of adjustment to equilibrium

β = long run matrix of coefficients

For simplicity, assume k=2

$$\begin{pmatrix}\Delta Y_t \\ \Delta X_t \\ \Delta Z_t\end{pmatrix} = \Omega \begin{pmatrix}\Delta Y_{t-1} \\ \Delta X_{t-1} \\ \Delta Z_{t-1}\end{pmatrix} + \pi \begin{pmatrix}\Delta Y_{t-1} \\ \Delta X_{t-1} \\ \Delta Z_{t-1}\end{pmatrix} + \varepsilon t \tag{9}$$

The first step to test for Johansen cointegration is to test the order of integration of the variables. In order to avoid spurious relationships, the variables should be non-stationary variables. All variables should be of the same order to obtain the best results. The Johansen approach finds the number of linearly independent columns in π. Variables should be of the order 1 because the I(0) variables are already stationary and including them in the regression would increase the number of cointegrating equations which would lead to misleading results. It would be forming a cointegrating equation with itself which means an additional linearly independent vector in π. Similarly, the inclusion of an I (2) variable would lead to misleading results. If there are two I(2) variables and two I(1) variables, the two I(2) variables could cointegrate down to an I(1) which would in turn cointegrate again with an I(1) variable which would create more cointegrating vectors. The second step is determining the appropriate lag length. This is done to avoid standard normal error terms that suffer from autocorrelation, heteroskedasticity and so on… A common way to find the optimal lag length is to estimate a VAR model by beginning with a large number of lags and decreasing unto 0 lags. The optimal lag length is the one with the lowest AIC and SBC values. When running the Johansen cointegration test, one has to specify whether the data has nonzero means, deterministic trends or stochastic trends and whether the cointegrating equations have intercepts or deterministic trends. There are several cases presented in E-views. The first case is used when all series have zero mean. It is rarely used. The second case is used when the series appears to have a trend. The third case is used when the series follows a stochastic trend. Finally, case 4 is used when the series is trend stationary.

Beta and Sigma convergence

I sought another method to give me a wider understanding of fiscal convergence in the European Union. I rely on the Vogelsang(1998,1999) β-convergence with structural breaks methodology. For further details on the methodology used by them and the

derivation, refer to Vogelsang (1998, 1999).Vogelsang(1998,1999) relied on a method that deals with β-convergence by using time-series methodology. One of the advantages of the Vogelsang(1998) method is that this method allows for the residual term to have an unknown form of serial correlation (ranging from I(0) to I(1)). The method is sensitive to post transition economies and allows for structural breaks by including possible shifts in the trend function. For β-convergence to exist, the following equation has to show a statistically significant μ and β of opposite signs. This would imply that the variable is converging towards the benchmark.

$$y_t = \mu + \beta t + \varepsilon_t \tag{10}$$

However, this method would only work if ε_t was serially uncorrelated. In reality, this is not always the case. To go past this problem, Vogelsang (1998, 1999) proposed a methodology that would make the results robust to the existence of unit roots and serial correlation in the error term.

The first regression is:

$$Y_t = \mu_1 DU_{1t} + \mu_2 DU_{2t} + \delta_1 DT_{1t} + \delta_2 DT_{2t} + \Upsilon x_t + u_t \tag{11}$$

$DU_{1t} = 1$ if $t \leq$ Tb (Break date) $DU_{2t} = 1$ if $t >$ Tb (Break date)

      $=0$ otherwise $=0$ otherwise

$DT_{1t} = t$ if $t \leq$ Tb (Break date) $DT_{2t} = t$-Tb if $t >$ Tb (Break date)

      $=0$ otherwise $=0$ otherwise

Where,

Y_t: Budget deficit to GDP/Debt to GDP of country i minus the benchmark

δ: Trend coefficient

μ: Intercept that shows the starting level of deviation

x_t: control variables, if any

u_t: residual term

This equation uses the t-stat= $T^{-1/2} t_y$, where t_y is the t-statistics for testing the null hypothesis that each parameter in y_t is zero and T is the sample size.

The second equation uses partial sums.

$$z_t = \mu_1 DT_{1t} + \beta_1 SDT_{1t} + \mu_2 DT_{2t} + \beta_2 SDT_{2t} + S_t \tag{12}$$

where $z_t = {}_{j=1}^{t}\Sigma \, y_j$, $SDT_{it}={}_{j=1}^{t}\Sigma DT_{ij}$, i=1,2 , and $S_t={}_{j=1}^{t}\Sigma \varepsilon_j$

This equation uses the t-statistics of t-PS_t=$T^{-1/2}t_z$exp(-bJ_T) where b is a constant that is obtained when making the critical values of the t-statistics the same whether ε_i is I(0) or I(1), where t_z is the t-statistics for testing the null hypothesis that each parameter in z_t is zero, T is the sample size, and J_T is T^{-1} multiplied by the Wald statistic that tests $c_2=c_3=\ldots=c_9=0$ in the following equation:

$$Y_t = \mu_1 DU_{1t} + \mu_2 DU_{2t} + \delta_1 DT_{1t} + \delta_2 DT_{2t} + {}_{i=2}^{9}\Sigma c_i t^i + u_t \tag{13}$$

$J_T = (RSS_{13}\text{-}RSS_{11})/RSS_{11}$, where RSS_{13} is the sum of the square residuals from equation 13 and RSS_{11} the sum of the square residuals from equation 11. If we are sure that the errors are I (0) then b=0 and J_T will have no effect on the t-tests.

β-convergence requires for μ to be statistically significant and for δ to be of opposite sign and equally significant. One of the advantages of the Vogelsang (1999) method is that the residual term u_t can have any form of serial correlation. To analyze the results with regards to fiscal convergence, I tested the significance and the opposite signs in the pair of coefficients, μ_1, δ_1, and μ_2, δ_2.

B. Results

Johansen cointegration

The General Government Debt (as a %GDP) of each country is checked for cointegration against the Eurozone average. We find very limited cointegration for the Johansen test. Cointegration is only accepted for Luxembourg, the Netherlands, and

Slovenia.. For Luxembourg, the results show the existence of 1 cointegrating equation for the trace test but none for the max-eigenvalue. Finally, for the Netherlands and Slovenia, 1 cointegrating equation exists for both the trace and max-eigenvalue tests. Since the system is bi-variate, the trace results are preferred over the max-eigenvalue ones. These results, however, do not take into account the structural breaks in the economy.

B-convergence using Vogelsang(1998) methodology

The existence of β-convergence implies that the corresponding country or area variable (general government debt or deficit as a % of GDP) moves towards the chosen benchmark. These statistics were calculated with an unknown break date. The estimated break dates are shown in the last column of every table. For β-convergence to exist in the each period, the corresponding μ and δ from that period must have opposite signs and be of statistical significance.

Tables 1-6 show the results of the z_t regression without J_T correction. The t-statistics t-PS $_T$ without J_T correction is found under each coefficient. Kočenda(2008) describes the way in which the results should be interpreted. First, it is important to note that the general government gross debt to GDP was expressed as a negative value with the existence of debt. Similarly, a positive general government deficit (-) and surplus (+) indicates a surplus and a negative indicates a deficit. The null hypothesis is that the trend coefficients are equal to zero. In other words, it is the absence of a trend in the variable. The alternative hypothesis is that the trend coefficients are statistically different from zero. This indicates the presence of a positive or negative trend, depending on the sign. Table 1 shows weak divergence within the European Union in the pre-break period. It also shows weak convergence for the Non-Eurozone countries in the post-break period towards the 60% Maastricht benchmark and divergence in the pre-break period for the Eurozone countries towards the same benchmark. Table 3 shows 11out of the 18 Eurozone countries exhibit weak divergences within the

Eurozone in the pre-break period. This is followed by 4 countries showing weak convergence in the post-break period. Table 4 shows that 6 out of 15 Eurozone countries display strong β-convergence towards the Eurozone average in the post-break period and one country displays divergence. Many of the countries exhibit signs that β-convergence has already happened in the pre-break period. Finally, tables 5 and 6 display divergence for the new member countries towards the pigs and core countries in the pre-break period. This is followed by convergence in the post-break period, mainly towards the core countries. However, these results should be interpreted with caution given as this test assumes that the residuals are I (0).

Tables 7-12 show the results of the z_t regression with J_T correction. In this case, the results are robust to I (1) errors. Table 8 shows that β-convergence has already happened in the European Union in the pre-break period for deficit. Table 9 only shows evidence for divergence for Finland in the pre-break period. Table 10, on the other hands, shows the most conclusions. Table 10 is the case of general government deficit within the Eurozone. In the pre-break period, a lot of the countries show convergence. This seems to also be in the case in the post-break period with a lot of β-convergence. Spain is the exception, diverging in the post-break period. Table 11 is inconclusive. Finally, Table 12 shows divergence for the member countries towards the core in the pre-break period and convergence towards the EU in the pre and post-break period.

Tables 13-18 show the results of the y_t regression. The t-statistics $T^{-1/2} t_y$ is found under each coefficient. Table 13 shows divergence within the European Union, given as the Eurozone and Non-Eurozone both show coefficients that are of the same sign and are significantly different from zero for the case of the European Union average benchmark. It shows different results for the Eurozone in terms of the Maastricht benchmark when it comes to the 2 different variables. In the case of general government debt, it shows convergence and in the case of government deficit, it shows divergence. Table 15 shows that many of

Eurozone countries converge towards the average in the pre-break period as opposed to the post-break period which is dominated by divergence. Table 16, the case of government deficit within the Eurozone, shows an overwhelming number of countries with no conclusion. Finland shows convergence in the pre-break period and Germany shows divergence. Table 17 shows pre-break divergence for general government debt for new member countries towards the core and EU averages. In the case of the core benchmark, this seems to switch in the post-break period with evidence for convergence. In the case of general government deficit, no conclusions can be drawn from the results. Table 19 shows a summary of the results. The letter C denotes β-convergence, or when δ and μ have opposite signs and are both significantly different from zero, D denotes divergence when δ and μ have same signs and are both significantly different from zero, c denotes convergence when δ and μ have opposite signs but only one is significantly different from zero, d denotes divergence when δ and μ have same signs but only one is significantly different from zero, and u denotes no conclusion .The break dates are mostly clustered around the 2008Q4-2011Q4 period. This period pertains to the global crisis and European Sovereign Debt crisis period.

Tables 7-18, which pertain to t-PS$_T$ with J$_T$ correction and $T^{-1/2}t_y$, show the strongest results. These results are robust to highly persistent errors. They are more conservative but more reliable.

In terms of debt, there appears to be a lot of divergence within the European Union pre and post-break. Within the Eurozone, the pre-break period showed weak divergence and convergence. However, in the post-break period, there appears to be more divergence within the Eurozone. New members seem to be diverging away from the EU average. They appear to converge towards the core average and diverge away from the pigs post-break. The New members seem to be moving more closely towards the core countries.

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In terms of deficit, it appears that β-convergence has already happened pre-break within the European Union. Within the Eurozone there appears to be a lot of convergence pre and post-break. Contrary to the case of debt, the new members seem to converge to the EU average.

Sigma Convergence

Although β-convergence is thought to be important, it is not a sufficient condition for σ-convergence. Sigma convergence is of greater interest because it shows directly the reduction of disparities among regions in time. It is more revealing of reality than β-convergence as it does not rely on the estimation of a particular model. One measure used in sigma convergence is cross sectional standard deviation. Cross sectional mean is used to assess the fiscal position.

The case of debt: The Eurozone shows a generally worst debt position on average than the rest of the European Union throughout time. The position of both the Eurozone and non-Eurozone countries shows slight improvement up until 2008Q4 and take a drastic dip thereafter, continuing to drop until the present day. The new members have a notably better fiscal position compared to the core, pigs, and generally the rest of the EU. The pigs, particularly, take a drastic dip relative to the core post 2010. However, this worsening began post 2008.

In terms of fiscal discipline and disparities, new members, core countries, the Eurozone, and the European Union, in general all display a worsening in fiscal discipline post 2008-2009. In comparison to the rest of the EU, the Eurozone shows the largest standard deviation across time. The PIGS seem to alternate their position in a downwards and upwards spiral. New members seem to display better fiscal discipline than the rest of the EU.

The case of deficit: Deficit-mean graphs do not show as clear a difference in position as that of debt. What is clear is the gradual worsening of the pigs deficit position post 2008, reaching the lowest point at 2010-2011.It seems to evolve in par with the core and new members with time. New members and the rest of the EU in general worsen their position post 2009-2010.

Overall, in terms of fiscal discipline, pigs seem to have the worst case, fluctuating at higher peaks than the core and the new members with the worst point reached in the 2009 period. New members seem to reach a worst point in 2014 but later subsided and evolved in par with the rest of the EU. However, overall, standard deviation seems to have a relative stable level throughout the years, ranging from 2 and 4 and increasing post 2008-2009.

In the case of general government debt, in terms of fiscal discipline, disparities and debt position, new members, core countries, the Eurozone, and the European Union display a worsening in fiscal discipline post 2008-2009. In the case of general government deficit, there also appears to be a similar worsening in fiscal position post 2008-2009. Fiscal discipline conclusions are not clear for general government deficit.

CHAPTER V

CONCLUSION

In this thesis I tackle the issue of fiscal convergence in the EU area over the period 2002Q1-2015Q2 through a wide-ranging analysis. I examined the Johansen cointegration for general government debt within the EU and β and σ-convergence of general government debt and deficit within the EU, Eurozone and the new members during the period of 2002Q1-2015Q1 for deficit and 2002Q4-2015Q2 for debt. I tested for B-convergence using the Vogelsang (1998) methodology that accounts for structural breaks and makes the results robust to I (1) errors. For Johansen cointegration, the results mainly showed lack of fiscal convergence in terms of debt in the EU. For β-convergence, the results are different for the debt and deficit variables. In the case of deficit, there is β-convergence within the EU and Eurozone pre-break but also β- convergence within the Eurozone post-break. In the case of debt, there is mainly convergence within the EU and Eurozone pre-break and divergence post-break. For σ-convergence, there is generally a worsening in disparities for both the EU and the Eurozone after the break for debt. The case of deficit is less clear but shows a generally slight worsening also. The β-convergence and σ-convergence results seem to generally agree that there is convergence within the EU and Eurozone pre-break and divergence post-break.

Fiscal divergence is not desirable in the establishment of a fiscal union. One of the main points made against the establishment of a fiscal union is a unified fiscal budget. The stronger fiscal countries, such as Germany, would be forced to continuously bailout highly indebted countries, such as Greece. It would create incentive for the highly indebted countries to slack off, dragging everyone down with them. The above results show us that in

terms of debt, there appears to be divergence within the Eurozone and EU in general after the economic crisis. This would indicate greater differences in debt-to-GDP ratios among member countries and would entail a required future bailout of a highly indebted country by another less indebted one. The lender country would definitely be losing on the arrangement. Fiscal transfers are carried out successfully in transfer unions such as the USA .In the USA, fiscal transfer amounts are enormous. However, there are major differences between the USA and a European fiscal union. In the case of a Europe, the member countries have different cultures, languages, and have been independent for a long period of time before deciding to form a union with each other. This would lead to political discontent among countries with better fiscal situations to bailout the countries in need. However, a fiscal union would certainly control borrowing by member states which in the long run might benefit the union.

APPENDIX

Table 1 β-convergence of general government gross debt to GDP within the European Union and towards the Maastricht benchmark. Empirical results using the Z_t regression and t-PS$_T$ statistics without J_T correction.

Countries	μ1	δ1	μ2	δ2	Break
Eurozone-EU	-0.733 (-0.924)	-0.175** (-3.078)	-8.213 (-0.967)	0.160 (0.188)	20011Q1
Eurozone-bench	4.590 (-1.206)	0.629** (2.207)	6.287 (0.196)	-1.642 (-0.581)	2010Q2
Non-Eurozone-EU	1.467 (-0.924)	0.351** (3.078)	16.426 (0.967)	-0.321 (-0.188)	2011Q1
Non-Eurozone-bench	6.489 (0.908)	1.267 (0.169)	21.483** (3.008)	-1.128 (-0.157)	2010Q1

Note: The dependent variable is the general government gross debt (as a % of GDP) of region or country *I* minus the chosen benchmark (**)* represent 5 and 10% levels of significance.

Table 2 β-convergence of general government gross deficit (-) or surplus (+) to GDP within the European Union and towards the Maastricht benchmark. Empirical results using the Z_t regression and t-PS$_T$ statistics without J_T correction.

Countries	μ1	δ1	μ2	δ2	Break
Eurozone-EU	-0.004 (-0.028)	0.001 (0.207)	-0.201 (-0.374)	-0.001 (-0.042)	2009Q1
Eurozone-bench	-0.252 (-0.131)	0.143 (1.024)	-1.314 (-0.257)	0.124 (0.351)	2008Q4
Non-Eurozone-EU	0.059 (0.230)	-0.0001 (-0.006)	0.614 (0.644)	-0.001 (-0.101)	2009Q1
Non-Eurozone-bench	-0.360 (-0.42)	0.118* (1.706)	-1.271 (-0.508)	0.138 (0.828)	2008Q4

Note: The dependent variable is the general government gross deficit (as a % of GDP) of region or country *I* minus the chosen benchmark (**)* represent 5 and 10% levels of significance. GDP growth is used as a control variable.

Table 3 β-convergence of general government gross debt to GDP within the Eurozone. Empirical results using the Z_t regression and t-PS_T statistics without J_T correction.

Countries	μ₁	δ₁	μ₂	δ₂	Break
Austria	-10.150 (-1.16)	-0.821* (-1.454)	-77.072 (-0.518)	8.389 (0.427)	2012Q1
Belgium	-21.799 (-1.092)	-2.334* (-1.695)	-103.529 (-0.569)	5.521 (0.319)	2010Q3
Cyprus	-8.675 (-1.396)	-0.106 (-0.289)	-177.650 (-0.733)	29.425 (0.537)	2013Q3
Estonia	13.245 (1.139)	2.593** (2.939)	75.198 (0.763)	-1.130 (-0.130)	2010Q2
Finland	1.807 (0.935)	0.692** (4.192)	18.376** (2.275)	-0.033 (-0.063)	2008Q3
France	-2.862 (-0.873)	-2.916** (-4.962)	-20.999** (-7.828)	0.054 (0.501)	2004Q4
Germany	-9.364 (-1.328)	-0.465** (-1.803)	-108.896 (-0.620)	16.216 (0.547)	2012Q4
Ireland	8.242 (0.861)	0.812 (1.032)	-18.183 (-0.249)	-1.772 (-0.302)	2010Q1
Italy	-15.494 (-0.673)	-3.353** (-1.765)	-72.338 (-0.378)	2.082 (0.135)	2010Q2
Latvia	13.105 (0.750)	2.180 (0.985)	42.684 (0.462)	-0.664 (-0.116)	2008Q4
Lithuania	16.472 (1.341)	0.760 (1.095)	283.243 (0.837)	-39.565 (-0.624)	2013Q1
Luxembourg	16.400 (1.251)	1.8329** (2.096)	113.176 (0.627)	-6.309 (-0.299)	2011Q3
Malta	-8.016 (-1.102)	-0.987** (-1.809)	-23.672 (-0.425)	2.029 (0.429)	2010Q1
Netherlands	-0.426 (-1.104)	-0.018 (-0.705)	2.409 (0.620)	0.436 (1.135)	2010Q4
Portugal	-2.580 (-0.929)	-1.096** (-5.88)	-61.070** (-1.873)	0.802 (0.229)	2011Q2
Slovakia	1.973 (1.235)	0.922** (6.539)	23.061** (3.910)	-0.129 (-0.35)	2008Q1
Slovenia	11.948 (1.355)	0.603 (1.141)	205.418 (0.592)	-42.006 (-0.540)	2013Q3
Spain	2.746 (1.354)	0.062 (0.494)	14.33 (0.281)	-4.965 (-0.579)	2012Q4

Note: The dependent variable is the general government gross debt (as a % of GDP) of country *I* minus the average of the rest of the Eurozone. (**)* represent 5 and 10% levels of significance.

Table 4 β-convergence of general government deficit (-) and surplus (+) within the Eurozone. Empirical results using the Z_t regression and t-PS$_T$ statistics without J$_T$ correction.

Countries	μ1	δ1	μ2	δ2	Break
Austria	0.07 (0.198)	-0.01 (-0.294)	2.51** (2.284)	-0.05* (-0.975)	2008Q3
Belgium	0.491 (0.605)	0.049** (1.807)	4.33 (0.532)	-0.464 (-0.528)	2011Q1
Estonia	0.014 (0.159)	-0.006** (-1.785)	4.618** (10.324)	-0.247** (-7.475)	2009Q3
Finland	1.043 (0.568)	0.097 (1.122)	10.957 (0.422)	-1.33 (-0.390)	2011Q4
France	-0.083 (-0.073)	-0.073 (-0.683)	-0.467 (-0.159)	-0.008 (-0.05)	2008Q2
Germany	-0.816 (-1.182)	-0.064 (-0.919)	2.144 (0.730)	0.034 (0.185)	2008Q1
Ireland	-0.043 (-0.059)	-0.090 (-1.021)	-13.497** (-4.57)	0.453** (2.328)	2008Q2
Italy	0.293 (0.624)	0.029 (1.10)	4.203** (3.076)	-0.082 (-0.848)	2008Q2
Latvia	-0.021 (-0.394)	-0.085** (-35.77)	2.721** (4.891)	-0.131** (-2.206)	2011Q1
Luxembourg	0.407 (1.12)	-0.034 (-0.340)	4.403** (3.379)	-0.102** (-1.333)	2007Q1
Netherlands	-0.046 (-0.803)	0.028** (7.991)	-1.537** (-2.262)	0.16** (2.035)	2011Q2
Portugal	-1.015 (-0.785)	-0.08 (-1.424)	-11.67 (-0.673)	1.397 (0.645)	2011Q3
Slovakia	-0.175 (-0.354)	-0.034 (-1.107)	-2.046 (-0.425)	0.217 (0.421)	2011Q1
Slovenia	-0.013 (-0.276)	-0.039** (-21.458)	-11.219 (-0.683)	1.375** (5.572)	2013Q1
Spain	-0.0041 (-0.04)	-0.078 (-0.040)	-2.083** (-4.438)	-0.061** (-4.784)	2008Q2

Note: The dependent variable is the general government deficit (-) and surplus (+) (as a % of GDP) of country *I* minus the Eurozone average (**)* represent 5 and 10% levels of significance. GDP growth is used as a control variable. Some countries are excluded due to insufficient data.

Table 5 β-convergence of general government debt of new member countries towards the rest of the EU, core, and pigs. Empirical results using the Z_t regression and t-PS$_T$ statistics without J$_T$ correction.

Countries	μ_1	δ_1	μ_2	δ_2	Break
NM-EU	3.075 (0.766)	0.740** (2.171)	21.23 (0.770)	-0.305 (-0.147)	2009Q4
NM-core	9.205 (1.103)	1.985** (2.519)	46.621** (1.688)	-0.573 (-0.361)	2008Q1
NM-pigs	1.476 (0.905)	0.96** (7.531)	51.773** (3.410)	0.623 (0.454)	2010Q3

Note: The dependent variable is the general government debt (as a % of GDP) of new member countries minus the chosen benchmark. (**)* represent 5 and 10% levels of significance.

Table 6 β-convergence of general government deficit (-) and surplus (+) of new member countries towards the rest of the EU, core, and pigs. Empirical results using the Z_t regression and t-PS$_T$ statistics without J$_T$ correction.

Countries	μ_1	δ_1	μ_2	δ_2	Break
NM-EU	-0.058 (0.180)	0.024 (0.154)	-0.305* (1.423)	0.053 (-0.698)	2008Q1
NM-core	-0.635 (-0.937)	-0.316** (-2.020)	-0.972** (-1.651)	0.013 (0.646)	2004Q1
NM-pigs	0.379 (-0.089)	0.048 (0.226)	9.493 (-0.157)	-0.313 (0.416)	2008Q2

Note: The dependent variable is the general government deficit (-) and surplus (+) (as a % of GDP) of new member countries minus the chosen benchmark. (**)* represent 5 and 10% levels of significance. GDP growth is used as a control variable. Some countries are excluded due to insufficient data.

Table 7 β-convergence of general government gross debt to GDP within the European Union and towards the Maastricht benchmark. Empirical results using the Z_t regression and t-PS$_T$ statistics with J$_T$ correction.

Countries	μ_1	δ_1	μ_2	δ_2	Break
Eurozone-EU	-0.733	-0.175	-8.213	0.160	20011Q1
Eurozone-bench	4.590	0.629	6.287	-1.642	2010Q2
Non-Eurozone-EU	1.467	0.351	16.426	-0.321	2011Q1
Non-Eurozone-bench	6.489	1.267	21.483	-1.128	2010Q1

Note: The dependent variable is the general government gross debt (as a % of GDP) of region or country *I* minus the chosen benchmark (**)* represent 5 and 10% levels of significance.

Table 8 β-convergence of general government gross deficit (-) or surplus (+) to GDP within the European Union and towards the Maastricht benchmark. Empirical results using the Z_t regression and t-PS$_T$ statistics with J$_T$ correction.

Countries	μ_1	δ_1	μ_2	δ_2	Break
Eurozone-EU	-0.004	0.001	-0.201	-0.001	2009Q1
Eurozone-bench	-0.252	0.143	-1.314	0.124	2008Q4
Non-Eurozone-EU	0.059	-0.0001	0.614	-0.001	2009Q1
Non-Eurozone-bench	-0.360	0.118	-1.271	0.138	2008Q4

Note: The dependent variable is the general government gross deficit (-) or surplus (+) (as a % of GDP) of region or country *I* minus the chosen benchmark (**)* represent 5 and 10% levels of significance. GDP growth is used as a control variable. Some countries are excluded due to insufficient data.

Table 9 β-convergence of general government gross debt to GDP within the Eurozone. Empirical results using the Z_t regression and t-PST statistics with J_T correction.

Countries	μ_1	δ_1	μ_2	δ_2	Break
Austria	-10.150	-0.821	-77.072	8.389	2012Q1
Belgium	-21.799	-2.334	-103.529	5.521	2010Q3
Cyprus	-8.675	-0.106	-177.650	29.425	2013Q3
Estonia	13.245	2.593	75.198	-1.130	2010Q2
Finland	1.807	0.692*	18.376	-0.033	2008Q3
France	-2.862	-2.916	-20.999	0.054	2004Q4
Germany	-9.364	-0.465	-108.896	16.216	2012Q4
Ireland	8.242	0.812	-18.183	-1.772	2010Q1
Italy	-15.494	-3.353	-72.338	2.082	2010Q2
Latvia	13.105	2.180	42.684	-0.664	2008Q4
Lithuania	16.472	0.760	283.243	-39.565	2013Q1
Luxembourg	16.400	1.8329	113.176	-6.309	2011Q3
Malta	-8.016	-0.987	-23.672	2.029	2010Q1
Netherlands	-0.426	-0.018	2.409	0.436	2010Q4
Portugal	-2.580	-1.096	-61.070	0.802	2011Q2
Slovakia	1.973	0.922	23.061	-0.129	2008Q1
Slovenia	11.948	0.603	205.418	-42.006	2013Q3
Spain	2.746	0.062	14.33	-4.965	2012Q4

Note: The dependent variable is the general government gross debt (as a % of GDP) of country *I* minus the Eurozone average (**)* represent 5 and 10% levels of significance.

Table 10 β-convergence of general government deficit (-) and surplus (+) within the Eurozone. Empirical results using the Z_t regression and t-PS$_T$ statistics with J_T correction.

Countries	μ_1	δ_1	μ_2	δ_2	Break
Austria	0.07	-0.01	2.51**	-0.05	2008Q3
Belgium	0.491	0.049*	4.33	-0.464	2011Q1
Estonia	0.014	-0.006*	4.618**	-0.247**	2009Q3
Finland	1.043	0.097	10.957	-1.33	2011Q4
France	-0.083	-0.073	-0.467	-0.008	2008Q2
Germany	-0.816	-0.064	2.144	0.034	2008Q1
Ireland	-0.043	-0.090	-13.497*	0.453**	2008Q2
Italy	0.293	0.029	4.203**	-0.082	2008Q2
Latvia	-0.021	-0.085**	2.721**	-0.131**	2011Q1
Luxembourg	0.407	-0.034	4.403**	-0.102*	2007Q1
Netherlands	-0.046	0.028**	-1.537**	0.16**	2011Q2
Portugal	-1.015	-0.08	-11.67	1.397	2011Q3
Slovakia	-0.175	-0.034	-2.046	0.217	2011Q1
Slovenia	-0.013	-0.039**	-11.219	1.375**	2013Q1
Spain	-0.0041	-0.078	-2.083**	-0.061**	2008Q2

Note: The dependent variable is the general government deficit (-) and surplus (+) (as a % of GDP) of country *I* minus the Eurozone average. (**)* represent 5 and 10% levels of significance. GDP growth is used as a control variable. Some countries are excluded due to insufficient data.

Table 11 β-convergence of general government debt of new member countries towards the rest of the EU, core, and pigs. Empirical results using the Z_t regression and t-PS_T statistics with J_T correction.

Countries	μ_1	δ_1	μ_2	δ_2	Break
NM-EU	3.075	0.740	21.23	-0.305	2009Q4
NM-core	9.205	1.985	46.621	-0.573	2008Q1
NM-pigs	1.476	0.96	51.773	0.623	2010Q3

Note: The dependent variable is the general government debt (as a % of GDP) of new member countries minus the chosen benchmark (**)* represent 5 and 10% levels of significance.

Table 12 β-convergence of general government deficit (-) and surplus (+) of new member countries towards the rest of the EU, core, and pigs. Empirical results using the Z_t regression and t-PS_T statistics with J_T correction.

Countries	μ_1	δ_1	μ_2	δ_2	Break
NM-EU	-0.058	0.024	-0.305*	0.053	2008Q1
NM-core	-0.635	-0.316*	-0.972	0.013	2004Q1
NM-pigs	0.379	0.048	9.493	-0.313	2008Q2

Note: The dependent variable is the general government deficit (-) and surplus (+) (as a % of GDP) of new member countries minus the chosen benchmark. (**)* represent 5 and 10% levels of significance. GDP growth is used as a control variable. Some countries are excluded due to insufficient data.

Table 13 β-convergence of general government deficit (-) and surplus (+) of new member countries towards the rest of the EU, core, and pigs. Empirical results using the Z_t regression and t-PS$_T$ statistics with J$_T$ correction.

Countries	μ_1	δ_1	μ_2	δ_2	Break
Eurozone-EU	-2.072**	-0.073*	-5.414**	-0.137	20011Q1
	(-2.479)	(-1.758)	(-4.478)	(-1.172)	
Eurozone-bench	13.750**	-0.164	-1.833	-0.906	2010Q2
	(1.590)	(-0.348)	(-0.168)	(-0.995)	
Non-Eurozone-EU	4.14**	0.146*	10.828**	0.279	2011Q1
	(2.479)	(1.758)	(4.478)	(1.167)	
Non-Eurozone-bench	19.531**	0.097	12.845	-0.441	2010Q1
	(3.048)	(0.269)	(1.659)	(-0.715)	

Note: The dependent variable is the general government gross debt (as a % of GDP) of region or country *I* minus the chosen benchmark. (**)* represent 5 and 10% levels of significance.

Table 14 β-convergence of general government gross deficit (-) or surplus (+) to GDP within the European Union and towards the Maastricht benchmark. Empirical results using the Y_t regression and $T^{-1/2}t_y$ statistics.

Countries	μ_1	δ_1	μ_2	δ_2	Break
Eurozone-EU	0.317	-0.009	-0.234	0.004	2009Q1
	(0.162)	(-0.091)	(-0.130)	(0.039)	
Eurozone-bench	3.019*	0.046	-1.365	0.168	2008Q4
	(0.785)	(0.222)	(-0.376)	(0.675)	
Non-Eurozone-EU	-0.7	0.021	0.492	-0.01	2009Q1
	(-0.159)	(0.093)	(0.127)	(-0.040)	
Non-Eurozone-bench	2.023	0.06	-0.376	0.132	2008Q4
	(0.293)	(0.170)	(-0.06)	(0.303)	

Note: The dependent variable is the general government gross deficit (-) or surplus (+) (as a % of GDP) of region *I* minus the chosen benchmark. (**)* represent 5 and 10% levels of significance. GDP growth is used as a control variable. Some countries are excluded due to insufficient data.

Table 15 β-convergence of general government gross debt to GDP within the Eurozone. Empirical results using the Y_t regression and $T^{-1/2}t_y$ statistics.

Countries	μ_1	δ_1	μ_2	δ_2	Break
Austria	-22.882** (-2.971)	0.077 (0.223)	-10.623 (-0.776)	0.393 (0.228)	2012Q1
Belgium	-56.447** (-11.559)	0.470* (1.820)	-38.052** (-5.9)	0.405 (0.718)	2010Q3
Cyprus	-16.118** (-1.147)	0.349 (0.642)	-25.805 (-0.66)	-0.923 (-0.106)	2013Q3
Estonia	41.462** (6.181)	0.155 (0.424)	56.161** (6.634)	0.636 (0.9)	2010Q2
Finland	6.027** (1.059)	0.255 (0.640)	15.994* (2.992)	0.122 (0.360)	2008Q3
France	-12.292** (-1.524)	-0.587 (-0.41)	-20.431** (-5.857)	0.033 (0.240)	2004Q4
Germany	-17.748** (-2.466)	0.086 (0.290)	-5.276 (-0.341)	0.952 (0.382)	2012Q4
Ireland	26.712** (1.138)	-0.792 (-0.599)	-32.587 (-1.149)	-0.422 (-0.187)	2010Q1
Italy	-54.519** (-12.846)	-0.089 (-0.385)	-50.247** (-9.381)	-0.320 (-0.717)	2010Q2
Latvia	35.788** (3.158)	-0.054 (-0.021)	16.281 (1.466)	0.904 (1.258)	2008Q4
Lithuania	28.344** (6.159)	0.042 (0.227)	35.962** (3.379)	0.327 (0.172)	2013Q1
Luxembourg	41.556** (6.495)	-0.049 (-0.162)	46.172** (4.521)	0.616 (0.548)	2011Q3
Malta	-22.584** (-3.58)	0.297 (0.838)	-7.437 (-0.977)	0.762 (1.258)	2010Q1
Netherlands	-1.120 (-0.236)	0.035 (0.145)	3.939 (0.602)	0.301 (0.499)	2010Q4
Portugal	-6.695** (-1.040)	-0.796 (-2.556)	-48.869** (-5.003)	-0.425 (-0.421)	2011Q2
Slovakia	5.409** (1.058)	0.530 (1.362)	19.918** (4.510)	0.052 (0.203)	2008Q1
Slovenia	22.488** (4.764)	-0.052 (-0.286)	3.837 (0.295)	-1.362 (-0.468)	2013Q3
Spain	5.404 (0.545)	-0.115 (-0.280)	-13.822 (-0.649)	-0.818 (-0.238)	2012Q4

Note: The dependent variable is the general government gross debt (as a % of GDP) of country *I* minus the Eurozone average. (**)* represent 5 and 10% levels of significance.

Table 16 General government deficit (-) and surplus (+) to GDP within the Eurozone. Empirical results using the Y_t regression and $T^{-1/2}t_y$ statistics.

Countries	μ_1	δ_1	μ_2	δ_2	Break
Austria	0.485 (0.057)	-0.034 (-0.066)	2.442 (0.288)	-0.05 (-0.090)	2008Q3
Belgium	3.550 (0.230)	-0.038 (-0.059)	1.706 (0.078)	-0.138 (-0.060)	2011Q1
Estonia	0.238 (0.568)	-0.017 (0.033)	4.634 (0.453)	-0.245 (0.324)	2009Q3
Finland	5.506* (0.682)	-0.075 (-0.225)	1.072 (0.130)	-0.325 (-0.182)	2011Q4
France	-1.624 (-0.263)	0.002 (0.004)	-0.408 (-0.052)	-0.037 (-0.076)	2008Q2
Germany	-2.495* (-0.807)	0.138 (0.426)	3.065 (0.690)	0.010 (0.038)	2008Q1
Ireland	2.535 (0.120)	-0.149 (-0.115)	-15.423 (-0.771)	0.615 (0.48)	2008Q2
Italy	0.930 (0.131)	-0.035 (-0.078)	3.897 (0.517)	-0.059 (-0.13)	2008Q2
Latvia	-0.233 (-0.016)	-0.076 (-0.124)	2.752 (0.146)	-0.137 (-0.072)	2011Q1
Luxembourg	1.363 (0.209)	-0.095 (-0.182)	3.823 (0.146)	-0.067 (-0.072)	2007Q1
Netherlands	-0.170 (-0.024)	0.033 (0.113)	-1.193 (-0.107)	0.121 (0.09)	2011Q2
Portugal	-2.577 (-0.383)	0.001 (0.006)	-1.766 (-0.138)	0.292 (0.197)	2011Q3
Slovakia	-1.662 (-0.246)	0.000 (0.000)	-0.983 (-0.1)	0.078 (0.076)	2011Q1
Slovenia	-0.116 (0.009)	-0.035 (-0.081)	-11.057 (-0.412)	1.339 (0.255)	2013Q1
Spain	-0.379 (-0.02)	-0.075 (-0.094)	-1.774 (-0.112)	-0.074 (-0.079)	2008Q2

Note: The dependent variable is the general government deficit (-) and surplus (+) (as a % of GDP) of country *I* minus the Eurozone average. (**)* represent 5 and 10% levels of significance. GDP growth is used as a control variable. Some countries are excluded due to insufficient data.

Table 17 β-convergence of general government debt of new member countries towards the rest of the EU, core, and pigs. Empirical results using the Y_t regression and $T^{-1/2}t_y$ statistics.

Countries	μ1	δ1	μ2	δ2	Break
NM-EU	10.296**	0.102	16.383**	0.112	2009Q4
	(5.430)	(0.932)	(7.464)	(0.672)	
NM-core	24.461**	0.268	34.090**	-0.005	2008Q1
	(7.747)	(1.117)	(12.5)	(-0.032)	
NM-pigs	4.558	0.706	48.614*	0.914	2010Q3
	(0.370)	(1.085)	(2.996)	(0.661)	

Note: The dependent variable is the general government debt (as a % of GDP) of country or region *I* minus the chosen benchmark. (**)* represent 5 and 10% levels of significance.

Table 18 β-convergence of general government deficit (-) and surplus (+) of new member countries towards the rest of the EU, core, and pigs. Empirical results using the Y_t regression and $T^{-1/2}t_y$ statistics.

Countries	μ1	δ1	μ2	δ2	Break
NM-EU	-1.689	0.035	0.825	-0.041	2008Q1
	(-0.42)	(0.148)	(0.220)	(-0.179)	
NM-core	-2.934	0.233	-0.976	0.013	2004Q1
	(-0.185)	(0.084)	(-0.131)	(0.049)	
NM-pigs	-4.529	0.127	10.305	-0.452	2008Q2
	(-0.415)	(0.208)	(1.021)	(-0.676)	

Note: The dependent variable is the general government deficit (-) and surplus (+) (as a % of GDP) of country or region *I* minus the chosen benchmark. (**)* represent 5 and 10% levels of significance. GDP growth is used as a control variable. Some countries are excluded due to insufficient data.

Table 19 β-convergence within the European Union and towards the Maastricht criteria

Countries	t-PS$_T$ without J$_T$ correction				t-PS$_T$ with J$_T$ correction				T$^{-1/2}$t$_y$			
	Debt		Deficit		Debt		Deficit		Debt		Deficit	
	Pre-break	Post-break	Pre-break	Post-break	Pre-break	Post-break	Pre-break	Post-break	Pre-break	Post-break	Pre-break	Post-break
Eurozone-EU	d	u	E	u	u	u	E	u	D	d	u	u
Eurozone-bench	d	u	u	u	u	u	u	u	c	u	d	u
Non-Eurozone-EU	d	u	E	u	u	u	E	u	D	d	u	u
Non-Eurozone-bench	u	c	c	u	u	u	u	u	d	u	u	u

D denotes the case where μ and δ both hold the same sign and are both significant at least at the 10% level

C denotes the case where μ and δ hold opposite signs and are both significant at least at the 10% level

c denotes the case where μ and δ are of opposite signs but only one of the coefficients is significant

d denotes the case in which μ and δ both share the same sign but only one coefficient is significant at least at the 10% level

u denotes the case with neither μ nor δ are significantly different from zero, regardless of the signs

E denotes cases where the point estimates are very small in magnitude and statistically insignificant which means that β-convergence has already occurred

Table 20 β-convergence within the Eurozone

Countries	t-PS$_T$ without J$_T$ correction				t-PS$_T$ with J$_T$ correction				T$^{-1/2}$t$_y$			
	Debt		Deficit		Debt		Deficit		Debt		Deficit	
	Pre-break	Post-break	Pre-break	Post-break	Pre-break	Post-break	Pre-break	Post-break	Pre-break	Post-break	Pre-break	Post-break
Austria	d	u	E	C	u	u	E	c	c	u	u	u
Belgium	d	u	d	u	u	u	d	u	C	c	u	u
Cyprus	u	u	N/A	N/A	u	u	N/A	N/A	c	u	N/A	N/A
Estonia	d	u	c	C	u	u	c	C	d	d	u	u
Finland	d	c	u	u	d	u	u	u	d	d	c	u
France	d	c	E	u	u	u	E	u	d	u	u	u
Germany	d	u	u	u	u	u	u	u	c	u	d	u
Ireland	u	u	E	C	u	u	E	C	d	d	u	u
Italy	d	u	u	C	u	u	u	c	d	d	u	u
Latvia	u	u	d	C	u	u	d	C	d	d	u	u
Lithuania	u	u	N/A	N/A	u	u	N/A	N/A	c	u	N/A	N/A
Luxembourg	d	u	u	C	u	u	u	C	c	d	u	u
Malta	d	u	N/A	N/A	u	u	N/A	N/A	c	u	N/A	N/A
Netherlands	u	u	c	C	u	u	c	C	u	u	u	u
Portugal	d	c	u	u	u	u	u	u	d	d	u	u
Slovakia	d	c	u	u	u	u	u	u	d	d	u	u
Slovenia	u	u	d	c	u	u	d	c	c	u	u	u
Spain	u	u	E	D	u	u	E	D	u	u	u	u

D denotes the case where μ and δ both hold the same sign and are both significant at least at the 10% level

C denotes the case where μ and δ hold opposite signs and are both significant at least at the 10% level

c denotes the case where μ and δ are of opposite signs but only one of the coefficients is significant

d denotes the case in which μ and δ both share the same sign but only one coefficient is significant at least at the 10% level

u denotes the case with neither μ nor δ are significantly different from zero, regardless of the signs

E denotes cases where the point estimates are very small in magnitude and statistically insignificant which means that β-convergence has already occurred

Table 21 β-convergence of the new members towards the EU, core, and pigs averages

Countries	t-PS$_T$ without J$_T$ correction				t-PS$_T$ with J$_T$ correction				T$^{-1/2}$t$_y$			
	Debt		Deficit		Debt		Deficit		Debt		Deficit	
	Pre-break	Post-break	Pre-break	Post-break	Pre-break	Post-break	Pre-break	Post-break	Pre-break	Post-break	Pre-break	Post-break
NM-EU	d	u	u	c	u	u	E	c	d	d	u	u
NM-Core	d	c	d	c	u	u	d	u	d	c	u	u
NM-PIGS	d	d	u	u	u	u	u	u	u	d	u	u

D denotes the case where μ and δ both hold the same sign and are both significant at least at the 10% level

C denotes the case where μ and δ hold opposite signs and are both significant at least at the 10% level

c denotes the case where μ and δ are of opposite signs but only one of the coefficients is significant

d denotes the case in which μ and δ both share the same sign but only one coefficient is significant at least at the 10% level

u denotes the case with neither μ nor δ are significantly different from zero, regardless of the signs

E denotes cases where the point estimates are very small in magnitude and statistically insignificant which means that β-convergence has already occurred

Cross-Sectional general government debt mean
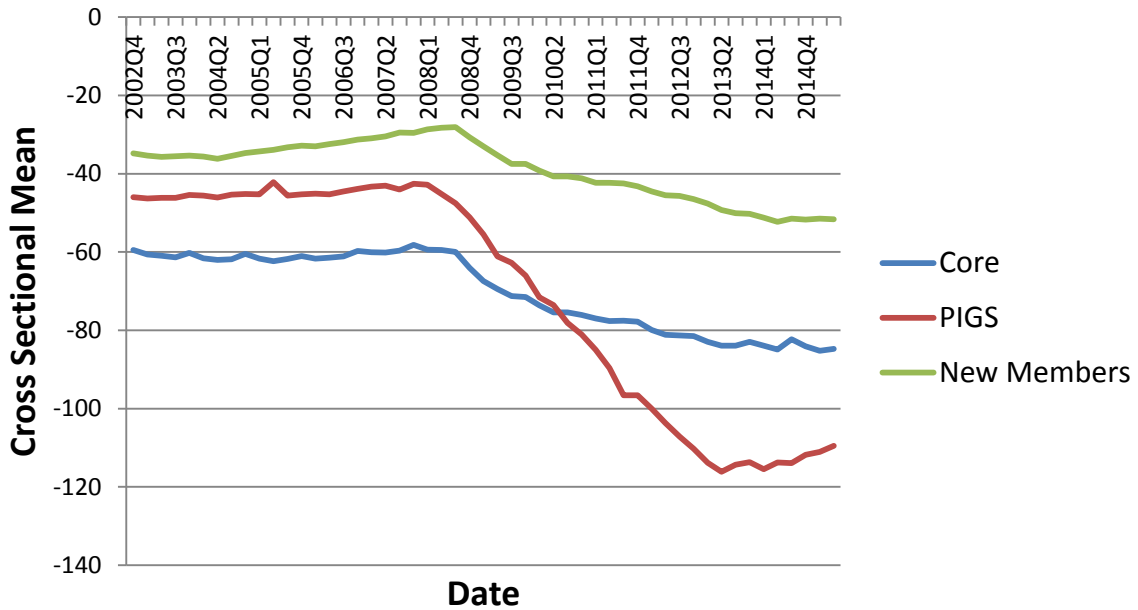
Figure 2 Cross sectional mean of general government gross debt over time for the core, pigs, and new members
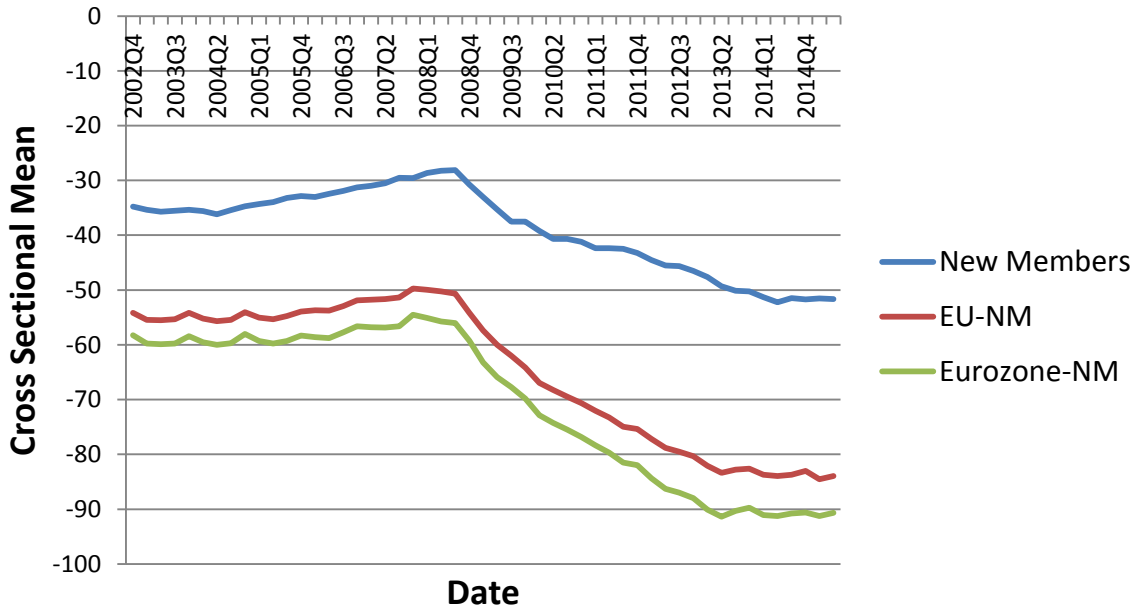

Figure 3 Cross sectional mean of general government debt over time for the new members and the rest of the EU and EMU
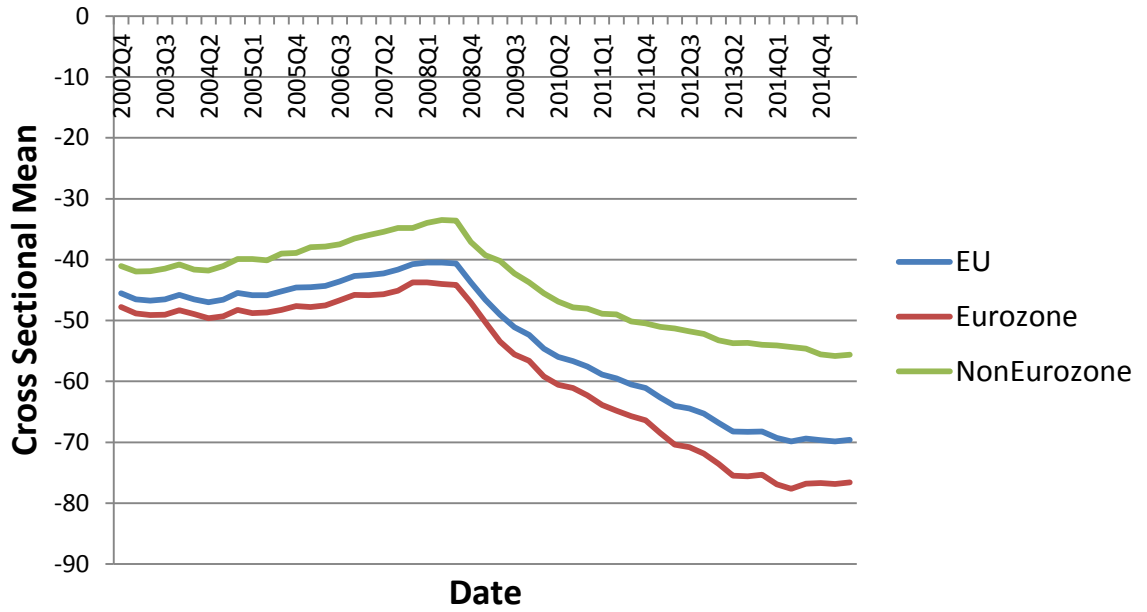
Figure 4 Cross sectional mean of general government debt over time for the EU, Eurozone, and Non-Eurozone
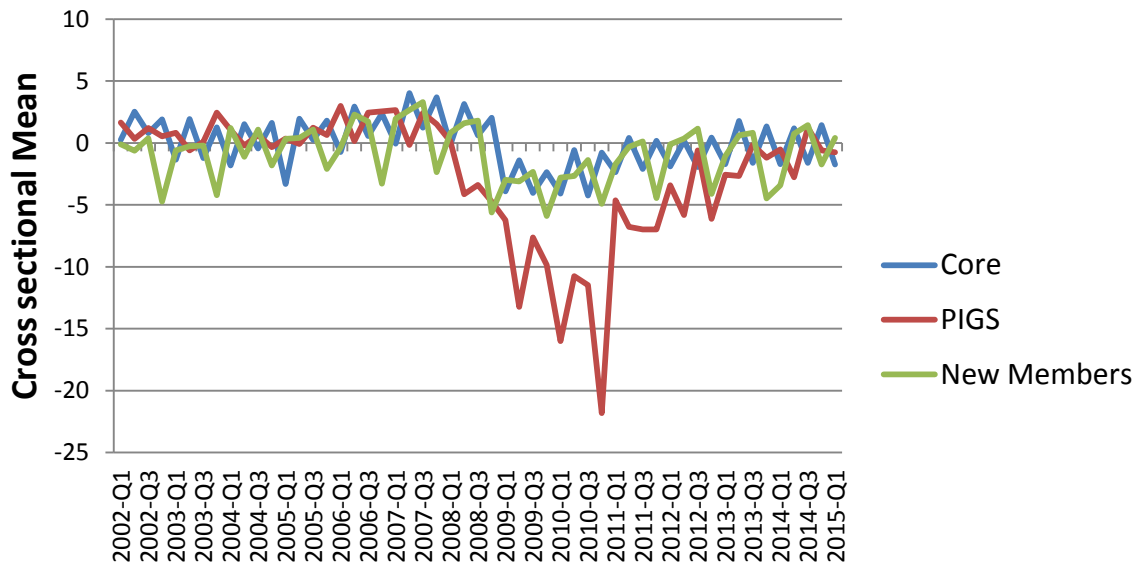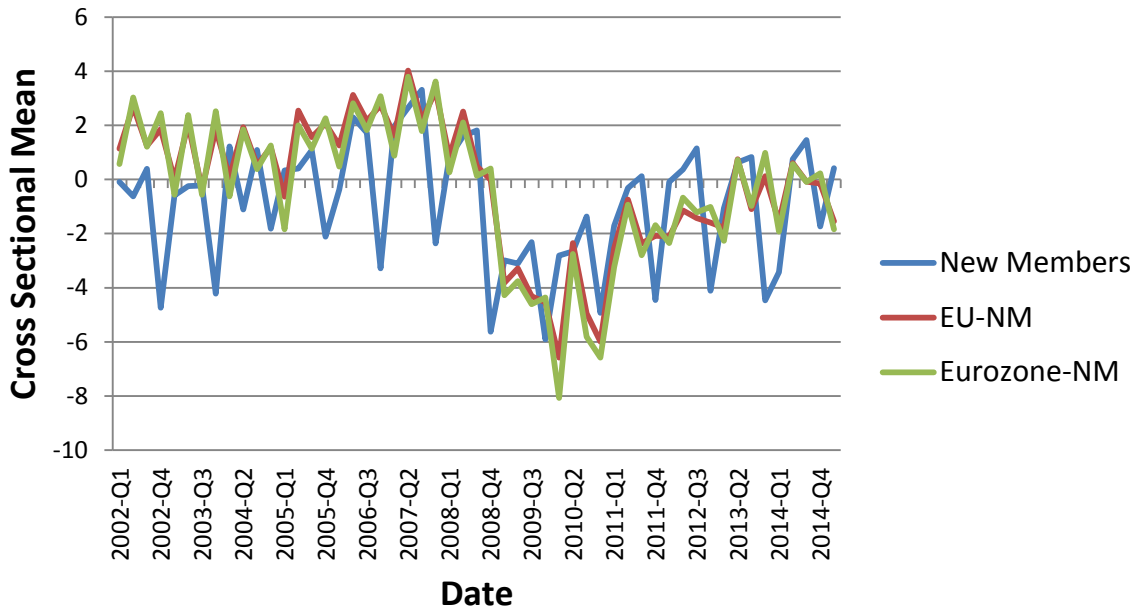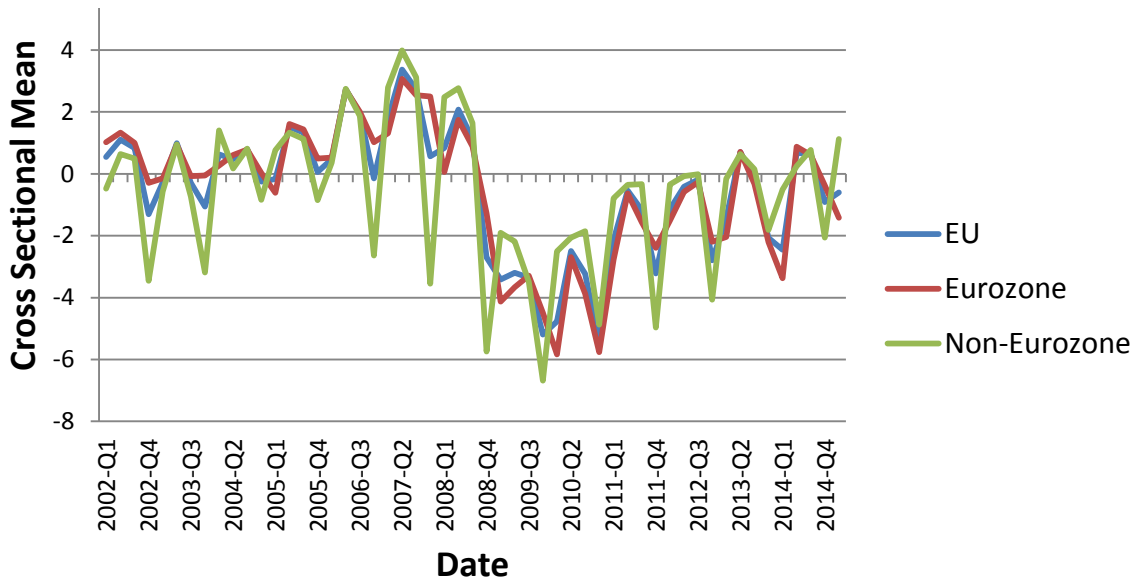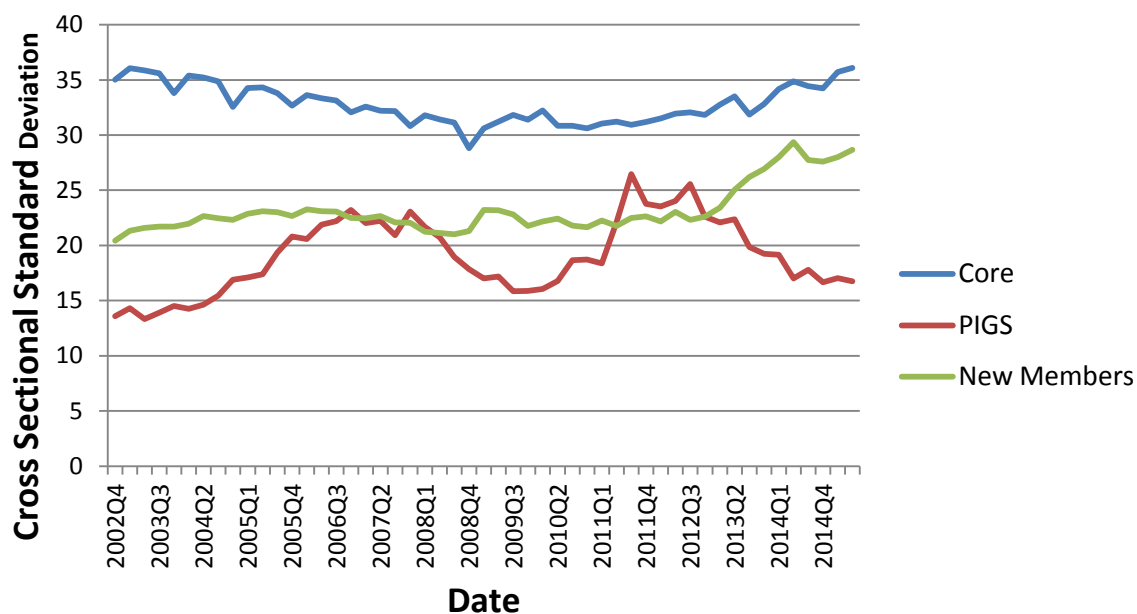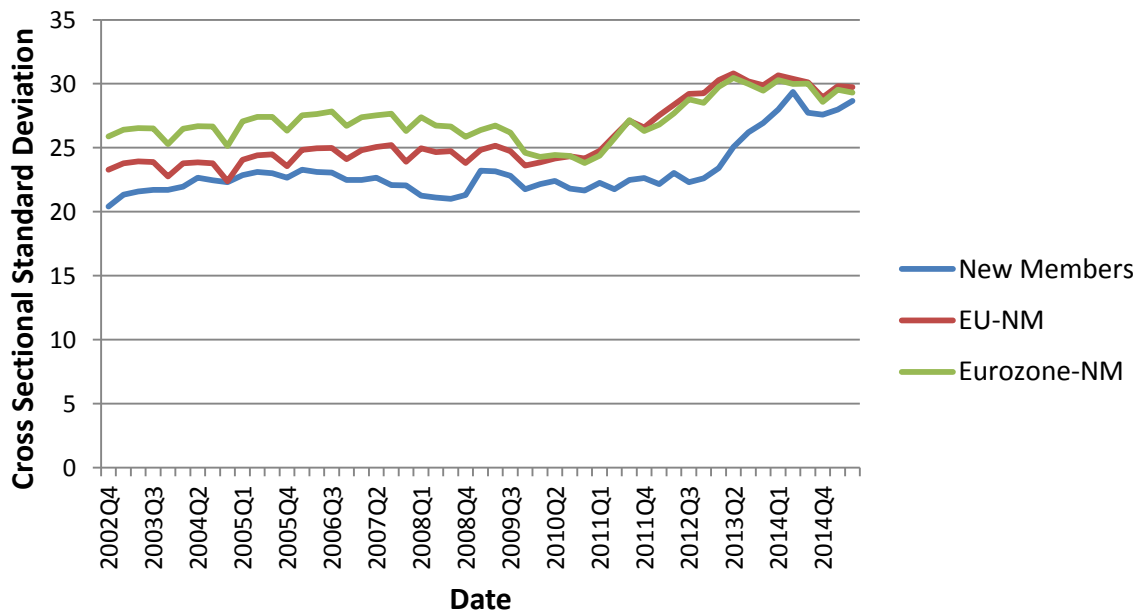

Figure 5 Cross sectional mean of general government deficit over time for the core, pigs, and the new members

Figure 6 Cross sectional mean of general government deficit over time for the new members and the rest of the EU and EMU

Figure 7 Cross sectional man of government deficit over time for the EU, Eurozone and NonEurozone

Figure 8 Cross sectional standard deviation of general government debt over time for the core, pigs and new members

Figure 9 Cross sectional standard deviation of general government debt over time for the new members and the rest of the EU and EMU
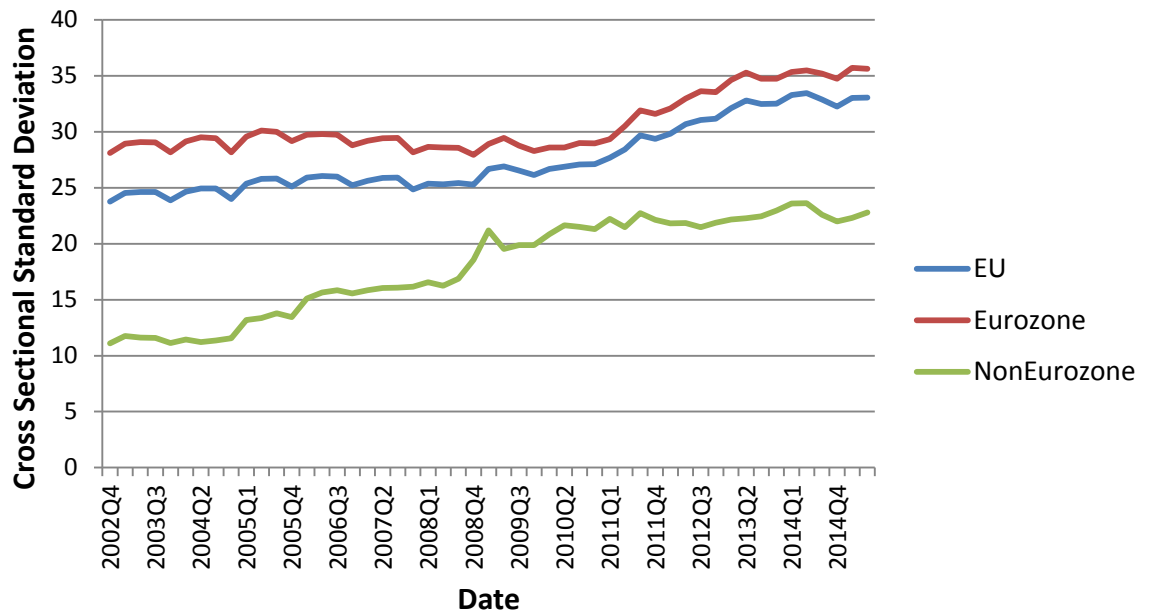
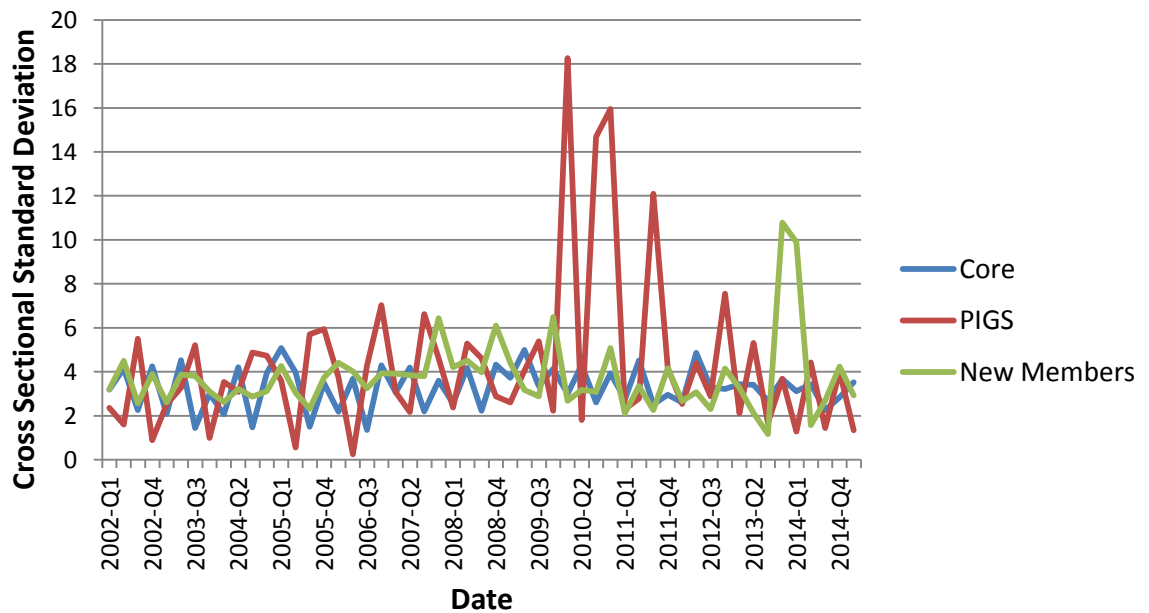**Figure 10** Cross sectional standard deviation of general government debt over time for the EU, EMU, and non-EMU countries

Figure 11 Cross sectional standard deviation of general government deficit over time for the core, pigs an new members
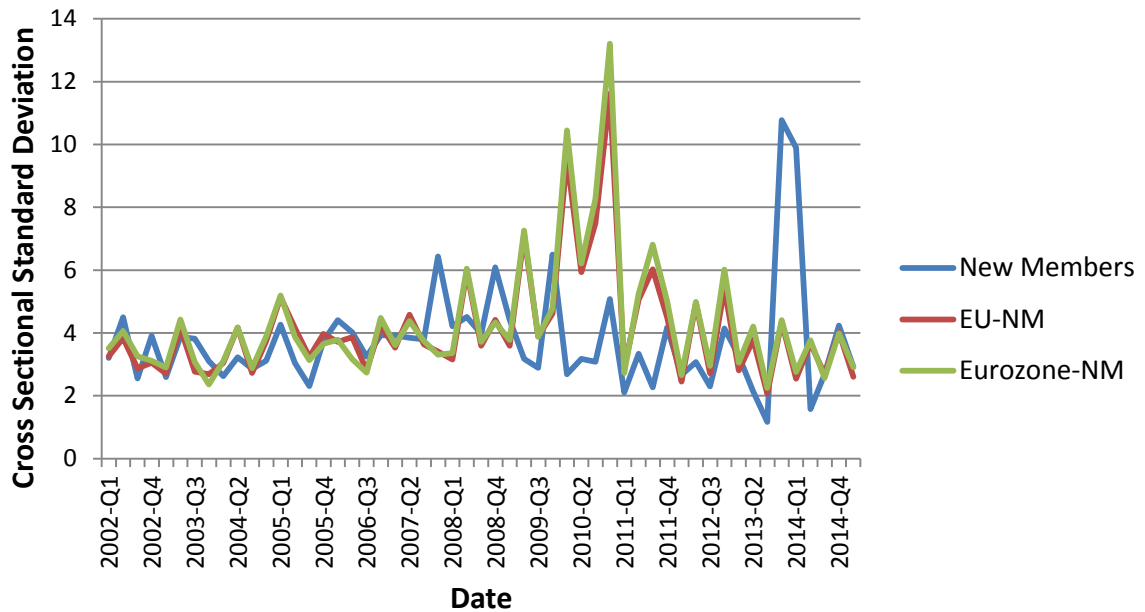
Figure 12 Cross sectional standard deviation of general government deficit over time for the new members and the rest of the EU and EMU
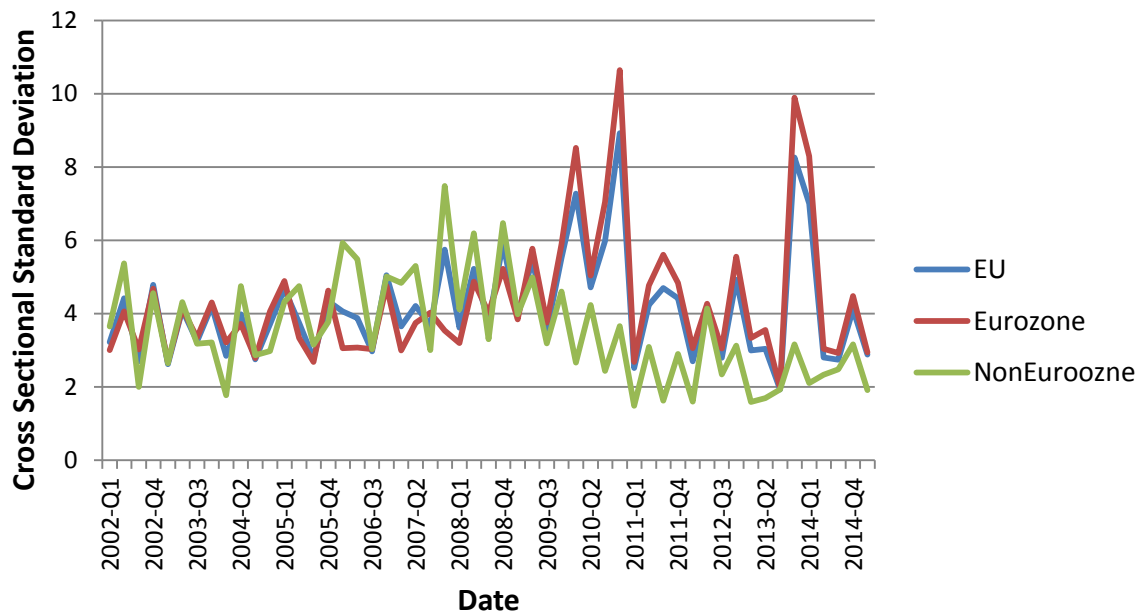

Figure 13 Cross sectional standard deviation of general government deficit over time for the EU, EMU and the non-EMU countries

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