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Fiscal policy convergence and business cycle synchronization in the euro area

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Tables

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Executive summary

This thesis aims to detect whether fiscal policy convergence (or divergence) is a determinant of business cycle synchronization in the European Economic and Monetary Union (EMU) of the European Union. The thesis is based on the literature on *Optimum Currency Areas* (OCA) which states that a common currency and a collective monetary policy are most appropriate if business cycles are synchronized across countries. We contribute to the discussion on the European Union (EU) as an optimum currency area by studying if fiscal policy convergence increases business cycle synchronization in the EMU. This is done by addressing the two Maastricht fiscal convergence criteria of the Stability and Growth Pact (SGP), as it is the tool for coordination of fiscal policy across the EMU.

While the majority of existing literature on fiscal policy focuses on discretionary fiscal spending, our thesis also studies fiscal policy in the form of automatic fiscal stabilizers, namely governmental revenues and expenditures which size is determined by the phase of the country's business cycle. Additionally, we address the impact of debt dynamics by using interest payments as a measure of accumulated debt. Fiscal policy divergence is measured as four independent variables: the structural deficit divergence, cyclical deficit divergence, primary deficit divergence, and interest payments divergence. Our data expands over the period 1980-2010. We conduct bilateral fixed effect analyses in order to account for country-pair specific effects. Our first finding suggests that convergence of automatic stabilizers increases business cycle synchronization. This is particularly interesting as the majority of earlier studies do not account for automatic stabilizers, but focus on discretionary fiscal policy as a determinant of business cycle synchronization. Our second finding is that convergence of accumulated debt increases business cycle synchronization. The findings are especially interesting in combination, as they link the two convergence criteria of Maastricht.

1. Introduction

One decade after the introduction of the euro as the common currency, the European Union (EU) finds itself in times of sovereign debt crises amongst the member states. Unsustainable fiscal policy conducted in some member states has been blamed to challenge the economic integration in the union. Precisely, the fiscal integration makes the Economic and Monetary Union (EMU) of the European Union one in a kind of monetary unions. The EMU does not have a central fiscal authority, but 17 member states[1] performing fiscal policy individually, under the restrictions provided by the Stability and Growth Pact (SGP), to maintain macroeconomic stability.

Robert Mundell published *A theory of optimum currency areas* in 1961, four decades before the implementation of the euro as a common currency in the EMU. Mundell's paper explores the proper conduction of fiscal and monetary policies in a currency area. Subsequent contributions to the literature on optimum currency areas (OCAs) emphasize the importance of business cycle synchronization for a currency area to be optimal. A common currency on a continent where the social, political and economic conditions are heterogeneous has inspired a line of research on the effects of convergence in economic policies on business cycle synchronization. This thesis focuses on convergence of fiscal policy in the EMU as a determinant of business cycle synchronization. We define our research question as:

DOES FISCAL POLICY CONVERGENCE (OR DIVERGENCE) BETWEEN TWO EMU COUNTRIES AFFECT THE SYNCHRONIZATION OF THESE COUNTRIES' BUSINESS CYCLES?

Fiscal policy is measured through different approaches in the literature. Primary deficit, discretionary fiscal policy and structural fiscal policy are measures that have been used interchangeably. We provide a distinction between structural and cyclical deficit to obtain a measure of respectively discretionary fiscal spending and automatic fiscal stabilizers. Also, we provide a distinction between primary deficit and interest payments to obtain a measure of a general fiscal deficit

[1] The euro zone consists of Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia and Spain. Estonia became a member in 2011.

(including both structural and cyclical deficit) and interest payments as a proxy of accumulated government debt. Our main finding is that both convergence of automatic fiscal stabilizers and convergence of accumulated government debt increases business cycle synchronization.

2. Theoretical Framework

2.1 The Theory of Optimum Currency Areas (OCA)

In 1961, Robert Mundell published the article "A theory of optimum currency areas" (Mundell, 1961). At this time, participating countries of the Bretton Woods system had pegged their national currencies to the US dollar which again had a fixed exchange rate to gold. In his article, Mundell (1961) questions: *What is the appropriate domain of a currency area?* Mundell stresses that the flexible exchange rate is presented as a "device whereby depreciation can take the place of unemployment when the external balance is in deficit, and appreciation can replace inflation when it is in surplus" (Mundell, 1961, p. 657). A single currency area implies a single central bank, which will challenge possible needs of adjustment between countries. Mundell's discussion entails these needs of adjustments under a fixed exchange rate regime. Mundell (1961, p. 657) states that:

> "It is patently obvious that periodic balance-of-payments crises will remain an integral feature of the international economic system as long as fixed exchange rates and rigid wage and price levels prevent the terms of trade from fulfilling a natural role in the adjustment process."

Mundell argues that the optimum area for a single currency is a region, or an economic unit, within each of which there is factor mobility and between which there is factor immobility. Each region should have a separate currency which fluctuates relative to all other currencies.

When discussing the practical application of his theory, Mundell stresses that it is based on the Ricardian assumption that factors of production are mobile internally, but immobile internationally. He argues that the argument for flexible exchange rate based on national currencies, is only as valid as the Ricardian assumption about factor mobility. Meanwhile, "if regions cut across boundaries or countries are multiregional, then the argument for flexible exchange rates is only valid if currencies are reorganized on a regional basis" (Mundell, 1961, p. 661).

Such reorganization should be possible if it is accompanied by a "profound political change" as the currency is an expression of national sovereignty (Mundell, 1961, p. 661). To achieve equilibrium with fixed exchange rate, it is thus important that fiscal policy is appropriately mixed with monetary policy. If monetary policy is contractionary, fiscal policy should be shifted to expansionary, and vice versa. This leads to Mundell's assignment rule: Assign to fiscal policy the task of stabilizing the domestic economy only, and assign to monetary policy the task of stabilizing the balance of payments (Pugel, 2007).

2.2 The Mundell trade-off and the OCA properties

The OCA theory is often used as a benchmark for the analysis of the costs and benefits of monetary integration in trade unions, and other authors base their research on Mundell's work. McKinnon (1961) and Kenen (1969) are important contributors in this literature by establishing properties for an optimal currency area.

The OCA theory postulates that benefits can be gained in a currency union with a common monetary policy if the countries forming a monetary union share certain common characteristics. The economic benefits from a single currency and monetary institution derive from eliminated transaction costs of doing business with many different currencies, and eliminated risks to business associated with fluctuating currencies. Whether the increased trade within a monetary union represents a net benefit depends on the relative importance of trade-creating effects - meaning the increased trade among the member countries - and trade-diverting effects - meaning the diversion of existing imports from countries outside the monetary union to countries inside it (Feldstein, 1997). The economic costs of giving up national currency might be substantially higher than the benefits. Moving monetary policy authority to a union-wide central bank means that monetary policy and the exchange rate cannot be tailored to fit national conditions, but must be collectively decided for the whole union.

The trade-off between stabilization losses and transaction cost reductions is called the Mundell trade-off. The OCA theory argues that a collective monetary policy is most appropriate if regional trade levels are high, labor is very mobile, economic shocks affect the different geographic parts of the currency union in similar ways,

there are compensating fiscal transfers across the monetary union to make up for uneven economic development, and that business cycles are synchronized. These characteristics are called *the OCA properties* (McKinnon, 1961; Kenen, 1969). The latter property is seen as the most important one, and form the basis of this thesis.

2.3 Business cycles and business cycle synchronization

Business cycles are economy-wide fluctuations in economic activity, meaning that the state of the economy repeatedly alternates between business cycle expansions characterized by rapid growth, and business cycle recessions characterized by declining economic activity (Sørensen & Whitta-Jacobsen, 2010).

The American economists Arthur Burns and Wesley Mitchell (1946) emphasize several points in their definition of business cycles. Firstly, business cycles are characterized by a co-movement of a large number of economic activities. Secondly, business cycles are a phenomenon occurring in decentralized market economies. Thirdly, business cycles are characterized by periods of expansion of economic activity followed by periods of contraction in which economic activity declines. Fourthly, a full business cycle lasts for more than a year, or more specifically for no less than six quarters (18 months). Lastly, business cycles are not strictly periodic although they repeat themselves.

The literature defines two main types of business cycle: the classical cycle and the growth (or deviation) cycle. The *classical cycle* identifies turning points on the basis of an absolute fall or rise in the value of GDP (Sørensen & Whitta-Jacobsen, 2010). Burns and Mitchell (1946) proposed a definition in which a business cycle is a sequence of expansions and contractions of economic activity, paying a particular attention to peaks, troughs, turning points, and their timing.

The *growth cycle,* or the deviation cycle, defines alternating periods of expansion and contraction in macroeconomic activity with respect to deviations of the GDP growth rate from an appropriately defined trend rate of growth. According to this definition, which was initially proposed by Lucas (1980) and then refined by Kydland and Prescott (1990), the business cycle is simply the fluctuations in real GDP along the steady-state of growth.

According to the OCA theory, business cycles of countries sharing the same currency, and thus having a fixed exchange rate, should be synchronized. The reason is simple: when economic fluctuations in two or more countries are symmetric, the need for stabilization policy is also symmetric (Buti and Sapir 1998). On the other hand, when the cycle is not synchronized, the need for stabilization policies will differ among the countries. If economic fluctuations in countries within a monetary union are asynchronous, the member states will have little incentive to adopt common policies and to cooperate in the operation of the union. Having a fixed exchange rate, excludes the possibility to use monetary policy as a stabilizing instrument.

3. European Monetary Union (EMU)

3.1 The European Monetary System

From 1967, the prevailing world order for exchange rates, established as part of the Bretton Woods agreement in 1944, began to fall apart (El-Agraa and Mayes 2007). The European Community (EC) looked at the possibility of trying to create a locally stable system with the same sort of architecture for itself. After the failure of the "snake in the tunnel",[2] a new proposal for EMU was put forward in 1977 by the president of the European Commission, Roy Jenkins. It approved in a limited form, and was launched as the European Monetary System (EMS) in March 1979, with the participation of all member states' currencies except the British pound which joined later, in 1990, but only stayed for two years. This system was based on stable, but adjustable, exchange rates of the national currencies in relation to the newly created European Currency Unit (ECU). Currency fluctuations were controlled through the Exchange Rate Mechanism (ERM). The EMS was a radical innovation because exchange rates could only be changed by mutual agreement between participating member states and the Commission (The European Commission, 2011). After the introduction of the euro, the ERM was replaced by ERM II to ensure that exchange rate fluctuations between the euro and other EU currencies do not disrupt economic stability within the single market (European Commission, 2011).

[2] The snake in the tunnel' was an attempt at creating a single currency band for the European Economic Community (EEC), essentially pegging all the EEC currencies to one another. The Smithsonian agreement set bands of ±2.25% for currencies to move relative to their central rate against the US dollar. This provided a tunnel in which European currencies to trade.

3.2 The three stages of EMU

In 1988 a committee chaired by the EU president Jacques Delors, was appointed to study and propose concrete stages leading towards a monetary union in the European Union (El-Agraa and Mayes 2007). The "Delors Report" pointed out that the creation of the EMU must be seen as a single process in three stages, with the ultimate goal being a single currency with an independent European Central Bank. The decision to enter upon the first stage should commit a member state to the entire process. The EMU would require a common monetary policy and a high degree of compatibility of economic policies and consistency in other policy areas, particularly in the fiscal field (El-Agraa and Mayes 2007).

The three stages towards the EMU were:

Stage 1 (1990-1994): This stage included the completion of the internal market and the removal of restrictions of further financial integration. It was characterized mainly by the abolition of off all internal barriers to the free movement of goods, persons, services and capital - commonly known as the four freedoms - within EU member states (European Central Bank, 2011).

Stage 2 (1994-1999): This stage included the establishment of the European Monetary Institute to strengthen central bank co-operation and prepare for the European System of Central Banks (ESCB). In addition, it included defining the future governance of the euro area and achieving economic convergence between the member states.

Stage 3 (1999 and continuing): This stage included fixing the final exchange rates and transition to the euro, establishing the ECB and ESCB with independent monetary policy-making, and implementing binding budgetary rules in the member states (The European Commission, 2011). 11 EU member states joined the euro after meeting the convergence criteria.[3] Greece joined the euro area in 2001.

3.3 Introducing the euro: convergence criteria

The Madrid European Council of June 1989 decided to proceed to the first stage of EMU in July 1990 and the Treaty on European Union (TEU) - the Maastricht Treaty - set the "Maastricht convergence criteria" that member states would have

[3] The first 11 countries to join the euro were Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Portugal, and Spain.

to meet in order to adopt a single currency. The Maastricht criteria were designed to ensure that a member state's economy was sufficiently prepared for the adoption of the euro. Sustained economic convergence efforts by individual member states were important for the creation of an environment of price stability in Europe after the introduction of the single currency (European Central Bank, 2011). The four main Maastricht criteria were price stability, exchange rates, long-term interest rates, and government finances (European Union, 2011). Firstly, the inflation rate of a given member state must not exceed by more than 1,5 percentage points that of the three best-performing member states in terms of *price stability* during the year preceding the examination of the situation in that member state. Secondly, the member state must have participated in the *ERM II* without any break during two years before adopting the euro, and must not have devaluated its currency. Thirdly, the nominal *long-term interest rate* must not exceed by more than 2 percentage point that of the three best-performing member states in terms of price stability one year before adopting the euro (European Union, 2011). Lastly, there are constraints designed to impose prudence on fiscal policy, or *government finances*, so that no country's debt can start to raise the interest rates or lower the credit rating of the other EMU countries. These 'fiscal convergence criteria' limit the annual budget deficit not to exceed 3% of GDP and the gross public debt not to exceed 60% of GDP.

3.4 Monetary policy in EMU

The European Central Bank makes the monetary policy for the EMU member states. Together with the national central banks the ECB make up the European System of Central Banks (ESCB). Monetary policy actions are taken by the Governing Council of the ESCB[4], and monetary policy decisions are communicated by the president of the ECB or by its press office (Jones, 2006). The ECB aims to provide a stable economic environment across the EU by maintaining price stability (McNamara, 2006). The executive board of the ECB developed a two-track operational approach: monetary targeting (amount of money is measured) and inflation targeting.

[4] The Governing Council of the ESCB includes representatives of each member state central banks in the eurozone, plus the six members of the executive board of the ECB.

3.5 Fiscal policy in EMU

The EMU does not have a central fiscal authority; meanwhile, the EU has implemented a centralized budget. The centralized budget amounts to 1 per cent of EU GDP and at this level, the budget cannot constitute a real macroeconomic policy instrument for stabilization (El-Agraa, 2007). The fiscal policy thus remains at a sovereign level in the EMU, but the EU constrains the ability of the member states to run independent fiscal policies. These constraints are to avoid excessive fiscal deficits and 'to respect the medium-term budgetary objective of close to balance or in surplus' (Jones, 2006, p. 332). The fiscal governance in EMU is executed through three types of constraints: the Maastricht criteria (see chapter 3.3) , the Stability and Growth Pact (SGP), and annual settings of Broad Economic Policy Guidelines (BEPG) (Jones, 2006). This thesis focuses on the Maastricht criteria and SGP.

3.5.1 The Stability and Growth Pact (SGP)

To ensure that the member states would continue to comply with the Maastricht criteria, in particular the fiscal convergence criteria, after joining the EMU, the SGP was adopted in 1997. In line with the monetary policy, SGP's paramount objective is to secure price stability, enhancing the credibility of the euro. SGP is a rule-based framework implemented for the coordination of national fiscal policies within EMU. It is based on article 99 and article 104 of the Treaty Establishing the European Community (TEC)[5]. The SGP consists of a resolution and two regulations that are called the preventive and the corrective arm. The coordination among the member states takes place through the structure of Economic and Financial Affairs Council, assisted by the Commission, and includes the ability to impose financial penalties on member states that do not adhere to the prudent limits.

The *preventive arm's* purpose is to provide guidelines to make sure that the member states run sustainable fiscal policies by strengthening 'the surveillance of budgetary positions and the surveillance and coordination of economic policies'. The member states are obliged to submit annual stability or convergence

[5] The TEC was renamed Treaty on the Functioning of the European Union (TFEU) with the introduction of the Lisbon Treaty signed in 2007. Article 99 now constitutes article 121 in TFEU, and article 104 now constitutes article 126 in TFEU.

programs, where they outline medium term objectives related to fiscal policies and the national fulfillment of the Maastricht criteria. The Commission assesses the programmes, and the Council gives its opinion. The Council can, on the basis of a proposal by the Commission, issue an early warning to a member state in order to prevent an excessive deficit. The Commission can address policy recommendations to a member state directly if it regards the broad implications of the nation's fiscal policies.

The regulation of the *dissuasive arm* of the SGP concerns 'speeding up and clarifying the implementation of the excessive deficit procedure' (EDP) (TFEU article 126). If a member state exceeds the deficit threshold, the EDP is triggered at EU level. The Council will issue recommendations and deadlines for implementation of action to the specific member state. If the member state does not comply, it may face financial sanctions.

3.5.2 The challenges of the SGP

In 2003, France, Germany, Italy, Greece and Portugal, were exceeding the deficit threshold. The SGP broke down. The 3% criterion was criticized by the member states for being too strict in times of cyclical downturns in the economy. The argument was that if a state is to stabilize the fluctuations in its business cycle, it needs some economic room. If the state is close to the 3% deficit-to-GDP ratio, the room may be too small to act (Mayes, 2009). Therefore, the SGP was revised in 2005. The revised version allowed more room before identifying an excessive deficit, improvement of governance process of surveillance, and improvement of statistics and accounting balances. In order to account for macroeconomic imbalances, the 2005-revision made it possible to revise member states' criteria compliances due to special events.

After the financial crisis in 2008, the SGP was revised for the second time in the beginning of 2011.[6] The reformed 2011 SGP has a strengthened EDP. It is stricter in terms of governance, and sanctions can immediately be applied. Motivated to enhance member states attainment to their medium term objectives, the reformed

[6] The first suggestion to improvement of the economic governance was presented to the Council in the report "Strengthening the economic governance in the EU" October 21st 2010. The Council agreed on the measures the 15th of March 2011.

SGP contains an expenditure benchmark (Buti, 2011). This implies that annual expenditure growth should not exceed a reference medium-term rate of GDP growth. The aim is that excessive government revenue shall be used on debt reduction and not on further spending. The reformed SGP also contains a benchmark for sufficiently diminishing debt ratio (Buti, 2011). The benchmark is supposed to gauge whether the debt ratio is sufficiently diminishing towards the 60% of GDP threshold (European Commission, 2011).

4. Business Cycles and the Euro Area: State of the Art

In the debate about business cycles, fiscal policy, and business cycle synchronization in the euro area three main issues are being discussed: whether business cycles in the euro area converged after the introduction of the single currency, how politicians use fiscal policy as an instrument to stabilize business cycle fluctuations, and the issue of which factors that drive business cycle synchronization.

4.1 Monetary integration and synchronization of business cycles

There is little agreement in literature whether monetary integration will lead to more similar business cycles. This is not surprising as an argument can be made in both directions (Haan, Inklaar, & Jong-A-Pin, 2008). On the one hand, monetary integration may lead to more similarity since there will be less asymmetry in monetary policies. In addition, monetary integration may lead to more synchronization through the impact of exchange rate stability on trade relations. Increasing intra-EMU trade along with decreasing capital controls leading to a more integrated economic system may result in a more homogeneous currency area. On the other hand, if exchange rate changes are considered to be a shock absorbing mechanism, a common currency may lead to less synchronization if the countries in a monetary union face asymmetric shocks.

Analyzing the business cycle synchronization of EU countries, researchers have looked at changes in correlation patterns over time. Artis and Zhang (1997) examine the question of whether the functioning of the Exchange Rate Mechanism (ERM) of the European Monetary System has produced a strengthening of the linkages between the participating economies, and whether

this will result in a dilution of the effect of the US business cycle on these economies in favor of a stronger effect from the German business cycle. They employ monthly data for industrial production and three methods of de-trending a growth cycle. Dividing the sample period between a pre- and a post-ERM period, they find that the linkages between the ERM economies and Germany have grown whilst the linkages with the US cycle have diminished. Accordingly, they argue in favor of the emergence of a group-specific 'European business cycle' in the ERM period, fairly independent of the US cycle. The authors conclude that the nominal exchange rate peg of the ERM agreement appears to be an explanation for the observed European business cycle.

Massmann and Mitchell (2004) partly confirm the findings of Artis and Zhang. They examine seven measures of the 'growth' business cycle, and a measure of the 'classical' business cycle, and highlight that empirical inference about individual eurozone business cycles is found to be sensitive to the measure of business cycles considered. Nevertheless, their measure of convergence between eurozone business cycles reveals common features, namely that periods of convergence are distinguished from periods of divergence. They suggest that the eurozone has entered a period of convergence after a period of divergence in the early 1990s, and see their result as consistent with the emergence of a common eurozone business cycle. The authors expect the trend towards convergence to continue because fixed exchange rate is believed to encourage the emergence of a common business cycle for countries within the eurozone.

Altavilla (2004) investigates whether the establishment of the European currency union has resulted in increased business cycle synchronization in the EMU participating countries. The author computes a concordance index and cross-correlation analysis and finds both an alignment of each national business cycle with the aggregate euro area cycle and a high correlation across European economies. Further, the author divides the sample period into the pre-Maastricht and the post-Maastricht period and finds that affiliation of EMU members' business cycles has moved from the US to the euro area. Thus, Altavilla (2004) concludes that monetary integration has led to an increase in the business cycle affiliation of the participating economies.

Furceri and Karras (2006) analyze cyclical output for the EU-15 countries. They find that business cycle synchronization has increased for many countries from 1980–1991 to 1992–2003. Furceri and Karras (2008) find that all countries in their EU sample are better synchronized with the EMU-wide economy in the post-EMU period than they were before the euro. They also show that this increase in synchronization is present in all components of aggregate demand and supply, but is more pronounced in the trade components, that is imports and exports. In addition, they show that the increase in trade within the euro area is at least partly responsible for the increase in cyclical synchronization.

The literature has not agreed on a single interpretation of the likely effects of the creation of a monetary union on the business cycles of EMU countries (Altavilla, 2004). One example is Krugman (1991), who asserts that the business cycles of countries joining a monetary union in Europe will become less synchronized as the result of a specialization process followed by the increasing commercial integration of the participating economies. According to his view, the commercial integration leads to regional concentration of economic activities. As the composition of the EMU members' aggregate demand is likely to change to accommodate this concentration process, the probability that a shock impinges on EMU members' output asymmetrically increases.

Haan, Inklaar and Sleijpen (2002) are more specific than Krugman, and analyze whether exchange rate stability has affected the synchronization of business cycles in 18 OECD countries over the years 1961–97 in order to answer if further integration will make business cycles in EMU countries more similar. They divide the sample period in four phases: the Bretton Woods period (1961-73), a period without stable exchange rate arrangement within Europe (1973-79), the first ERM period (1979-87), and the second ERM period (1987-97). The authors find that exchange rate stability has a negative effect on business cycle synchronization. Thus, they argue that monetary integration in itself may lead to less synchronization as the stabilizing influence of exchange rate fluctuations is removed.

4.2 Fiscal policy and business cycles volatility

A line of study focuses on the role of fiscal policy in influencing the volatility of business cycles. A common approach is to measure either discretionary fiscal

policy, or the cyclical budget balance. From this approach one can investigate if fiscal policy in EMU acts countercyclical or procyclical,[7] and thus if the fiscal policy acts smoothing on business cycle volatility or not. Sovereign debt is an important issue as regards the financing of fiscal spending, and has therefore been explored in literature on fiscal policy.

4.2.1 Discretionary fiscal policy

Fatás and Mihov (2000) conduct an empirical study of the effects of fiscal policy by looking into the dynamic effects of discretionary changes in fiscal policy. Their sample consists of data from 20 OECD economies during the period 1960-1997, and the authors argue that their estimates should provide a benchmark for the discussion of national fiscal policies in eurozone countries. Their goal is to study how the economy reacts to various shifts in discretionary fiscal policy by using different methods of identification of discretionary fiscal policy shocks. The authors find strong effects of changes in fiscal policy on economic activity.

Gali and Perrotti (2003) investigate if the Maastricht criteria and the SGP have weakened the ability of EU governments to conduct a stabilizing fiscal policy and to provide an adequate level of public infrastructure. They estimate fiscal rules for the discretionary budget deficit over the period 1980-2002, and divide the time series in two periods: before and after the Maastricht treaty (1980-1991 and 1992-2002). Gali and Perotti identify discretionary policy by controlling for the cyclical component. Thus, they argue the discretionary policy to be the fiscal stance. By dividing the fiscal stance in an endogenous and an exogenous component, the authors distinguish between structural and random spending and revenues. Their main finding is that discretionary policy in EMU has become more countercyclical over time, and this is a trend that also concerns other industrialized countries.

Sebastian Dullien (2007) analyzes to what degree fiscal policy functions as a stabilizing tool in the EMU, and how this could be improved. The sample includes 12 EMU countries over the time period 1991-2006 and four OECD countries.

[7] If fiscal policy works countercyclical it works against the cyclical tendencies in the economy. If fiscal policy works procyclical it works in the same direction as the cyclical tendencies in the economy.

Dullien divides the time series in two periods: before and after the introduction of EMU in 1999 (1991-1998 and 1999-2006). Dullien's results on discretionary policy differ from Gali and Perotti, as Dullien finds discretionary policy to be acyclical and procyclical, depending on the country. He argues that discretionary fiscal policy suffers from information problems due to the fact that macroeconomic shocks are hard to predict as aggregated data are published six weeks after the end of a quarter.

Candelon *et al.* (2007) also come to a different conclusion than Gali and Perotti. Candelon *et al.* analyze the stability of fiscal rules for EMU countries in the time-periods before and after the Maastricht treaty. Fiscal policy is divided into discretionary and non-discretionary fiscal policy. The sample includes the years 1980-2004. The authors find that discretionary policy remains procyclical after 1992. Candelon *et al.* argue that the fiscal arrangements induced by EMU have provided less room for effective discretionary policy. Another finding is that fiscal rules differ between large and small countries. Large countries follow a procyclical discretionary policy.

Dinu *et al*. (2011) use a reaction function model of fiscal policy to study the behavior of governments in the eurozone countries. They include the first twelve member states of the EMU in the period 1990-2009. They study three models, namely the budget balance model, the structural budget balance model and the cyclical budget balance model. Their estimates show that the variation of the actual budget balance was acyclical in the sample period, while the variation of the structural budget balance, or the discretionary fiscal policy, was counter-cyclical. Thus, they claim that discretionary fiscal policy meets the stability condition, meaning that the years with expansionary policies were alternated with years of restrictive policies. However, their results show that the governments' response to the economy's cyclical fluctuations decreased along with adoption of the euro as a single currency because of the restrictions introduced by the Stability and Growth Pact.

4.2.2 Automatic stabilizers

Van den Noord (2000) investigates the role and the size of automatic fiscal stabilizers. He defines automatic stabilizers as components of government budgets

that are affected by the macroeconomic situation in ways that operate to smooth the business cycle. 'Automatic stabilizers' is another name for the cyclical component of the budget balance. He identifies the components as taxes and unemployment insurance. In times of recession fewer taxes will be collected and more unemployment insurance will be paid to support private incomes and stimulate the aggregated demand. In times of expansions more taxes will be collected and payments of unemployment insurance will decrease to counteract the aggregated demand. Van den Noord (2000, p. 4) states that the stabilizing property will be stronger if the tax system is more progressive. He points to the existence of other automatic stabilization mechanisms (such as financial markets), and calls the aforementioned automatic stabilizers for automatic fiscal stabilizers.

Van den Noord (2000) underlines three cautions in the workings of automatic stabilizers. The author argues that if governments allow automatic stabilizers to work fully in downswings, but fail to resist the temptation to spend cyclical revenue increases during an upswing, the stabilizers may lead to bias towards weak structural budget positions. The result may be rises in public indebtedness during periods of cyclical weaknesses that are not subsequently reversed when activity recovers. This could lead to higher interest rates and will also require reduction in spending or a tax raise. Another caution is that automatic stabilizers respond to structural changes in the economic situation. This may lead to a decline in the country's growth potential, which may lead to a scenario in which automatic stabilizers undermine public finance positions. The final caution is that the tax and insurance systems serve other objectives as income security and redistribution. These systems may delay necessary adjustments in the wake of a recession (van den Nord, 2000, p. 5). Van den Noord assesses to what degree automatic stabilizers operate to smooth the business cycle in individual OECD countries. He finds that automatic fiscal stabilizers have generally reduced cyclical volatility in the 1990s. Further, he finds that some countries have undertaken fiscal consolidation to improve fiscal stabilizers. The government has then taken discretionary actions that have reduced or off-set the effect of automatic fiscal stabilizers.

Fatás and Mihov (2000) also analyze the importance of automatic stabilizers on business cycle volatility. They use several measures of automatic stabilizers, such

as the size of government, and find that large governments are associated with less volatile business cycles. Disaggregating fiscal policy into different components, the authors find that changes in taxes, transfers and government employment are the most effective tools of fiscal policy when it comes to smoothing the business cycle.

In his analysis on the degree fiscal policy functions as a stabilizing tool in the EMU, Dullien (2007) examines the role of automatic stabilizers as a part of fiscal policy (explained in chapter 4.2.1). Dullien states through econometric analyses that sizable automatic stabilizers exist in EMU. The econometric calculations shows that discretionary fiscal policy has counteracted the automatic stabilizers so that the overall fiscal policy has been acyclical or pro-cyclical. Dullien proposes an EMU-wide unemployment scheme for further stabilization in the euro area. The study of Dinu *et al*. (2011) also confirms the role of the automatic stabilizers in stabilizing the cyclical fluctuations within the eurozone.

4.2.3 Sovereign debt accumulation

There are two ways of financing fiscal spending, either by borrowing money or through taxation (for instance via automatic stabilizers). The focus on financing sources has increased as the euro area is experiencing a sovereign debt[8] crisis. Several authors have examined if one of the financing sources is more appropriate than the other. The phenomenon mostly studied is perhaps the well known Ricardian equivalence theorem, stating that the outcome of financing government spending either through taxes or debt will in the long term accrue equal costs.[9] Leith and von Thadden (2006) discuss the design of simple monetary and fiscal policy-rules consistence with determinate equilibrium dynamics. By adding an assumption of actors' death in their model, and thus removing the presence of Ricardian equivalence, government debt turns into a relevant state variable which they claim needs to be accounted for in the analysis of equilibrium dynamics (Leith & von Thadden, 2006).

[8] Sovereign debt is the debt of the country, or debt of private consumers that is guaranteed by the country's government.

[9] This theory is criticized based on the assumption of perfect capital mobility, zero probability of death for the consumers, and no savings nor borrowing constraints on consumers, and that the consumers are willing to save for future taxes.

Dullien (2007) points to modern micro-founded models that have provided new rationale for the effectiveness of fiscal policies, including interest payments on sovereign debt. The author states that a number of models show that fiscal stabilization policy can be effective if households are liquidity-constrained and have limited access to unsecured loans. Thus, he argues that there exists empirical indication that the Ricardian equivalence theorem does not hold in its absolute form. In his analysis, Dullien removes the workings of interest payments and automatic stabilizers, and use the cyclically adjusted primary budget balance to find the discretionary policy. Dullien includes a measure of debt in his equation. By doing this he claims to include the debt level and thus policy makers' concern about the overall level of public debt. He further argues that a cost of stabilization is that governments increase their debt in order to meet the Maastricht fiscal deficit criteria. Dullien claims the cost of government debt is to be borne by each government, which should weight its own benefits from stabilization against the costs of such a policy. He argues that rationally the government will decide for a degree of stabilization which is significantly lower than it would be optimal for the currency union as a whole.

Interest payments are the result of the accrued sovereign debt and creditworthiness amongst creditors and other market actors. The sovereign debt trends detected in the last three decades suggest that the debt-to-GDP ratio has been increasing at a non-sustainable level for member states in the EMU (Gali & Perotti, 2003), (Lynn, 2011). The accrual of sovereign debt will in worst case scenario accumulate in a default if the country is not able to pay the interests. Hattenhouer (2000), in Gianviti *et al*. (2010), links accrual of sovereign debt to political judgement. Hattenhouer (2000) explains that the main asset of a sovereign debtor is its power and capacity to tax, which is an intangible asset in nature. Further, he argues that the economic value of this intangible asset depends on the degree of hardship a country's citizens are willing to bear in order to service its debt and on the government's administrative capacity to raise revenues. It has been argued that highly indebted countries benefit from euro area membership, in terms of lower interest rates paid on the countries' public debt because the monetary union makes the commitment to low inflation more credible (Gianviti, Kruger, Pisani-Ferry, Sapir, & von Hagen, 2010). Unlike the membership of a monetary regime of national

currencies,[10] sovereign default in a monetary union is more challenging because member states lack monetary policy autonomy. Gianviti *et al.* (2010) argue that by closing the inflation channel, monetary union leaves a country with only three ways out of a situation of excessive debt: severe and harmful fiscal retrenchment, default, or being bailed out by the other members of the monetary union. Gali and Perotti (2003) argue that the sovereign debt interest payments are largely outside the control of the incumbent fiscal authorities and is such not an expression of the current fiscal stance, but on earlier fiscal stances on accrual of sovereign debt. As such, they argue that interest payments are part of the discretionary policy which they find to influence business cycle volatility.

4.3 Determinants of business cycle synchronization

The literature on determinants of business cycle synchronization focuses mainly on the *endogenous* effects of monetary integration on the synchronization of business cycles; that is, if sharing a single currency may set in motion forces bringing countries' economies closer together (De Grauwe & Mongelli, 2005). The implication for the euro area is that the euro area may over time turn into an optimum currency area even if it was not an OCA before. Countries which join or want to join the EMU may satisfy OCA properties ex-post even if they do not fulfill them ex-ante.

4.3.1 Trade

Frankel and Rose (1998) started the debate on the endogenous effect of monetary integration on the synchronization of business cycles by studying the effects of *trade* on business cycle synchronization. From a theoretical point of view, closer international trade could result in either tighter or looser correlation of business cycles. On the one hand, if the predominant shocks are demand shocks, or that intra-industry trade accounts for most trade, then shocks might be common across countries. This could lead to more similar business cycles. The effect suggested by this point of view applies mainly to intra-industry trade. On the other hand, closer trade could result in countries becoming more specialized in goods and services in which they have comparative advantages. The countries might be more sensitive to industry-specific shocks, which in turn could result in more

[10] Historically, European countries experienced most defaults during the Gold Standard.

idiosyncratic business cycles. The effect operates via inter-industry trade. This point of view is noted by inter alia Kenen (1969), Eichengreen (1992), and Krugman (1993).

Frankel and Rose find the first point of view to be most realistic, but test the hypothesis on data. Using a panel of bilateral trade and business cycle spanning 20 industrialized countries over 30 years, and conducting an instrumental analysis, they find that closer international trade links result in more closely correlated business cycles across countries. Thus, they argue that a monetary union itself, which is expected to boost trade integration, could increase business cycle synchronization. Frankel and Rose's findings is an application of the well-known Lucas (1976) critique which casts doubt on macroeconomic models that try to predict the effects of a change in economic policy based on the relationships of observed historical data, not accounting for changes in policy. The Lucas critique enhances that macroeconomic models do not include structural parameters: when policy changes, the macroeconomic parameters will change as well.

Gruben, Koo and Millis (2002) use the same sample as Frankel and Rose (1998), however, instead of applying an instrumental analysis they apply an OLS-based estimation procedure. They also add structure-off-trade variables to their model measuring the impact of trade on business cycle synchronization in order to separate the effects of intra- and inter-industry trade flows. This allows them to test whether specialization reduces business cycle correlation. They find that specialization generally does not significantly asynchronize business cycles between two countries. Further, the authors' results confirm Frankel and Rose's general conclusion, but they suggest that Frankel and Rose model overestimates the effect of trade on business cycle synchronization.

Imbs (2004) employs a simultaneous equations approach and instrumentation analysis. Analyzing data from the 1980s and the 1990s from 24 countries worldwide, he verifies the overall positive impact of trade on business cycle synchronization but points out that "a sizable portion is found to actually work through intra-industry trade" (Imbs J. , 2004, p. 733).

The results of Frankel and Rose (1998) are also confirmed by Baxter and Kouparitsas (2005) who, among other variables, investigate the effect of trade on business cycle co-movements. Their dataset includes over 100 countries, both developed and developing. They use a "robustness" approach in which a variable is said to be a robust determinant of business cycle synchronization if the variable has a significant coefficient in all regressions when all other potential explanatory variables have had a chance to "knock the variable out of the equation" (Baxter & Kouparitsas, 2005, p. 114). They find that bilateral trade has an independent role in transmitting business cycles.

Kalemli-Ozcan, Sørensen and Yosha (2001) use a sample of 11 OECD countries to test the argument put forward by inter alia Eichengreen (1992), Kenen (1969), and Krugman (1993) that closer trade could lead to countries becoming more specialized. They empirically test whether countries that are more specialized are subject to less symmetric fluctuations. Their sample involves over 50 states, including ten OECD countries and the US. The sample period for sectoral GDP is 1977-1990, and 1980-1990. The sample for total GDP used to identify fluctuation asymmetry is 1963-1993. They find that economic integration may lead to better income insurance through greater capital market integration, which in turn will induce higher specialization in production. Furthermore, they find that the OECD countries with higher industrial specialization exhibit output shocks that are less correlated on average with aggregate OECD output. The authors argue that their finding on specialization counterbalances the effect of lower trade-barriers on business cycle synchronization as found by Frankel and Rose (1998).

4.3.2 Industrial similarity

A second determinant of business cycle synchronization explored in literature is *similarity in industrial structure*. The theoretical argument states that industrial similarity is likely to affect the international synchronization of business cycles directly. This will occur in the presence of sector-specific shocks, as two economies producing the same types of goods or services will be subjected to similar developments (Imbs J. , 2004).

Imbs (2004) finds that industrial similarity patterns have a sizable effect on business cycles as two economies with a similar economic structure are

significantly more correlated ceteris paribus. He shows that this happens mostly because economies grow through evolving stages of diversification. Most of the effect is independent of trade and financial policy, and directly reflects levels of GDP per capita. He argues that the importance of specialization patterns in affecting cycles is not due to his choice of a time period or geographic coverage, or to the prevalence of a given type of shock in a given sample.

Also Calderón, Chong and Stein (2007) report that symmetric production structure result in correlated business cycles. They study differences of the impact of trade intensity on business cycle correlation between industrial and developing countries. Using annual information for 147 countries for the period 1960–99, they find that asymmetries in the structure of production explain approximately 40% of the differences in the sensitivity of cycle correlation to trade intensity between industrial and developing country pair groups.

Haan, Inklaar and Jong-A-Pin (2008) study a sample of 21 OECD countries in the period 1970–2003. They use three indicators of industrial similarity, namely measures based on industrial specialization, export similarity and the share of intra-industry trade, and find that all three measures appear robustly related to business cycle synchronization. Thus, they argue that since intra-industry trade has increased substantially in Europe, the "fit" of the common monetary policy has increased as the member countries' business cycles have become more aligned (Haan, Inklaar, & Jong-A-Pin, 2008, p. 663).

However, not all studies find industrial similarity to be significantly related to business cycle synchronization. Baxter and Kouparitsas (2005) also argue that if the primary business-cycle shocks are sector-specific, then countries with greater similarity in sectoral structure would tend to have more correlated business cycles. They include industrial similarity in their analysis to test their hypothesis empirically. Nevertheless, they do not find that sectoral similarity is robustly related to cycle co-movement.

4.3.3 Financial integration

Financial integration is a third field of determinants of business cycle synchronization. Financial integration is often studied in connection to trade and

industrial similarity, but it has been difficult to obtain sufficient measures of bilateral financial integration due to lack of information sources and data (Imbs J. , 2004). The impact of financial integration on cross-country business cycle synchronization has been considered ambiguous (Böwer & Guillemineau, 2006). On the one hand, international financial linkages could stimulate specialization through the reallocation of capital, and this could lead to less synchronization of business cycles. On the other hand, financial linkages could result in a higher degree of business cycle synchronization by generating large demand side effects. Also, contagion effects that are transmitted through financial linkages could result in heightened cross-country spillover effects of macroeconomic fluctuations (Haan, Inklaar, & Jong-A-Pin, 2008). Another argument is that limited ability to lend or borrow internationally hampers the transfers of resources across countries and can such increase GDP correlations (Imbs J. , 2004). Alternatively, if investors have imperfect information or face liquidity constraints, limiting capital flows can decrease GDP correlations, as investors herd or withdraw capital from destinations simultaneously (Imbs J. , 2004). Empirical work supports that capital flows are correlated internationally and that financial integration tends to synchronize business cycles (Imbs J. , 2004).

Kalemli-Ozcan, Sørensen and Yosha (2001) include financial integration as an indirect measure in their study of the effect of increased trade on business cycle correlation (chapter 4.3.1). This is the first study in literature that finds a significant direct and positive effect of financial integration on business cycle synchronization (Imbs J. , 2004). The authors follow La Porta *et al*. (1998) who construct international data on several institutional determinants of financial development: indices of shareholders rights, indices of creditor rights and indices of enforcement laws. They argue that countries with a high degree of financial integration tend to have more specialized industrial patterns and less synchronized business cycles.

Kose, Otrok and Whiteman (2003) study the changes in world business cycles during the period 1960-2001 for the G7 countries. They employ a Bayesian dynamic latent factor model to estimate common components in the macroeconomic aggregates output, consumption, and investment. The authors

argue that financial integration enhances international spillovers of macroeconomic fluctuations leading to more business cycle synchronization.

Imbs (2004) tests both the direct and the indirect link between financial integration and business cycle synchronization, the latter link working through the effect of specialization. His study covers 24 countries, both developing and developed from the 1980s and the 1990s. Imbs obtains a measure of bilateral financial integration through indices capturing restrictions on capital flows, and variables that reflect effective financial flows. Thus, Imbs obtain a measure of institutional determinants, and a measure of the financial flows. Imbs finds that correlations in GDP fluctuations rise with financial integration, even though financial integration tends to result in more specialized economies and thus less synchronized business cycles. He also finds a positive effect dominating the indirect link via specialization dynamics.

4.3.4 Fiscal policy convergence

Other studies explore the effect of fiscal policy convergence on synchronization of business cycles. Theoretically, fiscal convergence could raise business cycle synchronization by eliminating idiosyncratic fiscal shocks. Most studies examining this issue employ fiscal policy variables in analyses exploring the effect of others determinants of business cycle synchronization (see for example Clark and van Wincoop (2001), Camacho, Perez-Quiros, and Saiz (2006), and Haan, Inklaar, and Jon-A-Pin (2008). Most of these studies find support that fiscal policy convergence leads to increased synchronization of business cycles.

Darvas, Rose and Szapáry (2007) employ a different methodology when considering the link between fiscal policy and business cycles. They ask whether there exists an indirect connection between the Maastricht criteria applied for EMU entry and the arguably most important OCA criteria, namely the synchronization business cycles. Using a panel of 21 OECD countries over 40 years of annual data, they show that countries with divergent fiscal policies tend to have less synchronized business cycles. Darvas, Rose and Szapáry's (2007) primary measure of fiscal divergence is the difference between countries in the general government budget deficit measured as a percentage of national GDP. The authors use the Pearson correlation coefficient as their dependent variable, and

define fiscal divergence as large average cross-country differences in the ratio of government net lending/borrowing to GDP (the general government deficit). To attain a measure of the deficit without impact of debt, the authors study the primary budget position. They show that convergence of both general government deficit and primary fiscal deficits tend to increase the level of business cycle synchronization. Thus, they conclude that the Maastricht convergence criteria, which have encouraged fiscal convergence and deficit reduction, also have indirectly moved Europe closer to an OCA by reducing countries' abilities to create idiosyncratic fiscal shocks. Darvas, Rose and Szapáry (2007) mention that the Maastricht criteria may impose convergence of budget deficits at such low levels that fiscal convergence could reduce business cycle synchronization. They contradict this by arguing that fiscal convergence seems to increase business cycle synchronization by reducing volatile fiscal shocks (Darvas, Rose, & Szapáry, 2007, p. 13).

Artis, Fidrmuc and Scharler (2008) also find that countries with divergent fiscal policies are subject to idiosyncratic business cycles. They use a different dependent variable, namely Fisher's transformation of the standard correlation coefficient[11], while applying average cross-country differences in the cyclically adjusted fiscal balances as measures of fiscal divergence. In addition, they control for other measures of integration such as labor market rigidities as well as trade and FDI links between countries. Their dataset consists of 10 euro area countries and 5 countries outside the euro area. Focusing on the six new member states of the EU (Czech Republic, Estonia, Hungary, Poland, Slovakia and Slovenia) and considering implications for EMU enlargement, they suggest that the Maastricht fiscal criteria should give rise to additional synchronization effects due to more convergent fiscal policies. Thus, the authors partially confirm an optimistic view towards the monetary integration of the new EU member states.

Haan, Inklaar, and Jon-A-Pin (2008) find that convergence in fiscal policies has a similar impact on business cycle synchronization as trade intensity. Their paper examines data from 21 OECD countries in the period 1970-2003, and estimates a multivariate model including variables capturing similarity of economic policies.

[11] Fisher's transformation of the standard correlation coefficient: ½ ln $[(1+\rho_{ij}) / (1-\rho_{ij}]$, where ρ_{ij} is the correlation coefficient between the countries *i* and *j*.

Their results suggest a sustainable EMU because of the integration process in which *inter alia* fiscal policies have become more similar in Europe.

Lan and Sylwester (2010) follow the same approach as Darvas, Rose and Szapáry, but they examine to what extent Chinese provinces with similar fiscal policies have synchronous business cycles. Lan and Sylwester study 27 of 31 Chinese provinces, and use annual data from 1966-2003, which again is divided in three sub-periods. They instrument for fiscal policy using government expenditure on cultural activities because causation can run from both fiscal policy to output fluctuations and from output fluctuations to fiscal policy. Their results show that provinces with similar budgetary positions tend to have similar business cycle movements, and thus, they suggest that fiscal policy could be a source of business cycle fluctuations.

5. Hypotheses

This thesis measures fiscal behavior in terms of the Maastricht fiscal criteria. The first criterion is the deficit-to-GDP ratio. In this thesis, we measure the impact of deficit by dividing the deficit in two components: a structural component and a cyclical component. The second criterion measures the debt-to-GDP ratio. We measure impact of debt indirectly by distinguishing between primary deficit and interest payments. Our four hypotheses are as follows:

H1: DIVERGENCE OF STRUCTURAL DEFICIT BETWEEN TWO EMU COUNTRIES HAS A NEGATIVE EFFECT ON THE SYNCHRONIZATION OF THESE COUNTRIES' BUSINESS CYCLES.

H2: DIVERGENCE OF CYCLICAL DEFICIT BETWEEN TWO EMU COUNTRIES HAS A NEGATIVE EFFECT ON THE SYNCHRONIZATION OF THESE COUNTRIES' BUSINESS CYCLES.

H3: DIVERGENCE OF PRIMARY DEFICIT BETWEEN TWO EMU COUTNRIES HAS A NEGATIVE EFFECT ON THE SYNCHRONIZATION OF THESE COUNTRIES' BUSINESS CYCLES.

H4: DIVERGENCE OF INTEREST PAYMENTS BETWEEN TWO EMU COUNTRIES HAS A NEGATIVE EFFECT ON THE SYNCHRONIZATION OF THESE COUNTRIES' BUSINESS CYCLES.

6. Methodology

6.1 Qualitative preparatory study

As part of our study, we have conducted a qualitative analysis of articles about the euro and the eurozone in four well-recognized journals in political economy from 1990-2010. The four revised journals were European Union Politics, International Organization, Journal of European Public Policy, and Journal of Common Market Studies. The distribution of articles revised can be found in appendix 1. The findings and conclusions from the article review have formed an understanding of challenges and dynamics of the EMU, and thereby functioned as a base for the quantitative study.

6.2 Measuring business cycles

6.2.1 Measures of business cycles

The two most important variables used when measuring business cycles are quarterly data on GDP and monthly data on industrial production (IP). Annual data are usually avoided to capture more of the high frequency fluctuations. Haan, Inklaar and Jong-A-Pin (2008) argue that GDP is the most appropriate variable because studies of business cycle synchronization should focus on the broadest possible output variable. Unfortunately quarterly real GDP data are not available for many countries on a long-term basis. We use quarterly data of GDP with constant 2000 prices for the period 1980-2010 for 16 of the 17 current member states of the EMU[12], and for three EU countries which do not use the euro as their currency, namely Denmark, Sweden and the United Kingdom.[13] Sweden has no more than derogation from participation in stage 3 of EMU, while Denmark and the UK have an opt-out, however still under the obligation of complying with regulations in the SGP.[14] Data of quarterly GDP used to calculate the dependent variable is collected through Datastream, from the Eurostat database.

[12] Estland is excluded due to limited access to data for this country.

[13] Denmark has not introduced the euro. The EU Treaty gives Denmark the right to remain outside the euro area, even when all convergence criteria are met (opt-out). However, the Danish krone has joined the ERM II and observes a central rate of 746.038 to the euro with narrow fluctuation margins of ±2.25%. The Swedish krona is not yet within the ERM II, but Sweden is obliged to join the euro once it meets the necessary conditions. The UK has negotiated and opt-out from the euro, and the pound sterling is not included in ERM II. The United Kingdom entered the ERM in October 1990, but was forced to exit the programme within two years (The European Commission, 2011).

[14] Regulation 1467/97 establishing the SGP states that paragraph 1 of article 104 in the TEC – "Member States shall avoid excessive government deficits" – does not apply to the UK, however,

6.2.2 Filtering methods

This thesis focuses on the growth cycle. The task of business (growth) cycle theory is to explain the fluctuations around a time trend. A problem with the hard-data series is that they do not provide a measure of "the business cycle" as such, but first have to be decomposed into trend and cycles using statistical techniques. There is no single 'correct' way of separating the cyclical component of a variable measuring business cycles. We need a method which allows for variation over time in the underlying growth trend, but which nevertheless ensures that the short-term fluctuations are categorized as temporary cyclical deviations from the trend.

In this thesis, we employ two well-known filtering methods: a band pass filter developed by Christiano and Fitzgerald (CF filter), and the Hodrick-Prescott (HP) filter. Both methods are nonparametric, meaning that they are not based on a specified statistical model. Researchers have come to different conclusions about whether the choice of filtering methods is crucial for the conclusions.[15] One feasible solution is to assess the robustness of the results by comparing the outcome of a number of filtering methods. We use the CF filter to our default estimations, but employ the HP filter to check for robustness.

The Christiano-Fitzgerald filter (a band pass filter)

A band pass filter is a filter that separates elements with fluctuations within a specified band of frequencies and elements with fluctuations outside this band. The "ideal" band pass filter can be used to isolate the component of a time series that lies within this specified band of frequencies. The band pass filter is preferable from a theoretical point of view since it intends to eliminate both high frequency fluctuations and low frequency fluctuations (Darvas & Szapáry, 2008). However, applying this filter requires a dataset of infinite length. In practice, an approximation is needed. Here, we roughly present two approximations, and choose to proceed with the Christiano-Fitzgerald filter.

it fails to state explicitly that it does not apply to Denmark. The 2002 Council opinion on the updates convergence programme for Denmark states that "Denmark is also expected to be able to withstand a normal cyclical downturn without breaching the 3% of GDP deficit reference value". The UK is still under the obligation of paragraph 4 of article 116 stating that "In the second stage, Member States shall endeavor to avoid excessive deficits" (Gali & Perotti, 2003, pp. 7-8)

[15] See for example Canova (1994), Artis and Zhang (1997) or Massmann and Mitchell (2004).

The mostly commonly used band pass filter is the filter developed by Baxter and King. Baxter and King (1999) criticized the HP filter stating that the technique resulted from a lack of attention to the definition of a business cycle. They proposed a new filter, the derivation of which is explicitly based on six requirements[16] and a moving average. Their filter assumes symmetric weights, which means it needs K observations at the beginning and end of the series to approximate the ideal band pass filter. Baxter and King recommend using a 12 quarter moving average. This leads to a loss of three years of data in both ends of the time series. This is the Baxter and King filter's most serious shortcoming.

Christiano and Fitzgerald (2003) developed a generalized version of Baxter and King's band pass filter. In their manuscript, they describe an algorithm to approximate the ideal band pass filter. They assume that the unfiltered time series have a unit root and that data are generated by a random walk, and find that this simple approach is "nearly optimal" (Christiano & Fitzgerald, 2003). In the compilation of the filter, Christiano and Fitzgerald use this minimization function as a starting point:

$E\{(y_t - \hat{y}_t)^2|x\}$, $x \equiv [x_1,\ldots,x_T]$.

Based on this, they construct a filter of which the filtering vectors is set in such a way that the mean squared error between the ideal filter (y_t) and the approximate filter ($\hat{y}_t$) is minimized given the raw data. An important characteristic of the CF filter is that they allow for the filter weight to be changed over time because this increases the amount of information in the data used to estimate the filter.

The differences between Baxter and King's filter and the CF filter are due to the type of approximation of the ideal band pass filter as they differ in two assumptions (Evans, 2006). Firstly, Baxter and King assume that the variables are independent and identically distributed, while Christiano and Fitzgerald presume the distribution of a random walk. Secondly, Baxter and King assume symmetric weights, whereas Christiano and Fitzgerald omit this assumption. Evans (2006)

[16] Following their logic, a useful detrending method should fulfill six requirements: (1) the filter should extract a cyclical component within a specified range of periodicities, and leave the characteristics of this component undistorted, (2) there should be no phase shift, (3) the filter should be an optimal approximation to the "ideal" filter, (4) the filter should have trend-reducing properties, (5) the filter should yield business cycle components unrelated to the length of the observation period, and (6) the method must be operational.

concludes that the filter by Baxter and King is a better approximation when it comes to shorter business cycles, while the filter by Christiano and Fitzgerald is better when dealing with longer business cycles. In addition, he concludes that it is advisable to employ the filter by Christiano and Fitzgerald if the characteristics of the cycles towards the ends of the data series are of particular interest.

As we prefer to make use of data from the whole sample period, we prefer the CF filter to the filter developed by Baxter and King. We employ not-seasonally adjusted time series for the CF filter because this filter is constructed to remove seasonally variations. When the business cycle is specified within a certain band of periodicities, it results in a two-sided moving average. In order to remove both low and high frequency components the weights of two low pass filters are applied. Upper and lower frequencies of the two filters are by Baxter and King (1999) recommended to be set to 8 and 1.5 years, respectively. In this thesis, we will translate the frequencies to quarterly data and set them to 32 and 6 quarters.

The Hodrick-Prescott filter

The HP filter is named after the American economists Robert Hodrick and Edward Prescott (1997). They define a time series (y_t) as the sum of the trend component (g_t) and the cyclical component (c_t).

$y_t = g_t + c_t$

The main advantage of the HP filter is that it is easy to employ because it simply solves the following problem:

$$\min \{\sum_{t=1}^{T} (y_t - g_t)^2 + \lambda \sum_{t=2}^{T-1} [(g_{t+1} - g_t) - (g_t - g_{t-1})]^2\},$$

where y_t is the log of GDP at constant prices in period *t*, g_t is the log of the growth component (trend), and λ is a smoothing parameter. The magnitudes $g_{t+1} - g_t$ and $g_t - g_{t-1}$ are approximately the *percentage growth rates* of the trend value of real GDP in periods t+1 and t, respectively. The term in the square bracket thus measures the change in the estimated trend growth rate from one period to the next. The term $y_t - g_t$ measures the cyclical component, c_t, of log (GDP) in period t.

The HP filter is based on the assumption that the seasonal component is already removed. Using data that is not seasonally adjusted may result in a volatile cyclical component because the filter is not able to remove these short term fluctuations. Thus, we use seasonally adjusted GDP when applying the HP filter. Additionally to its simplicity, the HP filter has other advantages, such as the ability to compute a good approximation of the cyclical component and the capacity to deal with the high and low frequencies of series (Silva, 2009). However, researchers have found that the HP filter has some problems. The filter is a two-way filter, i.e. it uses information from t-1, t and t+1 to determine the trend in period t. Consequently, the filter tends to give imprecise estimates of the trend at the end-point series. Some business cycle researchers therefore exclude the first and the last 12 estimated cyclical components of all quarterly time series (Sørensen & Whitta-Jacobsen, 2010). We choose to use all estimated cyclical components in our analysis, but keep in mind that the end-points may give biased results.

Another critique of the procedure is that it is derived without any theoretical justification. The researcher needs to choose the value of the smoothing parameter λ, and the results are thus affected by this.[17] For this investigation $\lambda = 1600$, since it is the recommended value for quarterly data.

In addition, researchers have criticized the assumption that upturns and downturns evens out in the long run. This means that positive and negative deviations are given the same weight, an assumption that is not necessarily true. A last critique of the filter is that it is poor in handling long cycles. A cyclical downturn which is longer than normal will result in negative adjustment of the trend growth. The success of the HP filter is thus dependent on how long the cycles are assumed to last.

Comparison of filters

In order to compare the results produced by the two filtering methods presented above, we compute correlation analysis between the same cycles computed with the CF filter and the HP filter (table 1).

[17] See for example Giorno *et al*. (1995) for more on this issue.

TABLE 1: CORRELATIONS BETWEEN CF AND HP FILTERS						
Austria	**Belgium**	**Cyprus**	**Finland**	**France**	**Germany**	**Greece**
0,624***	0,792***	0,724***	0,688***	0,736***	0,856***	0,720***
Ireland	**Italy**	**Luxembourg**	**Malta**	**Netherlands**	**Portugal**	**Slovakia**
0,700***	0,863***	0,744***	0,738***	0,683***	0,556***	0,663***
Slovenia	**Spain**	**Denmark**	**Sweden**	**UK**		
0,798***	0,797***	0,790***	0,274*	0,193*		

† p <0.1 * p < .05 ** p < .01 *** p < .001

The filters are significantly and positively correlated for all countries, however the correlation coefficient is relatively low for Sweden and the UK. Nevertheless, we proceed, as planned, with the CF filter when calculating the dependent variable. Graphs of the business cycles obtained with the HP filter and the CF filter are to be found in appendix 2.

6.3 Quantitative study

Our quantitative study aims to detect whether fiscal policy convergence is a determinant of business cycle synchronization. We use a panel data set of 19 countries from the years 1980-2010, implying that we include more recent data than earlier studies in this area. The panel data set combines time-series and cross-sectional data. This increases our sample size, and it gives us the opportunity to analyze both the time variation and the cross-country variation in our data. All variables in our analyses are defined as bilateral relationships over three periods: 1980-1990, 1991-1999, and 2000-2010. The dividing of time periods is done in order to capture a pre-Maastricht convergence period, a post-Maastricht pre-euro period, and a post-euro period. The most interesting split is between 1999 and 2000 because the euro was introduced in 1999. The splitting up of periods takes into account that sub-samples of smaller size than eight years are indeed less likely to capture a full business cycle (Böwer & Guillemineau, 2006) because the business cycles in several European countries seem to last up to eight years (Agresti & Mojon, 2001). Consequently, we are left with a maximum sample size of 513 observations [(19x18)/2)x3 periods]. In practice, the dataset has many gaps because of lacking data.

6.3.1 Empirical framework

Our general empirical framework follows that of Frankel and Rose (1998) who focused on the endogeneity of business cycle synchronization with respect to trade. We want to test whether more convergent fiscal policy causes more synchronized business cycles in the euro area. In theory, the relationship may be two-ways (Darvas, Rose, & Szapáry, 2007). On the one hand, fiscal policy divergence may be a response to asymmetric shocks, and thus may lead to more synchronized business cycles because fiscal policies then smooth economic fluctuations. On the other hand, fiscal policy may cause shocks. If this is the case, fiscal policy divergence leads to less synchronized business cycles. A last possibility is that there is no coherence between fiscal policy convergence and business cycle synchronization. The question is empirical, and we want to test it on data.

The benchmark regressions we estimate take the form:

$$\textbf{\textit{Business cycle synchronization}}_{ijt} = \beta_0 + \beta_1 \textbf{\textit{fiscal policy divergence}}_{ijt} + \varepsilon_{ijt},$$

where *business cycle synchronization*$_{ijt}$ is the correlation of business cycles between country *i* and *j* in period t, *fiscal policy divergence* is a measure of divergence of fiscal policies between country *i* and *j* in period t, and ε_{ijt} is assumed to be independent identically-distributed. The object of interest is the slope coefficient β_1. A negative estimate of β_1 indicates that an increase in fiscal divergence is associated with reduced business cycle coherence, meaning that an increase in fiscal convergence is associated with increased business cycle coherence.

6.3.2 Dependent variable

Various methods have been proposed in the literature to investigate the issue of business cycle synchronization. Business cycles are synchronized if their turning points occur at either roughly the same points in time or differ by intervals that are roughly constant, meaning that the turning points "cluster together". One possible approach is to look at the evolution of the standard deviation of EMU countries' business cycles over time (Gayer 2007). Due to this measure's scale-dependency, it is poorly suited to measure the genuine synchronization dimension of business cycle convergence. Other measures, such as dynamic correlation, phase-adjusted

correlation, and a concordance index, have also been proposed (Haan, Inklaar and Jong-A-Pin 2008). This thesis uses bilateral Pearson correlation coefficients between the cycles of countries *i* and *j* in the period *t*. The use of a correlation coefficient as the dependent variable in models examining the determinants of business cycle synchronization may lead to complications because the dependent variable lies between −1 and 1. Thus, the error terms in a regression model of the determinants of business cycle synchronization are likely not to be normally distributed. Evidence presented by Otto *et al.* (2001) suggests that it is necessary to transform the dependent variable. Consequently, as in Artis, Fidrmuc and Scharler (2008), we use Fisher's transformation of the standard correlation coefficient: ½ ln $[(1+\rho_{ijt}) / (1-\rho_{ijt}]$, where ln is the natural logarithm and ρ_{ijt} is the Pearson correlation coefficient between two countries in period *t*. If the observations used to calculate the Pearson correlation coefficient has a bivariate normal distribution, then Fisher's transformation is approximately normally distributed.[18]

A statistical issue is how to judge the change in co-movement between cycles over time. One approach is to use rolling windows as in Massmann and Mitchell (2004). This method has some drawbacks because of an assumption of a monotone development of correlations over time (Haan, Inklaar and Jong-A-Pin 2008). The simplest solution is to compare correlations in two periods, or for multiple periods as in Inklaar and De Haan (2001). Accordingly, this thesis will compare correlations over the three periods 1980-1990, 1991-1999, and 2000-2010, as presented in chapter 6.3.

6.3.3 Independent variables

We have four independent variables measuring fiscal policy divergence. The independent variables are derived from the EDP in the SGP. Firstly, we distinguish between structural and cyclical deficit based on an OECD method for calculating the cyclical components.[19] Secondly, we distinguish between primary

[18] Appendix 3 presents frequency distributions of the correlation coefficient and the transformed correlation coefficient, confirming that the transformed correlation coefficient is closer to be normally distributed.

[19] An explanation of the method used to derive cyclical adjustments of budget balances is provided in Appendix 4.

deficit and interest payments.[20] Data on the countries' budget balances is gathered from the Annual Macro-Economic (AMECO) database of the European Commission's Directorate General for Economic and Financial Affairs (DG ECFIN).

The first independent variable is divergence of *cyclically adjusted deficit*, also called the structural deficit. The structural deficit, here the cyclically adjusted budget balance, gives the value of GDP when cyclical components are removed. In this thesis this is a measure of the fiscal stance taken by the policy maker, or discretionary fiscal policy, and is therefore said to make out a structural component. Structural deficit divergence will be measured between country *i* and country *j* during sub-period *t* as differences in structural deficit, as in Darvas, Rose and Szapáry (2007).

$$\textbf{Structural deficit divergence}_{ijt} \equiv 1/t^{*}\sum(|\textbf{structural deficit}_{it} - \textbf{structural deficit}_{jt}|)$$

The second independent variable is divergence of *cyclical deficit*. The cyclical deficit consists of cyclical components of revenue and expenditure, variations explained by business cycle fluctuations in unemployment and the tax bases. In this thesis this is a measure of automatic fiscal stabilizers. The cyclical deficit will be measured between country *i* and country *j* during sub-period *t* as differences in cyclical deficit:

$$\textbf{Cyclical deficit divergence}_{ijt} \equiv 1/t^{*}\sum(|\textbf{cyclical deficit}_{it} - \textbf{cyclical deficit}_{jt}|)$$

The third independent variable is divergence of *primary deficit.* The primary deficit measured by the EDP is the budget deficit excluding interest payments, and thus makes a measure of the national deficit without the impact of accumulated debt. In this thesis this is seen as a measure of general fiscal policies. Primary deficit divergence will be measured between country *i* and country *j* during sub-period *t* as differences in primary deficit.

$$\textbf{Primary deficit divergence}_{ijt} \equiv 1/t^{*}\sum(|\textbf{primary deficit}_{it} - \textbf{primary deficit}_{jt}|)$$

[20] Appendix 5 provides Eurostat's guidelines for the measurement of the two SGP-criteria, and measurement of interest payments.

The fourth variable is divergence of *interest payments.* Data on interest payments is obtained by deducting the primary deficit from the general government deficit under the EDP. In this thesis, interest payments are used as a proxy of accumulated debt under the assumption that interest remains constant.[21] Interest payments divergence will be measured between country *i* and country *j* during sub-period *t* as differences in interest payments.

$$\textbf{Interest payments divergence}_{ijt} \equiv 1/t^* \sum(|\textbf{Interests}_{it} - \textbf{Interests}_{jt}|)$$

Data used to compute the independent variables is expressed as percentage of GDP. A larger value of the variables means a higher average divergence between the fiscal positions of the two member states. Thus, we expect a negative effect of the independent variables on the dependent variable. We will use the averages in the three subperiods 1980-1990, 1991-1999, and 2000-2010.

6.3.4 Control variables

We include several control variables in our analysis. These are variables that in previous studies have been seen as important determinants of business cycle synchronization. As our sample principally consists of EMU countries, we do not add *monetary integration* as a control variable in our analysis.[22]

Trade intensity

The first control variable is bilateral trade in goods. Bilateral trade is measured as bilateral trade intensity. We will use international trade data from the IMF database Direction of Trade. All data is provided in millions of US dollars. IMF follows UN guidelines when defining what constitute imports and exports: Imports shall be valued at the cost, insurance, freight transaction value at the frontier of the importing country, and export shall be valued at the free on board transaction value at the frontier of the exporting country (ESDS International, 2011). However, diversity exists among countries in valuation and definitions used, and in methods of obtaining value information. As in Frankel and Rose (1998), we will measure bilateral trade intensity between countries *i* and *j* at point

[21] A possible bias in our results is that interest payments are influenced by a variable interest.
[22] Including monetary integration as a control variable could create variation over time, but limited cross-country variation.

t in time. The bilateral trade intensities are normalized by total trade data[23] for countries *i* and *j*, and measure how connected in trade a country is to one country relative to another country:

$$\textbf{Trade intensity}_{ijt} = (X_{ijt} + M_{ijt}) / (X_{it} + X_{jt} + M_{it} + M_{jt}).$$

X_{ijt} denotes export from country *i* to *j* in period *t*, M_{ijt} denotes import from country *j* to *i* in sub-period *t.* X_{it} and X_{jt} denotes total export for respectively country *i* and *j* in sub-period *t*. M_{it} and M_{jt} denotes total import for respectively country *i* and *j* in sub-period *t.* Measuring the bilateral trade, we will use the average of the two-way exports between a country pair to reduce possible problems with under-reported intra-EU imports and over-reported intra-EU exports due to VAT fraud (Baldwin, Frankel, & Melitz, 2006). One should expect a positive effect of Trade $intensity_{ijt}$ on business cycle synchronization.

Industrial similarity

The second control variable is industrial similarity. There are no standard measures of similarity in industry specialization. Imbs (2001) uses a correlation coefficient between sectoral shares in aggregate output or employment, whereas Krugman (1991) and Clark and Wincoop (2001) use a variable akin to the Herfindahl index of concentration. In this thesis, we employ the methodology of Imbs (2004). Sectoral real value added is used to compute

$$\textbf{Industrial similiarity}_{ijt} = 1/T \sum_{t} \sum_{n}^{N} \left| Is_{ni} - Is_{nj} \right|,$$

where Is_{ni} denotes the GDP share of industry *n* in country *i,* and s_{nj} denotes the GDP share of industry *n* in country *j.* Industrial $similarity_{ijt}$ is the time average of the discrepancies in the economic structures of countries *i* and *j* in sub-period *t.* Consequently, the value of Industrial $similarity_{ijt}$ reaches its maximal value for two countries with no sector in common. One should therefore expect a negative effect of Industrial $similarity_{ijt}$ on business cycle correlation.

We employ the STAN indicators 2009 from the OECD Structural Analysis Statistics (STAN) Database. The database does not have data for Cyprus and Malta. The sectors utilized in the composition of the variable are: (1) agriculture,

[23] One alternative is to normalize bilateral trade intensity by GDP. This measures how connected in trade two countries are relative to their specific economies. In this paper we choose to normalize by total trade to exclude other components of the economies.

hunting, forestry and fishing, (2) mining and quarrying, (3) manufacturing, (4) electricity, gas and water supply, (5) construction, (6) wholesale and retail trade – restaurants and hotels, (7) transport, storage and communications, (8) finance, insurance, real estate and business services, and (9) community, social and personal services.

Financial integration

The Frankel and Rose empirical framework for measuring bilateral trade has been applied to measure financial bilateral integration (Imbs J. , 2006). Due to much difficulty measuring effective financial integration, partly caused by lack of relevant data, researchers have used different proxies, such as balance of payments and risk sharing. To capture a measure of financial integration, we will use Imbs (2004) categorization of proxies. He distinguishes between two proxies; the first proxy concerns restrictions on capital flows, and the other proxy concerns effective financial flows.

To measure *restrictions on capital flows* (capital controls), we follow Miniane's (2004) empirical framework (appendix 6). Miniane measures restrictions on capital accounts by using information provided from the IMF in the Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). We use 14 capital controls, and the controls are given a value of 1 if they exist, and 0 if they do not exist. The capital controls are summed for each country each year, and the calculations make out a restriction index. The restriction indices are then summed pair wise, and report the average number of countries with restrictions to financial flows, for each country pair over period *t* (Imbs J. , 2006). Miniane provides data from 1983 to 2000 on the 14 of the countries in our analysis[24]. Based on Miniane's methodology we extend the dataset in terms of countries and years. We extend the dataset to the year 2008, which is the latest year with available data. We also provide data on the remaining countries Cyprus, Ireland, Malta, Slovak Republic and Slovenia. Due to lack of time, the data series on these countries start respectively in 1994, 1993, 1995, 1995 and 1995. Data for Luxembourg exists from 1996. We expect a negative effect of capital controls on business cycle synchronization.

[24] Austria, Belgium, Finland, France, Germany, Greece, Italy, Luxembourg, Netherlands, Portugal, Spain, Denmark, Sweden, and the UK

To measure *effective financial flows* Imbs (2004) uses data on bilateral holdings. This is provided by IMF in the Coordinated Portfolio Investment Survey (CPIS). The available data is from 2001-2009, meaning that we only have available data for the last period in our analysis. This makes it impossible to conduct fixed effects analyses. Consequently, we only use capital controls as a proxy for financial integration in this thesis. This may constitute a weakness in the measure of financial integration.

Table 2 summarizes the variables in our analysis:

TABLE 2: SUMMARY OF VARIABLES

Concept:	Operationalization:	Source of data:	Expected value of parameter:
Business cycle synchronization (dependent variable)	Phillips transformation of correlation coefficient, CF filtered quarterly GDP data	Eurostat	
Structural deficit divergence	Divergence of cyclically adjusted (structural component) budget position	AMECO	Negative
Cyclical deficit divergence	Divergence of cyclical component of budget position	AMECO	Negative
Primary deficit divergence	Divergence of primary deficit	AMECO	Negative
Interest payments divergence	Divergence of interest payments	AMECO	Negative
Trade intensity	Bilateral trade intensity	IMF Direction of Trade Database	Positive
Industrial similarity	Sectoral real value added	OECD Structural Analysis Statistics Database	Negative
Financial integration	Capital account restrictions	IMF's Annual Report on Exchange Arrangements and Exchange Restrictions	Negative

6.4 Econometric issues

Our model may suffer from endogeneity bias, which occurs when the independent variable is correlated with the error term in a regression model (Wooldridge, 2009). Roughly speaking, a loop of causality between the independent and the dependent variables of a model leads to endogeneity. In our model, fiscal policy may be endogenous because politicians change their policies in response to the business cycle. This implies that the regression coefficient in a simple OLS regression is biased. Endogeneity may be caused by various sources, the most important being measurement error, omitted variables, and simultaneity.

The *measurement error problem* can be viewed as a data problem: we cannot obtain direct data on the variables of interest. If one uses an imprecise measure of an economic variable in a regression model, then our model contains measurement error (Wooldridge, 2009). In our model, an important econometric problem results from the fact that we do not observe the true cross-country business cycle correlation, Y_{ij}, but instead must use estimated correlations, $\hat{Y}_{ij,}$ which may contain measurement error (Baxter & Kouparitsas, 2005). Additionally, the dependent variable may contain measurement error due to weaknesses of the filter used to obtain the business cycles. If the measurement error in the dependent variable is correlated with the independent variables, then OLS estimation could be biased. Our model could also suffer from measurement error in the independent variables due to imprecise measure of fiscal convergence. There may be non-trivial measurement error in fiscal divergence (especially since measuring the general government budget position itself seems difficult).

If we omit a variable that actually belongs in the true model, our model may suffer from *omitted variable bias*. If an explanatory variable is correlated with an omitted variable this will lead to bias. The amount of the bias depends on the size of the omitted variable's coefficient and the correlation among the explanatory variables and between the explanatory variables and the omitted variable (Wooldridge, 2009). This is likely to be the case in our model as there is likely to be heterogeneity influencing bilateral business cycle correlation that is not explained by our independent variables.

Simultaneity arises when one or more of the explanatory variables are jointly determined with the dependent variable (Wooldridge, 2009). When x is partly determined by y, x is generally also correlated with the error term, so simultaneity meets the definition of endogeneity. Simultaneity is a potential worry in our model. For example, for some exogenous reason a high-deficit country decides to engage in long-term fiscal consolidation. If this leads to a recession, *ceteris paribus,* we might expect fiscal convergence to coincide with lower business cycle synchronization, at least over a short period of time. Alternatively, if a high-deficit country decides to engage in fiscal consolidation and convergence simultaneously the effect goes the opposite way (Darvas, Rose, & Szapáry, 2007).

In sum, our model may suffer from endogeneity bias caused by measurement error, omitted variables and simultaneity. One possible method used to reduce endogeneity problems is to use instrumental variable (IV) techniques. However, this is not necessarily advisable, especially since finding applicable instrument is a challenge. Rodrick (2000) points out that for an instrument to be valid, it is not enough that it be exogenous and related to the endogenous explanatory variable (instrument relevance). It must also affect the outcome variable only through the variable instrumented and be uncorrelated with the omitted variables (instrument exogeneity). Failing to fulfill with the criteria of instrument exogeneity may lead to too large estimates due to a statistical association between the instrumental and omitted variables (which would be part of the error term). Thus, performing and IV analysis can result in a bias greater than that from OLS (Gruben, Koo, & Millis, 2002). Earlier researchers have employed both OLS and IV techniques when testing the affect of fiscal policy convergence on business cycle synchronization. Darvas, Rose and Szapáry (2007) find that the results from OLS and IV are consistent, and also show that the results are insensitive to the exact choice of instrumental variables. But the quantitative IV results are approximately four times larger.

Consequently, we aim to reduce bias caused by endogeneity in other ways than including instrumental variables. To make progress on the measurement error problem, we include different robustness checks. Additionally, we make an assumption about the specific form of the measurement error in specifying a fixed-effects model. By allowing for time-invariant fixed effects to our model, we

also partly eliminate the bias caused by omitted variables. However, since there will be a time varying residual in the error, the results may still be biased (Baldwin, Frankel, & Melitz, 2006). Therefore, we further mitigate the omitted variable bias by including the control variables in our model. These variables are variables related to the unobserved variables that we would like to control for in our analysis. This is called the plug-in solution to the omitted variables problem (Wooldridge, 2009).

6.5 Multivariate analyses

6.5.1 Pooled OLS estimates

We start the multivariate analyses by running a regression over all the data using simple ordinary least squares. Hence, we pool all the data together and do not make any distinction between cross section and time series. This type of regression is the most straightforward to run, but may also be subject to several sources of estimation bias, as discussed above. However, pooled OLS is often used as a simple benchmark to which more sophisticated models can be compared.

Hypotheses H1 through H4 are tested in two equations in the OLS model:

(1) $\mathbf{Y_{ijt} = \beta_0 + \beta_1 Structural\ deficit\ divergence_{ijt} + \beta_2 Cyclical\ deficit\ divergence_{ijt} + \beta_3 Z + \varepsilon_{ijt}}$,

(2) $\mathbf{Y_{ijt} = \beta_0 + \beta_1 Primary\ deficit\ divergence_{ijt} + \beta_2 Interest\ payments\ divergence_{ijt} + \beta_3 Z + \varepsilon_{ijt}}$,

where Y_{ijt} is the transformed correlation coefficient between country *i* and *j* in period *t*, Z is a vector of the different control variables, and ε_{ijt} is the error term.

6.5.2 Basic Linear Unobserved Effects Model

OLS assumes no individual heterogeneity. Employing panel data, however, allows us to consider more flexible models than the simple pooled OLS model. In particular, we can employ the fixed effects (FE) or the random effects (RE) model, where we assume that the constant term for bilateral relationships differs. We can write this as

$y_{ijt} = \beta_0 + \beta_1 x_{ijt} + a_{ij} + e_{ijt}$,

where $\varepsilon_{ijt} = a_{ij} + e_{ijt.}$ Each a_{ij} is then a separate constant associated with a different bilateral relationship. We would like to hold a_{ij} constant when obtaining partial effects of the observable explanatory variables. This means that the actual constant term for each bilateral relationship is equal to $\beta_0 + a_{ij}$ or, if omitting β_0 from the model, just $a_{ij.}$ The assumption that a_{ij} is constant over time, and has a constant partial effect over time, is crucial to the following analysis (Wooldridge, 2010). The FE model treats a_{ij} as a variable that is partially correlated with the observed regressors. The RE model treats a_{ij} as independently distributed of the regressors. The main question to ask when deciding which of the two methods to use is whether the unobserved heterogeneity is correlated in one or more of the explanatory variables (Wooldridge, 2010). If a_{ij} is uncorrelated with the explanatory variables, RE will be more efficient. Random effects assume that the entity's error term is not correlated with the predictors which allows for time-invariant variables to play a role as explanatory variables. If a_{ij} is correlated with the explanatory variables, RE will be biased but FE consistent. When using FE we assume that something within the individual may impact or bias the predictor or outcome variables and we need to control for this. FE removes the effect of those time-invariant characteristics from the predictor variables so we can assess the predictors' net effect. Running the Hausman test for the two OLS models gives us a chi square value of 78.1257, and 57.9787, respectively. The tests reject the hypothesis that the random effects model is best for our equations, thus, we continue with the fixed effects model.

6.5.3 The Fixed Effects Model

The *fixed effect model* is a method of estimating panel data equations that works by allowing each cross-sectional unit to have different intercept (Studenmund 2011). The model assists in controlling for unobserved heterogeneity between countries when this heterogeneity is constant over time and potentially correlated with independent variables. We remove this constant from the data by making a dummy variable for ((19*18)/2) - 1 = 170 country pairs to adjust for country-pair specific effects. By doing this, we allow each cross-country pair intercept to differ. In essence, we have N=170 parallel regression lines, and observations across time in each country vary around a base line level specific to that country (Studenmund, 2011).

While the fixed effects model takes account of time-invariant factors, observed or unobserved, it also has some drawbacks. Degrees of freedom tend to be relatively low due to the time-demeaning of the data (Studenmund, 2011), which generally reduces the efficiency of the parameter estimates. In addition, any substantive explanatory variables that do not vary across time in each unit will be perfectly collinear with the fixed effects, so we cannot include them in the model. The first drawback should not constitute a problem in our analysis due to the large amount of observations. The second drawback, however, implies that we cannot investigate time-invariant causes of the dependent variables. Fixed-effects models are designed to study the causes of changes within an entity, in this case bilateral entities. A time-invariant characteristic cannot cause such a change, because it is constant for each entity.

Hypotheses H1 through H4 are tested in two equations in the FE model:

(3) $\mathbf{Y_{ijt} = \beta_0 + \beta_1 Structural\ deficit\ divergence_{ijt} + \beta_2 Cyclical\ deficit\ divergence_{ijt} + \beta_3 Z + \beta_4 A_{ij} + e_{ijt}}$

(4) $\mathbf{Y_{ijt} = \beta_0 + \beta_1 Primary\ deficit\ divergence_{ijt} + \beta_2 Interest\ divergence_{ijt} + \beta_3 Z + \beta_4 A_{ij} + e_{ijt}}$

where $Y_{ij\tau}$ is the transformed correlation coefficient between country *i* and *j* in period *t*, Z is a vector of different control variables, A_{ij} measures the country-pair-fixed effects, and e_{ijt} is the error term. Note that in models (1) and (2), $\varepsilon_{ijt} = A_{ij} + e_{ijt}$, implying that the original error term in the simple OLS estimation is now divided into two components: the country-pair specific effects and a new error term.

7. Results

7.1 Descriptive statistics

Table 3 presents the descriptive statistics of our data set.

TABLE 3: DESCRIPTIVE STATISTICS						
	Period	N	Minimum	Maxium	Mean	Standard Deviation
Correlation (CF)	1	36	-0,949	1,000	0,087	0,597
	2	136	-0,770	0,969	0,438	0,427
	3	171	0,301	0,983	0,748	0,168
	All	**343**	**-0,949**	**1,000**	**0,556**	**0,412**
Transformed correlation (CF)	1	35[25]	-1,822	3,800	0,113	1,019
	2	136	-1,020	2,076	0,585	0,603
	3	171	0,311	2,380	1,089	0,421
	All	**342**	**-1,822**	**3,800**	**0,786**	**0,667**
Structural deficit divergence	1	66	0,497	18,119	6,519	4,080
	2	171	0,469	10,649	3,327	2,075
	3	171	0,960	9,497	3,758	1,785
	All	**408**	**0,469**	**18,119**	**4,024**	**2,652**
Cyclical deficit divergence	1	66	0,022	2,267	0,866	0,520
	2	171	0,126	2,063	0,757	0,444
	3	171	0,287	1,628	0,793	0,272
	All	**408**	**0,022**	**2,267**	**0,790**	**0,397**
Primary deficit divergence	1	66	0,137	11,958	4,111	2,454
	2	171	0,522	12,032	3,868	2,503
	3	171	0,949	7,573	3,460	1,526
	All	**408**	**0,137**	**12,032**	**3,736**	**2,148**
Interest payments divergence	1	66	0,772	11,153	3,701	2,398
	2	171	0,100	10,091	2,811	2,244
	3	171	0,146	5,060	1,454	1,064
	All	**408**	**0,100**	**11,153**	**2,386**	**2,053**
Trade intensity	1	103	-0,066	0,421	0,264	0,106
	2	171	-0,091	0,423	0,269	0,101
	3	171	-0,019	0,425	0,287	0,089
	All	**445**	**-0,091**	**0,425**	**0,275**	**0,098**
Industrial similarity	1	105	9,625	42,981	23,514	6,905
	2	136	6,665	48,769	23,794	9,319
	3	136	7,765	56,538	26,180	11,105
	All	**377**	**6,665**	**56,538**	**24,577**	**9,493**
Capital controls	1	78	0,282	1,679	1,097	0,324
	2	171	0,077	1,710	0,659	0,364
	3	171	0,058	1,192	0,487	0,221
	All	**420**	**0,058**	**1,710**	**0,670**	**0,375**

[25] One of the correlation coefficients in period 1 has the value 1, and this value cannot be converted by the Fisher's transformation. Thus, the sample size of the transformed correlation coefficient in period 1 is 35.

Despite having a potential sample size of 513 observations, our real sample is smaller due to missing data in some of the variables, especially in the first period.

The dependent variable, *the transformed business cycle correlation coefficient,* has a total mean of 0.79. The mean has increased constantly during the three observed periods, implying an increase in average bilateral business cycle correlation over time. However, the standard deviation is high (0.67 for all periods). This implies that within a ± one standard deviation, we find bilateral relationships with values as low as 0.12 and as high as 1.46.

All the independent variables, measuring different levels of fiscal policy divergence, have relatively high standard deviations, implying dispersion in the observed values of divergence. The means have constantly decreased over the three periods (with the exception of cyclical component divergence and discretionary divergence between the second and the third period which show a small increase). This implies that the countries have become more similar in fiscal policies over time. Scatter plots of all the independent variables against the dependent variable over the three time periods and over the whole sample period as a whole are to be found in appendix 7. Overall, the scatter plots seem to support our hypotheses that the independent variables have a negative effect on the dependent variable.

7.2 Data screening

A problem of *multicollinearity* occurs when two or more explanatory variables in a multiple regression model are highly correlated. In this situation the coefficients estimates may change randomly in response to small changes in the data. We test for problems of multicollinearity by computing the correlation coefficients between the independent variables (table 4). None of the correlation coefficients exceed the value of 0.8, meaning that they should not create any problems (Studenmund, 2011). We also compute a 'Variance Inflation Factors' (VIF) test , which confirms no problems of multicollinearity in our data since none of the VIF value which exceeds the value 5 (Studenmund, 2011).

TABLE 4: CORRELATION BETWEEN INDEPENDENT VARIABLES				
	Structural deficit divergence	Cyclical deficit divergence	Primary deficit divergence	Interest payments divergence
Structural deficit divergence	1	-0,053	0,527	0,377
Cyclical deficit divergence	0,053	1	-0,3	-0,089
Primary deficit divergence	0,527	-0,03	1	0,107
Interest payments divergence	0,377	-0,089	0,107	1

The *homoscedasticity* assumption for multiple regression requires that the variance of the unobservable error is constant, $V(\varepsilon_j) = \sigma^2$ for all j (Wooldridge, 2009). Graphs of the residuals plots for all variables (appendix 8) show no sign of heteroscedasticity problems. We also compute the White test in order to test for generic heteroscedasticity. The test shows no sign of heteroscedasticity in the data set.

The assumption of no serial correlation states that the observations of the error term should be uncorrelated. We compute the Durbin-Watson *d* Test to test for this assumption. There is no single rule for which values indicate evidence of serial correlation, but values below 1 and above 3 are signs of a serial correlation problem. A value of 2 shows no correlation between the residuals.[26] Our test results may indicate the existence of autocorrelation, which is not surprising, as we deal with time series data. Nevertheless, it is important to note that residual autocorrelation is not so much a property of the data, as a symptom of an inadequate model (Cottrell & Lucchetti, 2011). Additionally, we would need longer time series in order to deal with this problem. Therefore, we choose not to do any transformation to resolve the autocorrelation problem. Instead, we include a lagged independent variable in one of our robustness checks. The existence of autocorrelation may constitute a weakness in our analysis.

[26] The results of Savin and White (1977) provide the critical values 1.651 (lower limits) and 1.817 (upper limits) for 150 observations and 6 regressors including the intercept for the 5% significance level. The Durbin-Watson *d* test gives a value of 1.452 for equation 1, and a value of 1.408 for equation 2. Since our test values are lower than the lower critical value, we reject the null hypothesis of no autocorrelation.

7.3 Multivariate analysis

The hypotheses are tested in equations 1 and 2 in the OLS model, and in equations 3 and 4 in the FE model (see chapter 6.5). The control variables have been entered stepwise as to investigate possible changes in the effect of each independent variable on the dependent variable and the model as a whole.

7.3.1 Pooled OLS estimation

TABLE 5a: POOLED OLS ESTIMATION EQUATION 1								
Variables								
Intercept	1.207***	(0.092	0.959***	(0.160)	0.776**	(0.279)	1.567***	(0.318)
Structural deficit divergence	-0.032**	(0.015)	-0.020	(0.016)	-0.019	(0.019)	-0.010	(0.018)
Cyclical deficit divergence	-0.325***	(0.091)	-0.318**	(0.093)	-0.334**	(0.105)	-0.381***	(0.102)
Trade intensity			0.715*	(0.382)	1.208†	(0.625)	0.189	(0.642)
Industrial similarity					0.001	(0.004)	-0.004	(0.004)
Capital controls							-0.668***	(0.144)
R^2	0.055		0.062		0.069		0.137	
Adjusted R^2	0.049		0.053		0.055		0.121	
F statistics	9.633***		7.155***		5.003***		8.617***	
Df (residual)	332		324		272		271	
N	335		328		277		277	
TABLE 5b: POOLED OLS ESTIMATION EQUATION 2								
Variables								
Intercept	1.043***	(0.075)	0.744***	(0.144)	0.554*	(0.279)	1.110***	(0.306)
Primary deficit divergence	-0.034*	(0.017)	-0.025	(0.018)	-0.016	(0.020)	0.005	(0.020)
Interest payments divergence	-0.044**	(0.019)	-0.043*	(0.020)	-0.047*	(0.021)	-0.039†	(0.021)
Trade intensity			0.924*	(0.386)	1.469*	(0.642)	0.740	(0.062)
Industrial similarity					0.000	(0.004)	-0.005	(0.004)
Capital controls							-0.601***	(0.152)
R^2	0.033		0.044		0.051		0.103	
Adjusted R^2	0.027		0.035		0.037		0.086	
F statistics	5.579**		4.962**		3.646**		6.215***	
Df (residual)	332		324		272		271	
N	335		328		277		277	

† p < .1 * p < .05 ** p < .01 *** p < .001

The pooled OLS estimation is used as a benchmark to which the fixed effects analysis is compared. Table 5a presents the results from the pooled OLS estimation for equation 1. The results show that *structural deficit divergence* is significantly and negatively correlated with business cycle synchronization only when no control variable is included. *Cyclical deficit divergence* is significantly and negatively correlated with business cycle synchronization in all equations. The coefficient of *trade intensity* is positive in all equations, as is in line with our expectations, however, only significant at a 5% significance level when no more control variable is included. The coefficient of *industrial similarity* changes between being positive and negative. The variable *capital controls* is significantly and negatively correlated with business cycle correlation.

Table 5b presents the results from the pooled OLS estimation for equation 2. *Primary deficit divergence* is significant and negative only when no control variable is included. *Interest divergence* is significantly and negatively correlated with business cycle synchronization, however, only at a significance level of 10% when all control variables are included. The coefficient of *trade intensity* is positive as is in line with our expectations, however, not significant when all control variables are included. *Industrial similarity* is not significantly correlated to the dependent variable, while the variable *capital controls* is significantly and negatively correlated to the dependent variable.

R^2 has a value of 5.5% in equation 1a, while adjusted R^2 is 4.9%, and these values increase when the control variables are added. For equation 2a the values are 3.3% and 2.7%, respectively. The low explanatory power of the models is not surprising as it most likely exist relevant variables that are not accounted for in the models. The FE regressions in tables 6a and 6b suggest that a large fraction on the unexplained variation is country-pair fixed.

7.3.2 Fixed effects estimation

TABLE 6a: FIXED EFFECTS ESTIMATION EQUATION 3								
Variables								
Intercept	1.1750***	(0.183)	-6.019***	(0.871)	-7.994***	(1.028)	-4.358***	(1.281)
Structural deficit divergence	-0.0416	(0.0273)	-0.007	(0.027)	0.008	(0.027)	0.052†	(0.027)
Cyclical deficit divergence	-0.243	(0.160)	-0.344*	(0.139)	-0.367*	(0.143)	-0.422**	(0.135)
Trade intensity			24.487***	(2.965)	29.178***	(3.326)	17.785***	(4.088)
Industrial similarity					-0.002	(0.014)	0.014	(0.014)
Capital controls							-1.111***	(0.257)
R^2	0.414		0.601		0.631		0.676	
Adjusted R^2	-0.208		0.152		0.257		0.342	
F statistics	0.666		1.339*		1.685**		2.024***	
N	335		328		277		277	
TABLE 6b: FIXED EFFECTS ESTIMATION EQUATION 4								
Variables								
Intercept	1.131***	(0.122)	-5.060***	(1.049)	-6.781***	(1.260)	-4.778***	(1.388)
Primary deficit divergence	-0.035	(0.030)	0.016	(0.020)	0.024	(0.0297559)	0.050†	(0.030)
Interest payments divergence	-0.176***	(0.035)	-0.079*	(0.037)	-0.081*	(0.039)	-0.046	(0.039)
Trade intensity			20.655***	(3.392)	25.721***	(3.805)	19.076***	(4.287)
Industrial similarity					-0.015	(0.0141865)	-0.001	(0.014)
Capital controls							-0.816**	(0.267)
R^2	0.492		0.595		0.624		0.648	
Adjusted R^2	-0.048		0.141		0.243		0.286	
F statistics	0.911		1.310*		1.638**		1.791***	
N	335		328		277		277	

† p < .1 * p < .05 ** p < .01 *** p < .001

The results from the fixed effects estimation are mostly in line with the results from the OLS estimation. However, the explanatory power of the models is now much higher. R^2 is 41.4% when no control variable is included in equation 3, while adjusted R^2 is -20.8%. For equation 4 the values are 49.2% and -4.8%, respectively. A negative adjusted R^2 indicates a poor model fit relative to the number of degrees of freedom (Wooldridge, 2009). Adjusted R^2 increases when the control variables are added to the model, which indicates better model fit.

Table 6a presents the results from the fixed effects estimation for equation 3. The results show that the coefficient of *structural deficit divergence* changes between being positive and negative. The coefficient of *cyclical deficit divergence* is significant and negative for all equation, except when no control variable is included, as in line with our expectations. *Trade intensity* is, as expected, significantly and positively related to business cycle synchronization, *industrial similarity* is not significant in any equations, while the variable *capital controls* is significantly and negatively correlated with the dependent variable.

Table 6b presents the results from the fixed effects estimation for equation 4. The coefficient of *primary deficit divergence* alters between being positive and negative, and is never significant. *Interest payments divergence* is significantly and negatively correlated with business cycle synchronization except when all control variables are included. *Trade intensity* is significantly and positively related to business cycle synchronization, *industrial similarity* is not significant, while the variable *capital controls* is significantly and negatively correlated with the dependent variable.

7.3.3 Robustness checks

We explore the robustness of our findings to: a) differences in the entry order of control variables; b) sample selection; c) inclusion of other controls; and d) a different measure of the dependent variable. The performed robustness-check analyses are all fixed effects estimations.

Differences in the entry order of control variables

Changes in the entry order of the control variables do not change the general pattern in our finding. We have tried to include control variables in all possible

orders. Consequently, we have performed five additional analyses. The results from these can be found in tables 8-12 in appendix 9. The general pattern of the results is the same irrespective of the entry order of the control variables.

Sample selection

There are missing observations in the sample, and especially the first period is missing quite a lot of observations which may constitute a concern. To check the robustness of the variables we conduct a fixed effect analyses in which observations from the first period are deleted. The results can be found in table 13 in appendix 10, and do not differ considerably from the analysis based on all three periods.

Some of the observations are calculated based on means of yearly data. Several of these means are calculated without a fully complete data set. To check whether this may have caused bias in our estimations we perform a fixed effect analysis in which we delete observations based on means of data from fewer than three years. The results are to be found in table 14 in appendix 10, and the main results do not differ considerably from the analysis based on all available observations.

We exclude the three countries not sharing the euro as a common currency, namely Denmark, Sweden, and the UK. Doing this changes the results on the affect of cyclical deficit divergence on the dependent variable. Cyclical deficit divergence is now only negative and significant at a 10% level when all control variables are included in the analysis. It is difficult to interpret why this happens. However, the integration process is not uniform across Europe. European countries have joined the EU and the EMU at different points in time, and this seems to influence our results. Nevertheless, as the three non-euro countries are under the obligation of complying with regulations in the SGP, we choose to include these countries in our analysis. The results of the regressions excluding Denmark, Sweden, and the UK from the sample is to be found in table 15 in appendix 10.

Inclusion of other controls

In order to reduce possible bias caused by the fact that one or more independent variables may be correlated with an omitted variable that we have not accounted

for in the analysis, we include the value of the dependent variable from an earlier period as a control (Y_{t-1}). Using lagged dependent variables as proxy variables provides a simple way to account for historical factors that cause *current differences* in the dependent variable that are difficult to account for in other ways (Wooldridge, 2009). The lagged Y variable switches between having a positive and a negative value, and is overall not significance. This indicates that this variable might not belong in the model. The results of the regressions with the lagged Y variable are to be found in table 16 in appendix 11.

We also conduct a fixed effect analysis in which we include time dummies with period 1 as the reference period. The results show that the dummy variable for period 2 is significantly and positively related to business cycle synchronization when none or one control variable is included in equations 3 and 4. The dummy variable for period 3 is significantly and positively related to business cycle synchronization except when all control variables are included in equation 3. In addition, including the time dummies make most of the effects of the independent variables and the control variables disappear. This indicates that there exists an average change over time for all country pairs in which the country pairs become more similar when it comes to all our variables. The effects we have found may be claimed to be driven by common trends. The results of the fixed effect analysis with time dummies are to be found in table 17 in appendix 11.

Different measure of dependent variable

We conduct a fixed effects analysis in which we make use of the transformed business cycle correlation coefficient composed by the HP filter instead of the CF filter. The results are to be found in table 18 in appendix 12. The analysis yields basically the same results with respect to the sign of the coefficients, but now almost all coefficients become significant. Nevertheless, as we know the HP filter tends to give imprecise estimates of the trend at end-point series, and that we yet have used all estimated cyclical components in our analysis, we choose not to base our interpretation on the results obtained with the HP filter.

7.3.4 Summary of results

Hypothesis 1 stated that divergence of the structural deficit between two EMU countries has a negative effect on the synchronization of these countries' business

cycles. The variable *structural deficit divergence* is most often not significantly correlated with business cycle synchronization. In addition, the sign of its coefficient changes between being positive and negative. Hence, we find no support for hypothesis 1.

Hypothesis 2 stated that divergence of the cyclical deficit between two EMU countries has a negative effect on the synchronization of these countries' business cycles. The variable *cyclical deficit divergence* is significantly and negatively correlated with business cycle synchronization in most of our regressions. Thus, we claim to have found support for hypothesis 2.

Hypothesis 3 stated that divergence of the primary deficit between two EMU countries has a negative effect on the synchronization of these countries' business cycles. The variable *primary deficit divergence* is most often not significantly correlated with business cycle synchronization, and the sign of its coefficient changes between being positive and negative. Hence, we find no support for hypothesis 3.

Hypothesis 4 stated that divergence of interest payments between two EMU countries has a negative effect on the synchronization of these countries' business cycles. The variable *interest payments divergence* is significantly and negatively correlated with business cycle synchronization in most of our regression. Thus, we claim to have found support for hypothesis 4.

8. Discussion

In this study we have found that divergence of cyclical deficit between two countries decreases business cycle synchronization. Further, we have found that divergence of interest payments decreases the synchronization of bilateral business cycles. In other words, convergence of cyclical deficit and convergence of interest payments between two EMU countries increase business cycle synchronization. Surprisingly, neither convergence of structural deficit nor convergence of primary deficit is found to significantly explain business cycle synchronization. The latter findings contradict with a range of previous studies investigating the impact of fiscal policy convergence on business cycle synchronization.

8.1 Discussion of findings

The OCA theory states that collective monetary policy is most appropriate if business cycles are synchronised (chapter 2.2). As stated in our descriptive results, our analyses show an increase in bilateral business cycle correlation over time. These results support De Grauwe and Mongelli's (2005) argument on the endogenous effect of monetary integration on the synchronization of business cycles, namely that sharing a single currency set in motion forces bringing countries' economies closer together, as explained in chapter 4.3. Implicitly the OCA theory states that the business cycles should be synchronized *ex ante* in order for the currency union to be optimum. However, the OCA theory does not take into account endogenous forces that may increase the synchronization of business cycles *ex post*. Our findings support the existence of such forces.

Our results show that *convergence of structural deficit* does not significantly explain business cycle synchronization. Thus our findings imply that convergence of fiscal stances of the policymakers is not significant for bilateral business cycle correlation. Darvas, Rose and Szapáry's (2007) conclusion that convergence of structural deficit increases business cycle synchronization differs from our results. However, they examine the general government deficit as the structural deficit, while we examine the cyclically adjusted budget balance. On the other hand, Artis, Fidrmuc and Scharler (2008) find that convergence of the cyclically adjusted budget balance decreases business cycle synchronization, and thus their results differ from our results.

Our results support that *convergence of cyclical deficit* increases bilateral business cycle synchronization. In other words, countries with more similar cyclical components share more similar business cycles. In our data, the automatic fiscal stabilizers consist of personal tax income, social security contributions, corporate income tax, indirect taxes of national revenue, and unemployment related transfers (appendix 5). As explained in chapter 6.3.3, these components are due to variations in business cycle fluctuations in unemployment and tax bases. Van den Noord (2000) finds that automatic fiscal stabilizers smooth the cyclical volatility for individual nations in OECD, and Dullien (2007) finds the existence of sizeable automatic stabilizers in the EMU (chapter 4.2.2). Our results are interesting in relation to the studies of these authors as we find that automatic

fiscal stabilizers are also important to create more similar business cycles bilaterally in our sample.

Surprisingly, our results show that *convergence of primary deficit* is found not to significantly explain business cycle synchronization. Darvas, Rose and Szapáry (2007) use the primary deficit to be a measure that captures discretionary fiscal policy. They examine if convergence of the primary deficit increases business cycle synchronization, and their results are in contrast to our findings. Darvas, Rose and Szapáry (2007) find that bilateral convergence of the primary deficit has increased business cycle synchronization (chapter 4.2.4).

Our findings support that *convergence of interest payments* increases the synchronization of bilateral business cycles. This means that similar interest payments will increase business cycle synchronization. This is interesting as interest payments are considered to be a part of discretionary policy, which we find not to be significantly related to business cycle synchronization. However, according to Hattenhouer (2000) in Gianviti *et al.* (2010), the main asset of a sovereign debtor is its power and capacity to tax. This is interesting as we find convergence of taxes in the form of automatic fiscal stabilizers to be significant.

The control variables *trade intensity* and *capital controls* are found to be significantly related to business cycle synchronization, and *industrial similarity* is found not to be significant. Our findings on *trade intensity* are in line with Frankel and Rose (1998) who find that closer international trade links result in more correlated business cycles across nations (chapter 4.3.1). Our findings on trade intensity are also supported by Baxter and Kouparitsas (2005) who find that bilateral trade has an independent role in transmitting business cycles, and Imbs (2004) who verifies the overall positive impact of trade on business cycle synchronization (chapter 4.3.1). Our results support the argument that intra-industry trade accounts for most trade, and thus that more bilateral trade increases the bilateral synchronization of business cycles.

Our findings on *industrial similarity* are coherent with Baxter and Kouparitsas' (2005) findings that industrial structure is not a robust determinant of business cycle synchronization. This is not coherent with the findings of Imbs (2004),

neither the findings of Calderón, Chong and Stein (2007), nor the ones of Haan, Inklaar and Jong-A-Pin (2008), who find that industrial similarity affects business cycle correlation. Our results do not support the view that two economies producing the same types of goods or services will be subjected to similar economic developments.

Our findings that *financial integration* increases business cycle synchronization, support the conclusion of Kalemli-Ozcan, Sørensen and Yosha (2001), Kose, Otrok and Whiteman (2003), and Imbs (2004). It is interesting to note that we obtain the same results as previous studies when we only use capital control to obtain a measure of financial integration. Our results support the argument that financial linkages could result in a higher degree of business cycle synchronization due to demand side effects or contagion effects. However, we cannot conclude on which of these effects that are driving the increased synchronization of business cycles.

It is important to note that when time dummies are included in our analysis, most of the effects of the independent variables and the control variables on business cycle synchronization disappear. This indicates the existence of an average change over time, in which the country pairs become more similar when it comes to all our variables. This is supported by looking at the descriptive statistics. The countries have become more similar in fiscal policies over time, and the value of the dependent variable has increased constantly during the three periods observed. This means that the effects we have found may be driven by common trends. Therefore, we should be careful with putting forward strongly held views on the importance of our conclusions. There might be a need for an analysis including data from more years in the future.

8.2 Implications for EMU policy

Our results hold implications for fiscal policy guidelines for EMU countries. Further fiscal reforms should try to better align the countries' fiscal positions in order to create a more uniform business cycle across the union, and by this provide for EMU to be an optimum currency area.

Mundell (1961, p. 661) predicted the need for "a profound political change" to make countries give up their national currencies for a regional currency and a common monetary policy. According to our results, there is a need for a more profound political change that includes aligning the EMU members' automatic fiscal stabilizers. As automatic fiscal stabilizers are income taxes and unemployment insurances the cyclical components are an expression of the welfare system. Today, the welfare system is governed at a national level, and is such a symbol of national sovereignty. Matthew Lynn (2011) points out that the economies that have joined the EMU have vastly different characteristics when it comes to welfare systems. In his view, this makes EMU economically unsustainable. Linking this to our results, the profound political change should include automatic stabilizers. This calls for a deeper fiscal union within the monetary union. It is not a purpose of this thesis to recommend the design of such a fiscal union, but our study on automatic fiscal stabilizers suggests that EU policy makers should pay special attention to the tax systems and the unemployment schemes of the member states.

The EMU has in recent years increased its focus on debt. This is not surprising as sovereign debt trends suggest that the debt-to-GDP ratio has been increasing at a non-sustainable level for several member states. According to our findings, accrual of debt should be of concern to business cycle synchronization. Dullien (2007) stresses that several member states accrued debt in order to meet the Maastricht criteria. Hence, debt became a stabilization cost for the monetary union. Our finding that convergence of *interest payments* tends to increase business cycle synchronization across EMU member states is interesting taking into account that convergence of *cyclical deficit* is also found to significantly increase business cycle synchronization. This links the two convergence criteria of Maastricht. Further on, cyclical deficit and interest payments can be argued to be extensions of the tax variables and debt variables in the Ricardian equivalence theorem, and the extensions stress the relevance of taxes and debt for bilateral business cycle synchronization. Hattenhouer (2000) in Gianviti *et al.* (2010) also links the two variables, stating that sovereign debtor's most important asset is its power and the capability to tax. Linking our finding to Gali and Perotti's (2003) argument, that interest payments are a result of earlier fiscal stances, the SGP should have an increased focus on the debt criterion. The EU has already

augmented its focus on this criterion by a new focus on member states' ability to pay the interest rates. This is evident in the reformed SGP in which a benchmark for sufficiently diminishing debt ratio is included.

9. Conclusion

Our research question asks if fiscal policy convergence between two EMU countries affect the synchronization of these countries' business cycles. Through our distinction of fiscal policy measures, we have found that bilateral convergence of automatic fiscal stabilizers and bilateral convergence of accumulated government debt increase business cycle synchronization in the EMU. The Maastricht fiscal criteria and the SGP have no direct relation to the OCA criteria of synchronized business cycles as the aim of the SGP is to provide a fiscal framework for nations to uphold domestic price stability in order to meet the monetary policy set by ECB. Our results suggest that if the Maastricht criteria and the SGP induce fiscal policy convergence with respect to automatic fiscal stabilizers and accumulated government debt, they indirectly enhance the stability and sustainability of EMU by increasing business cycle synchronization. The pattern in our data suggest that if EU policy makers allow fiscal policy to work as endogenous forces towards making the EMU an optimum currency area, fiscal policy may be better off coordinated at a supranational level and not decided upon at the domestic level, as postulated in Mundell's assignment rule. Moreover, at a supranational level, another available interpretation of our results suggest that the OCA theory is too static as it does not take into account endogenous forces that might change the economic situation in individual EMU member states *ex post* the introduction of a common currency. More generally, our results relate to the Lucas critique. In particular our results suggest that policy changes related to the automatic fiscal stabilizers and debt dynamics of countries lead to changes in macroeconomic parameters.

10. Final comments

This study is a quantitative study, and the findings should in principle be transferable to other monetary unions. However, there only exist two monetary unions in the world today, namely the euro in Economic and Monetary Union of the European Union and the dollar in the federal United States of America. The EMU is special because it exists of sovereign national states, while the USA is

one federation. This, in addition to the fact that our sample only consists of European countries, may make the transferability of our results limited.

While working with our thesis, we have become aware of themes connected to this thesis that constitute interesting areas of research in the future. We have excluded potential new EMU member states from Central and Eastern Europe. It would be interesting to verify whether the alleged endogenous effects work *ex ante* to create a more uniform European business cycle when these countries become members of the EMU and more data is available. It would also be interesting to include non-European countries in the sample to investigate if our results are exclusively characteristic for Europe. Finally, it is worth noticing that the EMU is still a young monetary union, formed only a decade ago, and it would be interesting to redo the analysis in the future when more data will be available.

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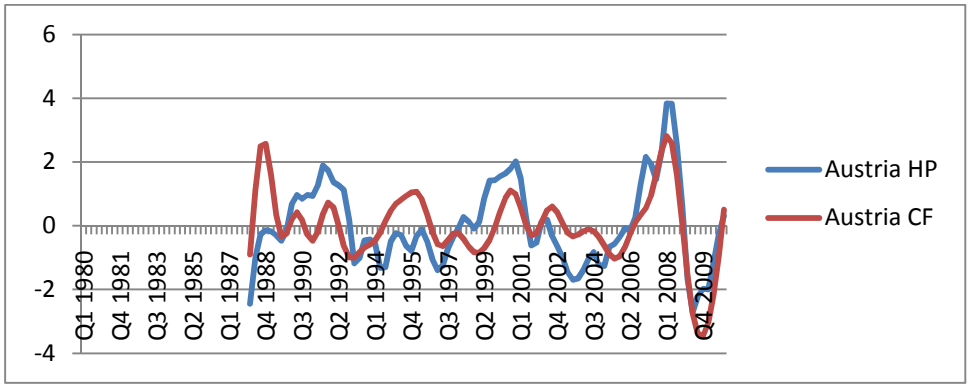
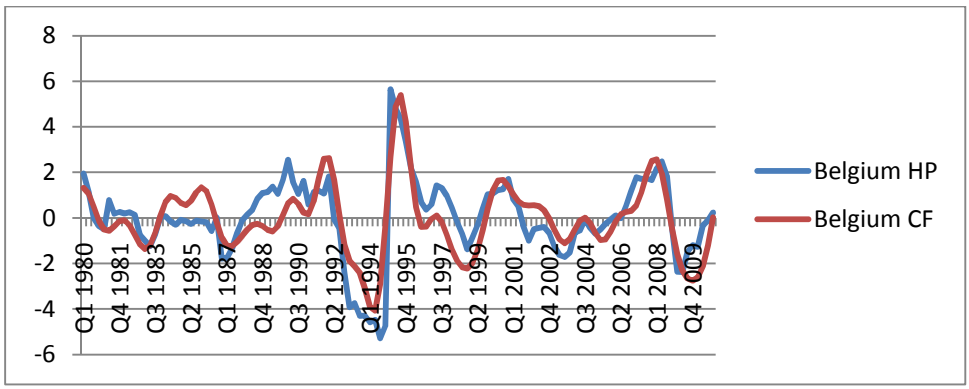
Appendix 1: Distribution of articles from the qualitative study

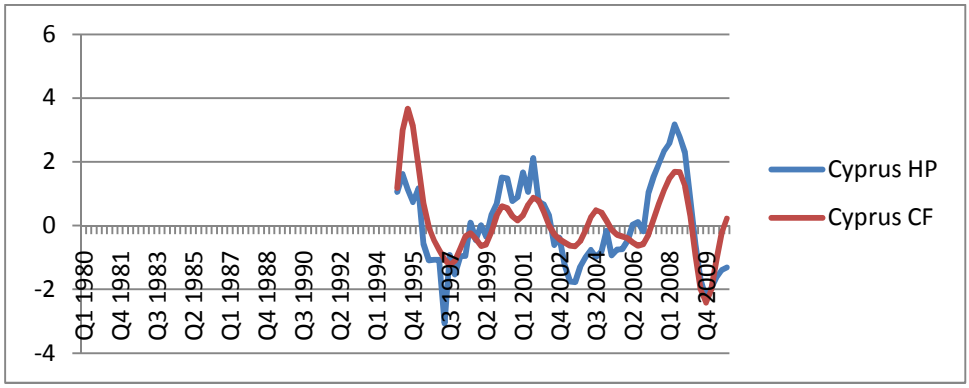
TABLE 7: DISTRIBUTION OF ARTICLES REVISED IN QUALITATIVE PREPARATORY STUDY

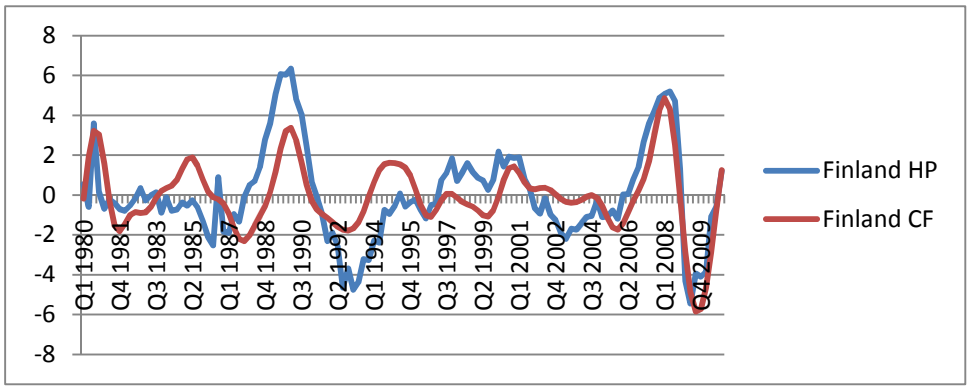
Journal/year:	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
European Union Politics	-	-	-	-	-	-	-	-	-	-	-	-	4	1	2	-	3	-	-	-	2
International Organization	-	2	1	1	-	1	-	1	5	-	2	-	9	1	1	-	1	-	-	-	-
Journal of European Policy	-	-	-	-	-	-	-	-	-	2	2	-	2	4	11	1	1	-	1	9	-
Journal of Common Market Studies	2	4	1	3	2	4	3	3	1	7	13	9	7	17	20	15	18	7	4	19	-

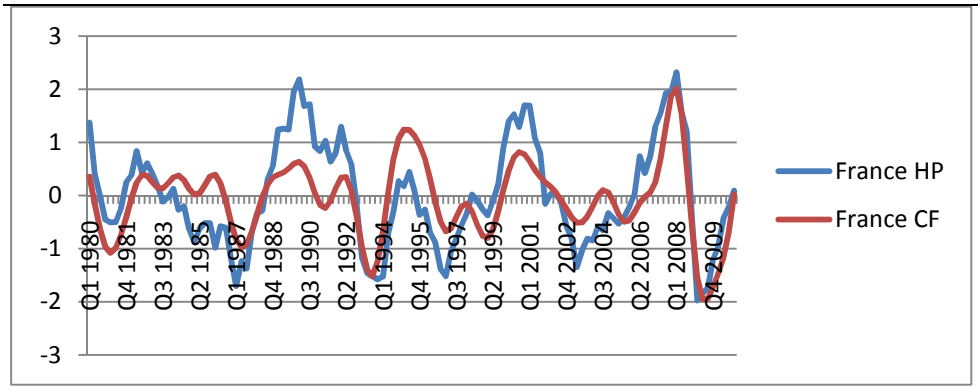
Appendix 2: Graphs business cycles: the HP versus the CF filter







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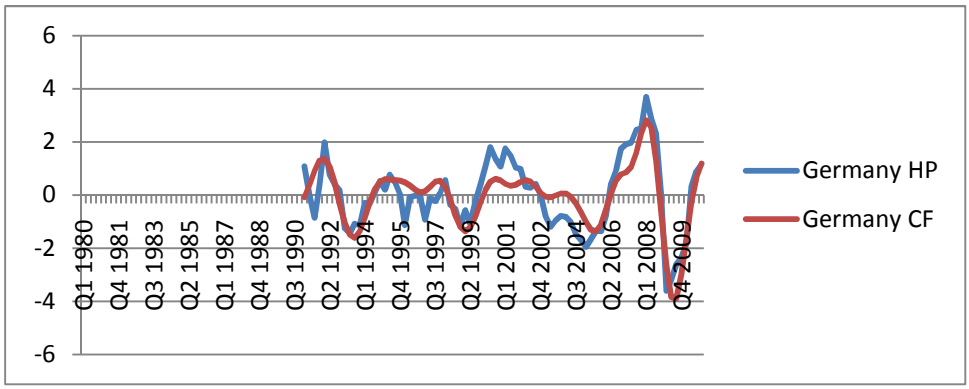
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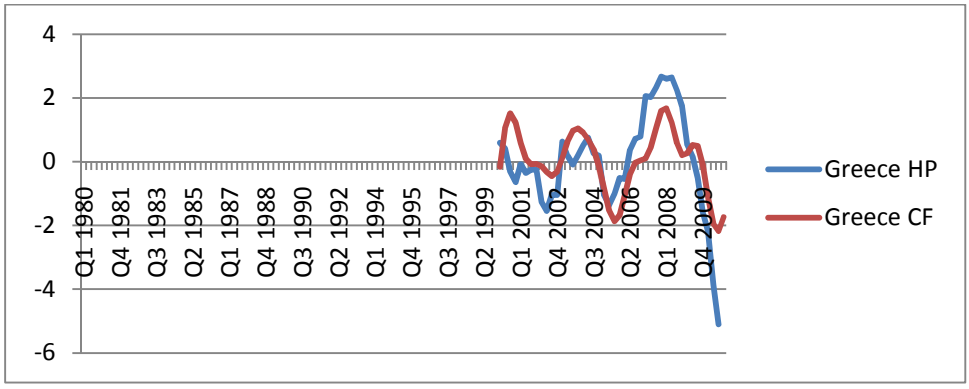
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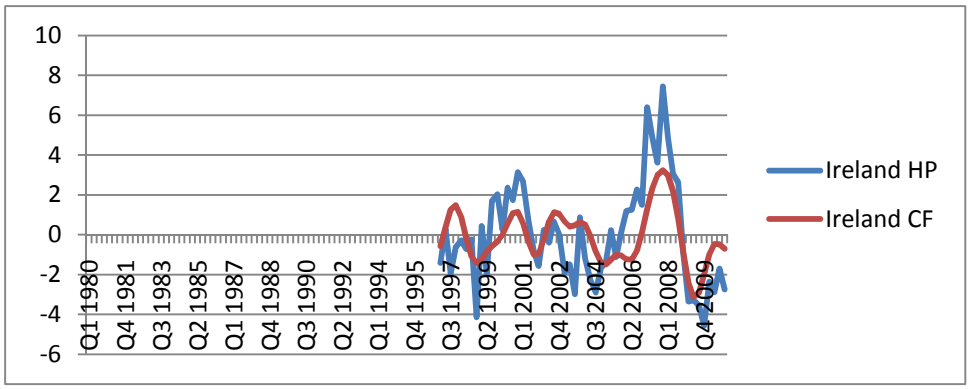
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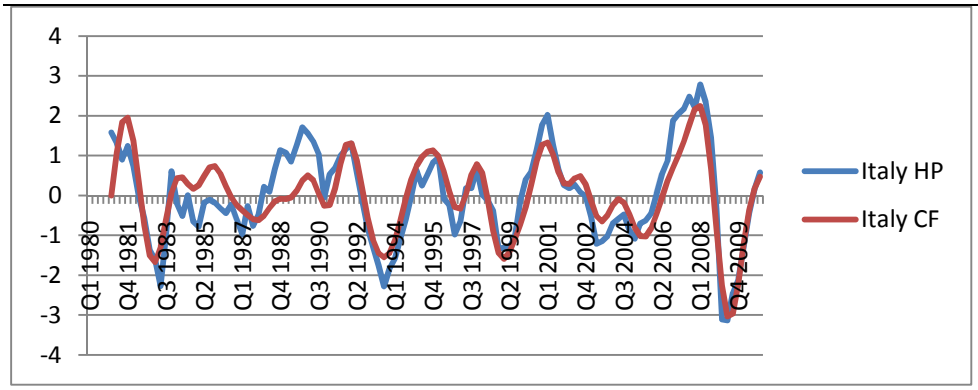
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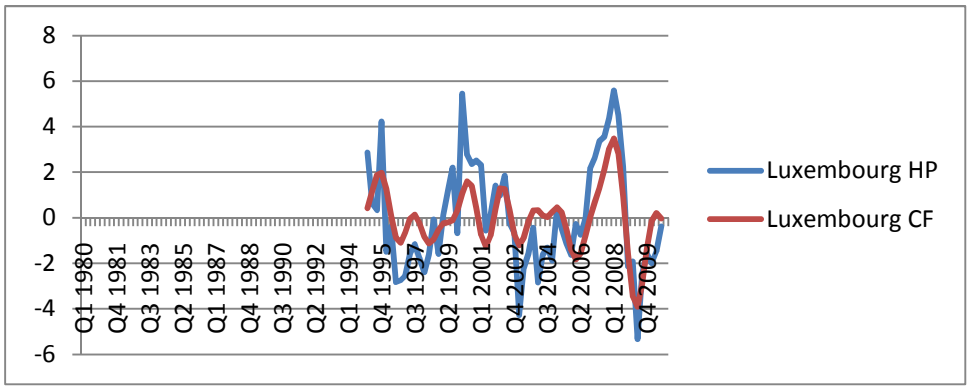
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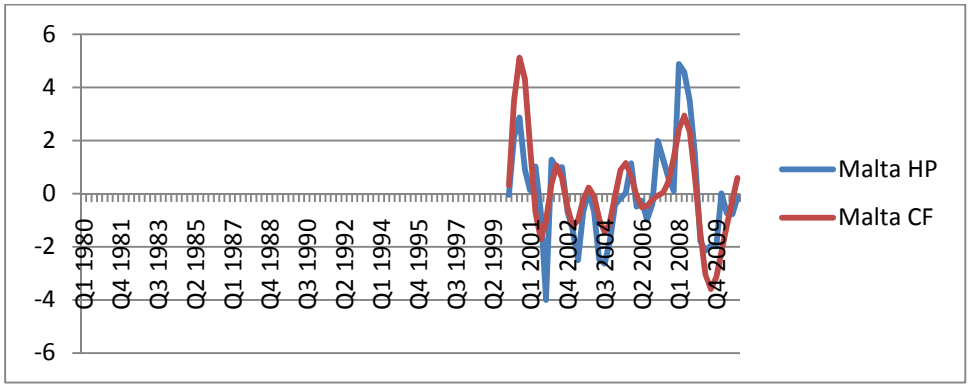
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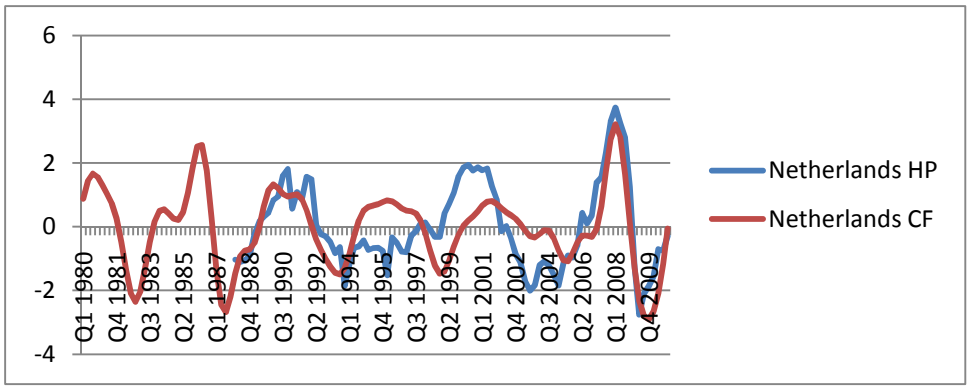
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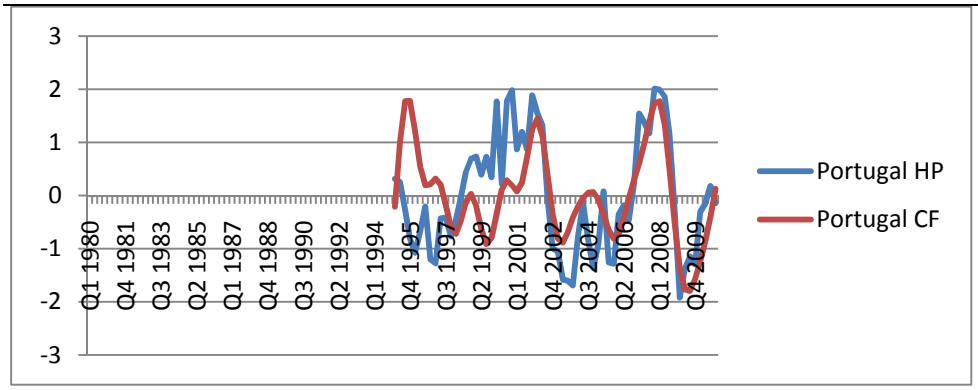
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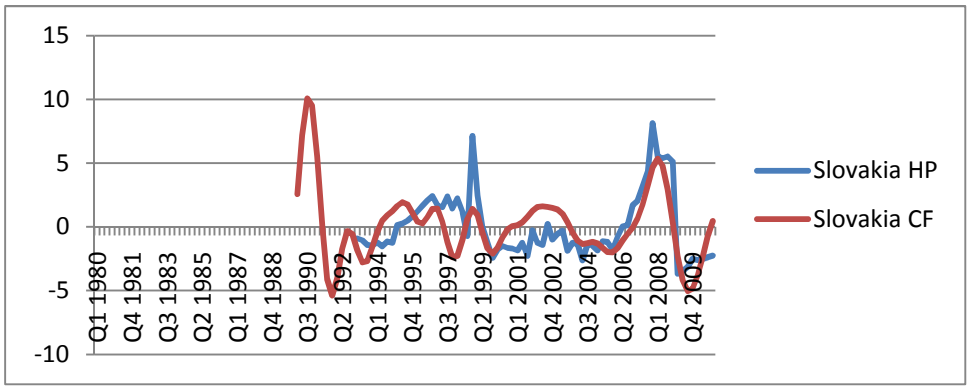
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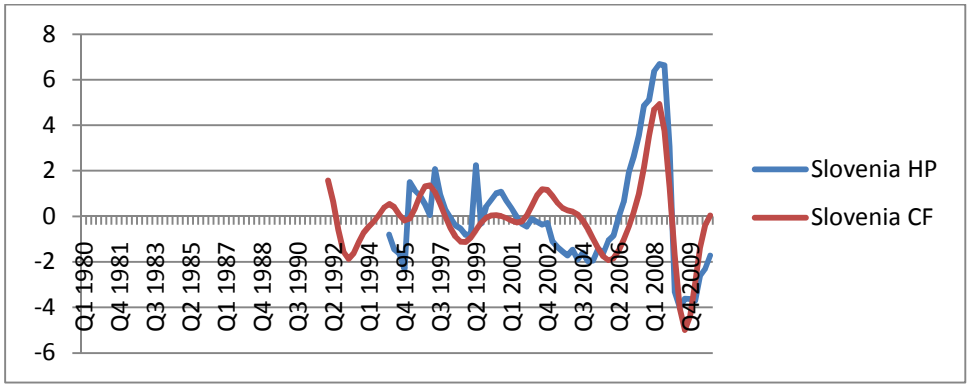
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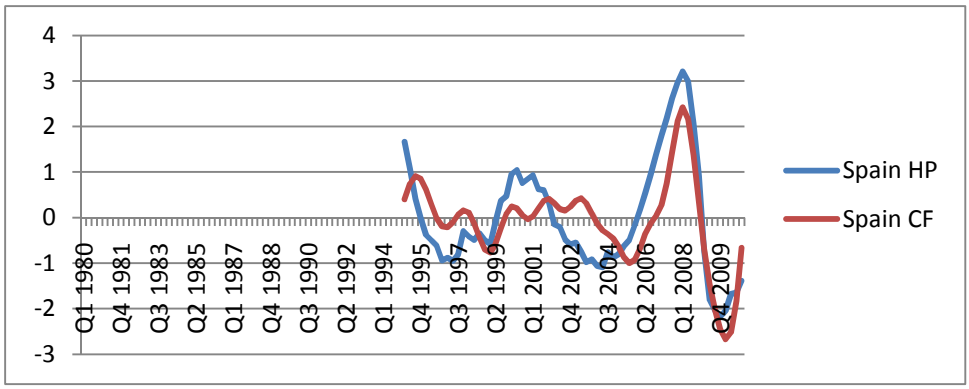
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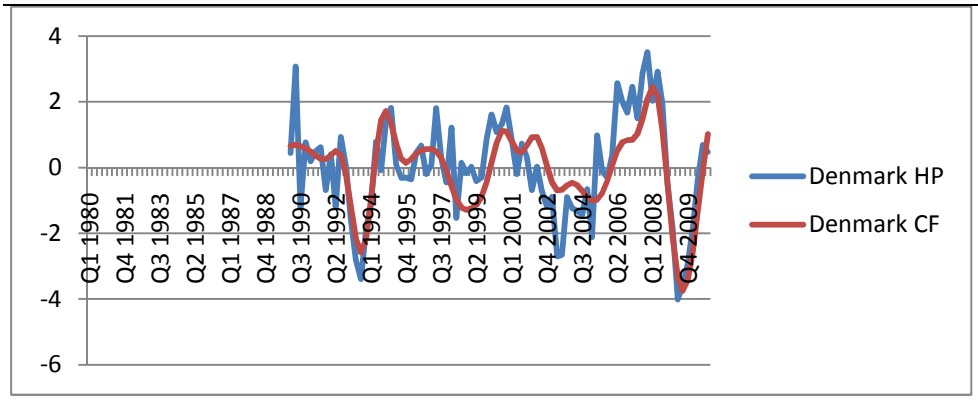
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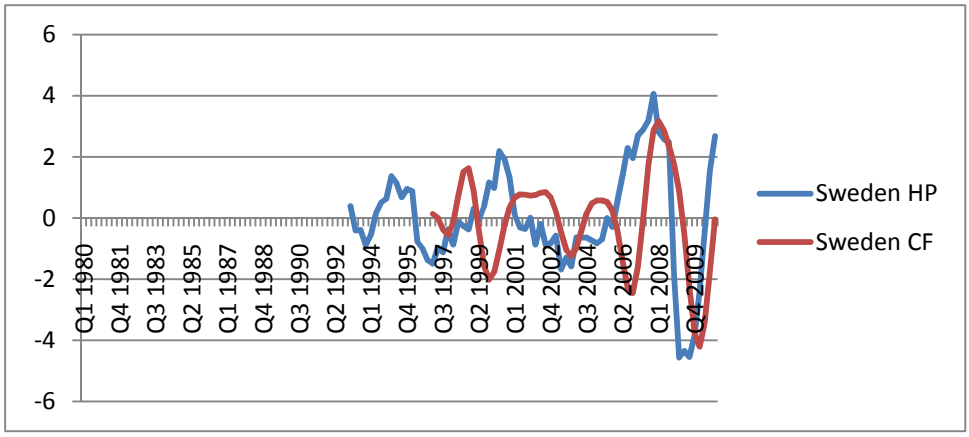
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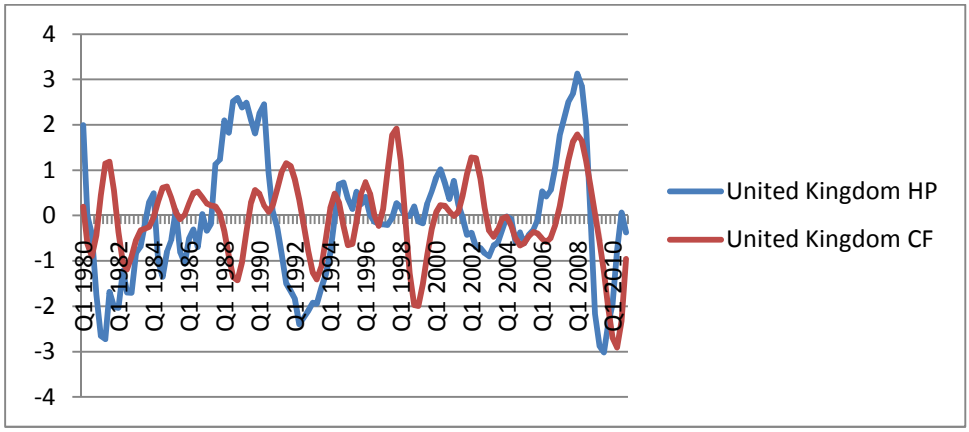
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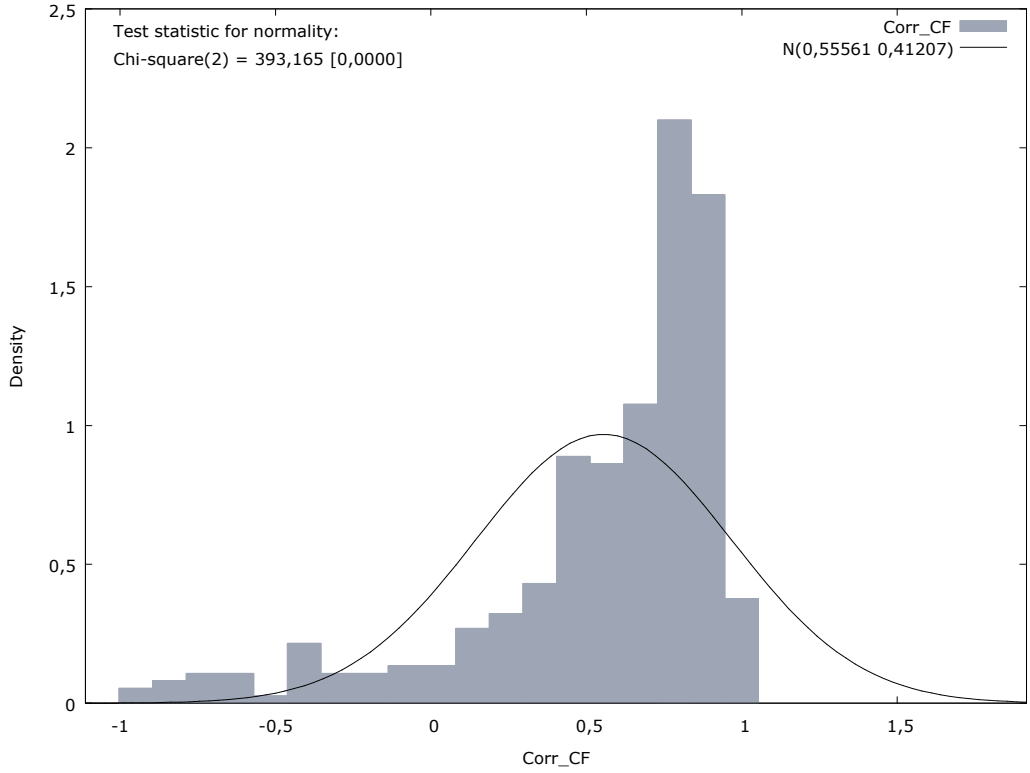
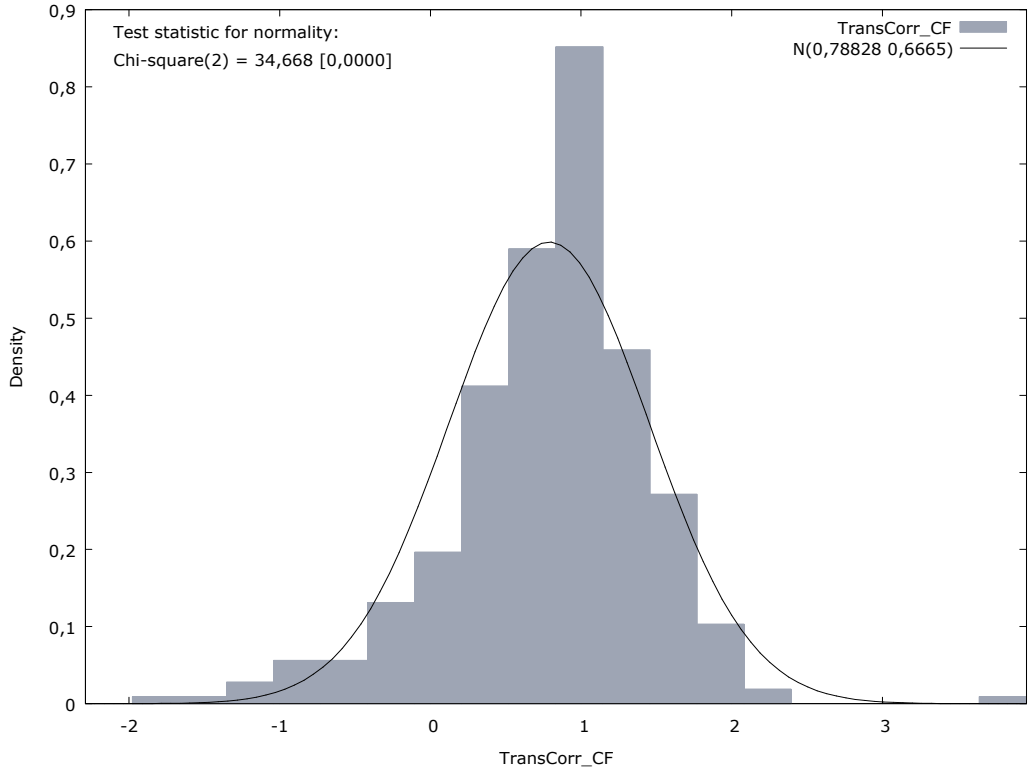
United Kingdom HP
United Kingdom CF

Appendix 3: Frequency distribution dependent variable

Correlation coefficient:



Transformed correlation coefficient:



Appendix 4: Measuring potential growth and output gaps - a production function approach

As we want to separate the cyclical component from the discretionary component of debt and deficit, we need a method that allows for cyclical developments. Any meaningful analysis of cyclical developments, of medium term growth prospects or of the stance of fiscal and monetary policies is predicated on either an implicit or explicit assumption concerning the rate of potential output growth (European Commission, 2006). The concept can only be derived from either a purely statistical approach, for example filtering methods as we do when measuring business cycles, or from a full econometric analysis. As mentioned above, we use data from the AMECO database applying an econometric approach when measuring fiscal policies. This approach constitutes the reference method when assessing the stability and convergence programmes, namely the production function approach (PF) for the estimation of output gaps presented by ECOFIN. Instead of making statistical assumptions on the time series properties of trends and their correlation with the cycle, the production function approach makes assumptions based on economic theory and focuses on the supply potential of an economy. This approach is preferred to a statistical approach inter alia because one gains the possibility of examining the underlying economic factors which are driving any observed changes in the potential output indicator and consequently the opportunity of establishing a meaningful link between policy reform measures with actual outcomes (European Commission, 2006). However, a drawback emerges as regards achieving a consensus amongst policy makers on the modeling and estimation methods to be employed because the PF approach requires assumptions on the functional form of the production technology, returns to scale, trend technical progress (TFP) and the representative utilization of production factors (European Commission, 2006).

The ECOFIN's PF approach is developed as an operational surveillance tool in the assessment of the annual stability / convergence programmes of the EU's member states, and is based on three requirements: (1) simplicity and transparency, (2) equal treatment for all member states, and (3) a prudent view regarding the assessment of the past and future evolution of potential growth in the EU. The PF approach estimates potential GDP (Y) by a combination of factor inputs, labour (L) and the capital stock (K), corrected for the degree of capacity

utilization (U_L, U_K), adjusted for the level of efficiency (E_L, E_K) (European Commission, 2010). A Cobb-Douglas specification assuming constant returns to scale is chosen for the functional form:

$Y = (U^L LE^L)^{\alpha} (U^K KE^K)^{1-\alpha} = L^{\alpha} K^{1-\alpha} * TFP$

$TFP = (E_L{}^{\alpha} E_K{}^{1-\alpha}) (U_L{}^{\alpha} U_K{}^{1-\alpha})$

The same specification is assumed for all countries, and the mean wage share for the EU15 over the period 1960-2000 is used as the estimate for the output elasticity of labor. This gives of 0.63 for α for all member states, and thus a value of 0.37 for 1-α.

Trend TFP and potential factor use must be determined when moving from actual to potential output. A HP filter is used to extract trend for TFP, and the level of employment consistent with *non-accelerating wage inflation* (NAWRU) is applied to extract the potential output contribution of employment. No distinction is made between actual and potential capital (European Commission, 2010). For a detailed presentation of the model, see "Calculating potential growth rates and output gaps - A revised production function approach" (European Commission, 2006).

Appendix 5: Guidelines for measurement of SGP criteria

The multilateral fiscal surveillance of the SGP is based on the Excessive Deficit Procedure (EDP) which sets out schedules and deadlines for the Council, following reports from and on the basis of opinions by the Commission and the Economic and Financial Committee, on how to judge whether an excessive deficit exists in a Member State. The reference values for deficit and debt under the EDP are based on concepts defined in European System of Accounts (ESA95). ESA95 is derived from, and almost entirely consistent with, the worldwide manual for national accounts (SNA93) (European Commission, 2010).

The government *deficit* is defined as "the balancing item "net borrowing/net lending" of General Government, including streams of interest payments resulting from swaps arrangements and forward rate agreements" (European Commission, 2010). Government is defined as the sector of general government which includes central government, state government, local government and social security funds. The budget balance consists of national revenue and expenditure. The cyclical components of national revenue are defined as personal tax income, social security contributions, corporate income tax and indirect taxes. The cyclical component of national expenditure is defined as unemployment related transfers. The different components are weighted by the relative share of each category in total revenue. These budgetary tax and transfer elasticities are calculated by OECD (European Commission, 2010).

Eurostat has special guidelines considering debt under the EDP. Government debt under the EDP remains similar in the ESA95 definition of government sector and of liabilities, but differs from it because debt is measured at nominal value (and not market value as in national accounts). The government debt is defined as the total consolidated gross debt at nominal value in the following categories of government liabilities: currency and deposits, securities other than shares excluding financial derivatives, loans and other accounts payable, and in some cases of specific units classified in the government sector, shares and other equity, and insurance technical reserves (European Commission, 2010). In EMU recording accrued interest is important for general government regarding the amount of debt in the member states, and regarding the specific debt instruments that are frequently used for deficit financing. The aim of implementing interest

payments in ESA 95 was to measure the rights and commitments between economic agents, expressed through financial assets and liabilities, at any point in time (European Commission, 2010). Accrued interests are recorded when economic value is created, transformed and extinguished, or when claims and obligations arise, are transformed or are cancelled. Thus, output is recorded when produced, not when paid for by purchaser, and the sale of an asset is recorded when the asset changes hands, not when the corresponding payment is made In the EDP compilations, interest payments from swap agreements and forward rate agreements have to be included. The net flows thus affect the government deficit (European Commission, 2010).

Appendix 6: Miniane's framework for measuring capital controls

The subsequent description of the methodology of calculating capital controls indices are described in Miniane (2004). The AREAER was reorganized in 1996. The choice of the capital controls in this thesis is, in line with Miniane, influenced by the 1996 edition. The 1996 edition divides capital controls in 13 sub-categories. We use these 13 capital controls in our thesis, also a fourteenth derived by Miniane. This means that in our extended dataset we derive the controls pre-1996 from text on capital in AREAER, and that we remain true to the 14 controls pre-1996 even though new controls have been added. The capital controls included in our analysis are:

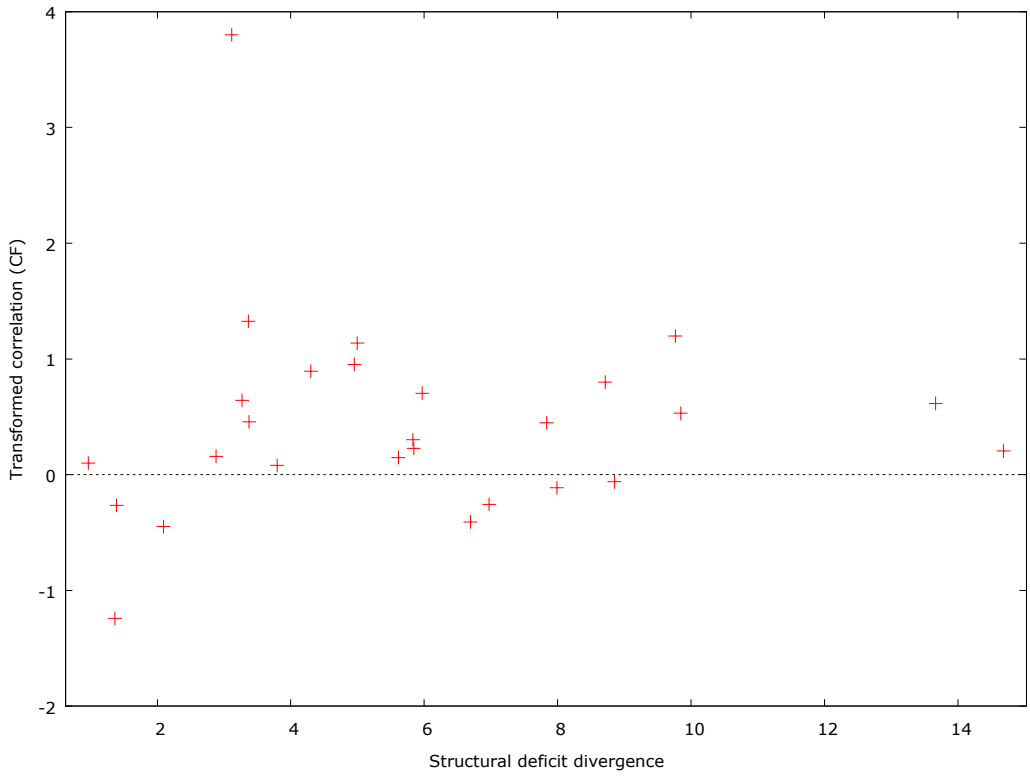
- Capital market securities,
- Money market instruments,
- Collective investment securities,
- Derivatives and other instruments,
- Commercial credits,
- Financial credits,
- Guarantees, sureties and financial back-up facilities,
- Direct investment,
- Repatriation of profits or liquidation of direct investment,
- Real estate transactions,
- Personal capital movements,
- Provision specific to commercial banks and other credit institutions,
- Provisions specific to institutional investors,
- Multiple exchange rate mechanism

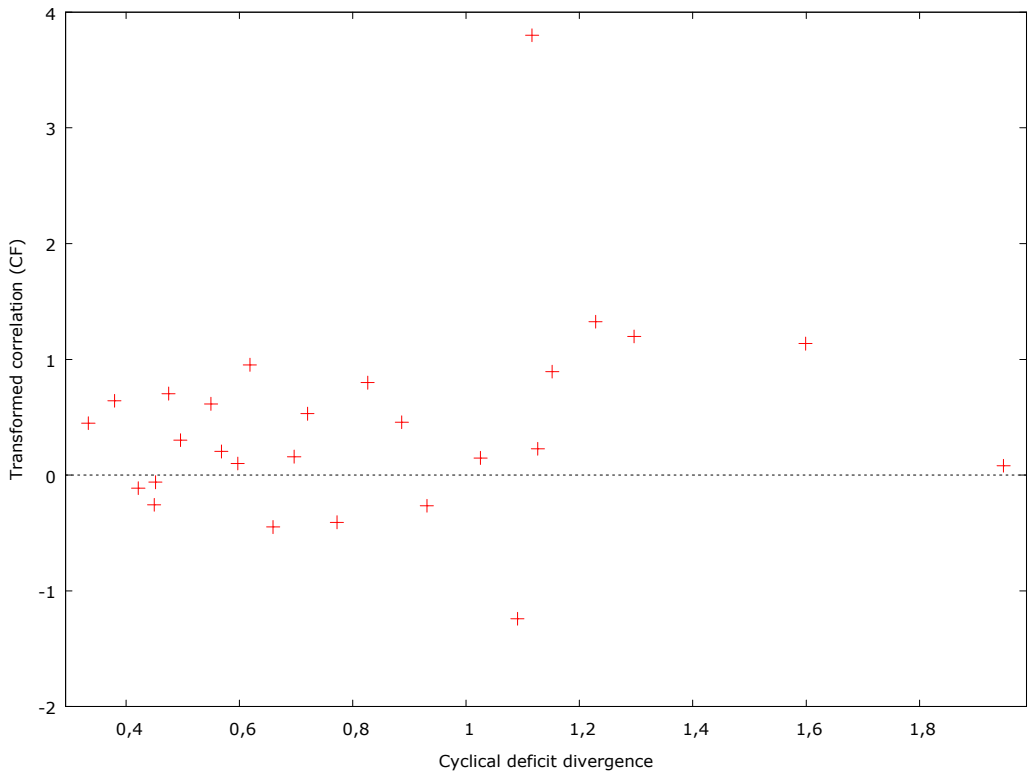
Miniane has mentioned elements in the construction of the indices. These elements will be included here. The post-1996 editions of AREAER provide clearly distinguished controls on outflows and inflows, whereas the text information in pre-1996 editions does not always contain information on both flows. Therefore, the indices account for both flows, like in Miniane (2004). Another element is that some countries have restrictions on foreign equity participation in some sectors. The new AREAER computes this in both capital market securities and in foreign direct investment. Miniane considers this to be double counting, and computes the measure as a single restriction on foreign direct investments. A third element is that many countries have restrictions on foreign investment in sectors related to defense and public order. Contrary to the AREAER, Miniane considers these not to be capital controls. The fourth element is that Miniane does not consider whether the controls are enforced, they are

valued if they exist. If AREAER clearly states that a control has never been enforced, the control is not given a value.

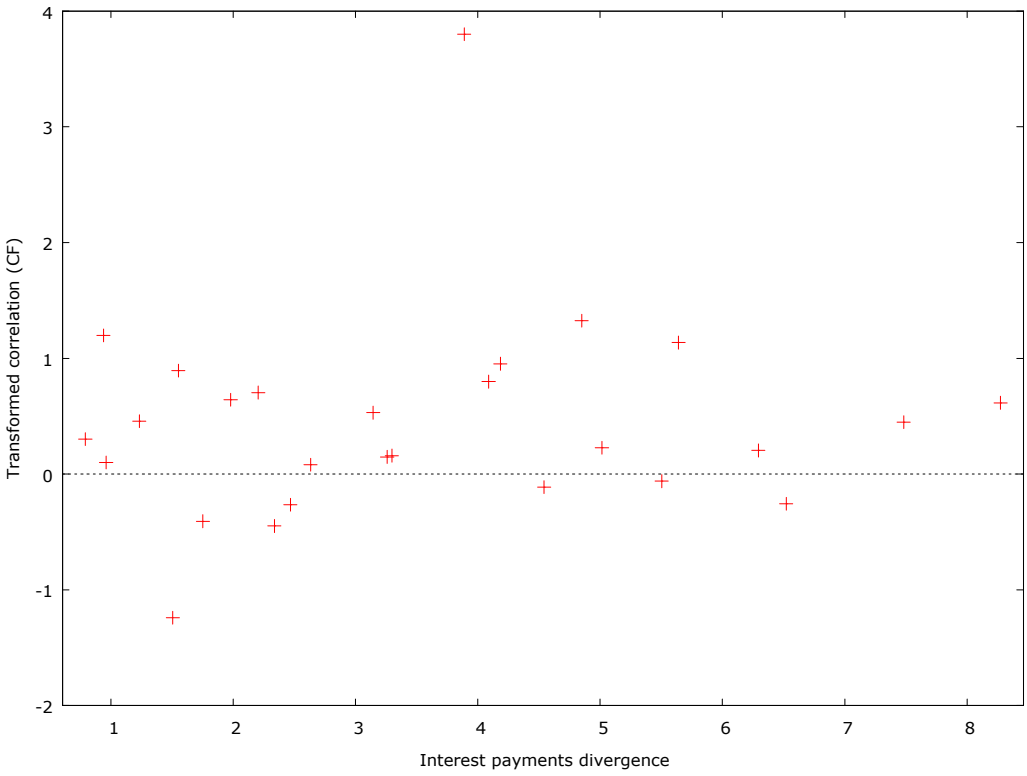
Appendix 7: X-Y Scatterplots[27]

Period 1 (1980-1990):

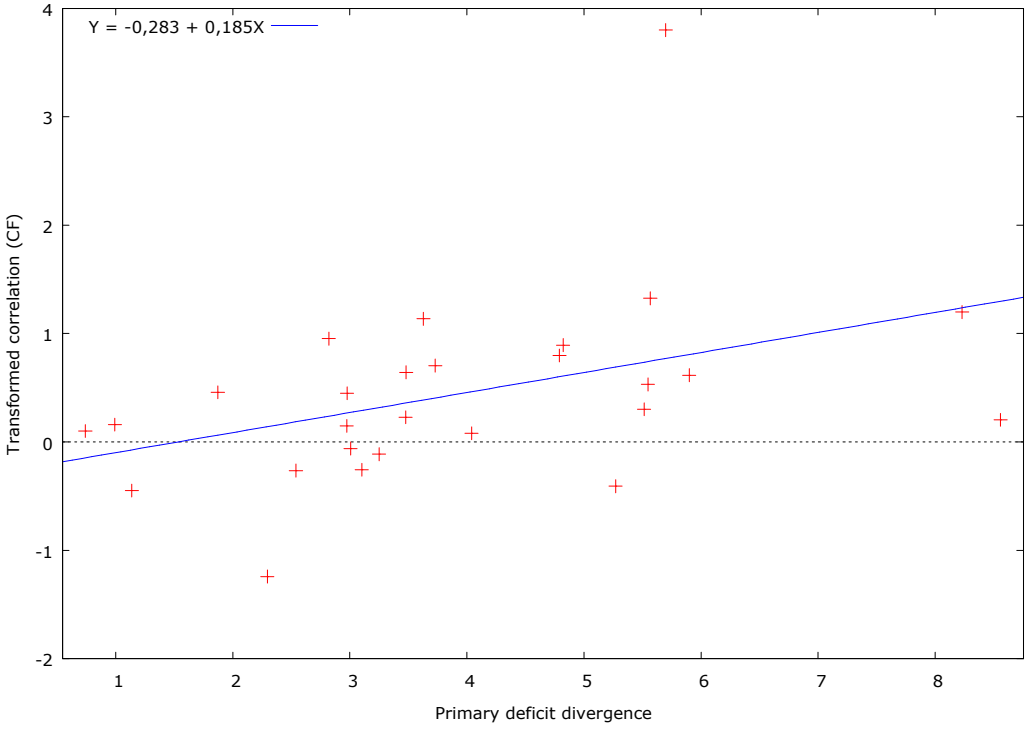




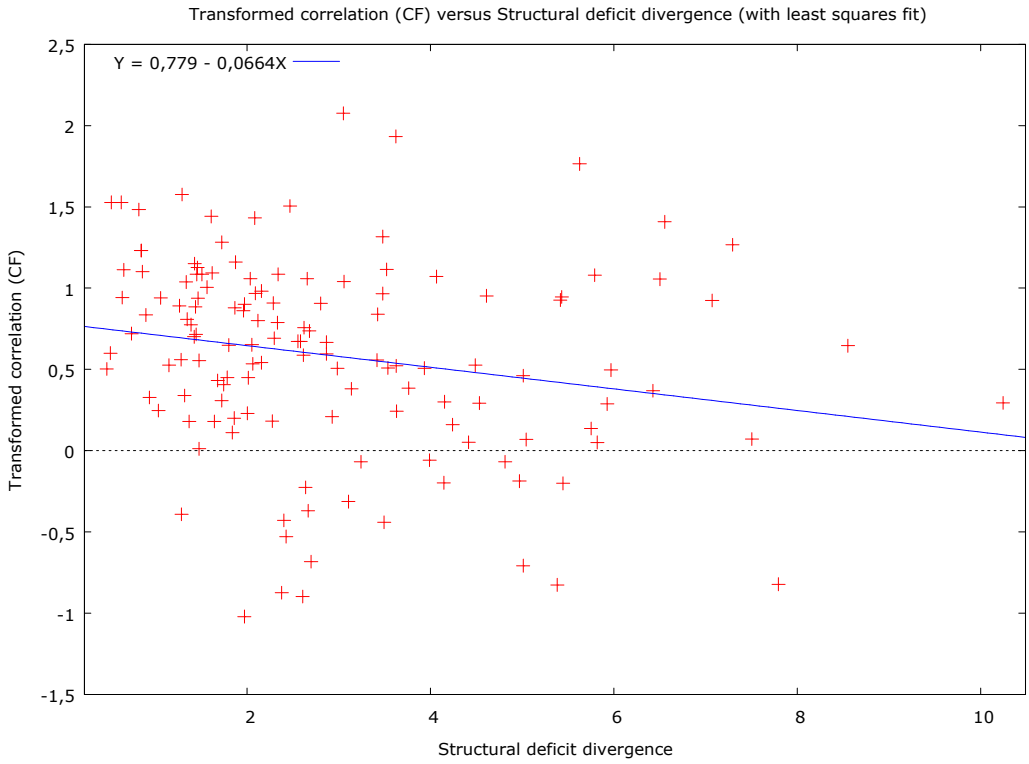
[27] A blue line and the OLS equation appear only when the OLS coefficient is significant at a 5% level.

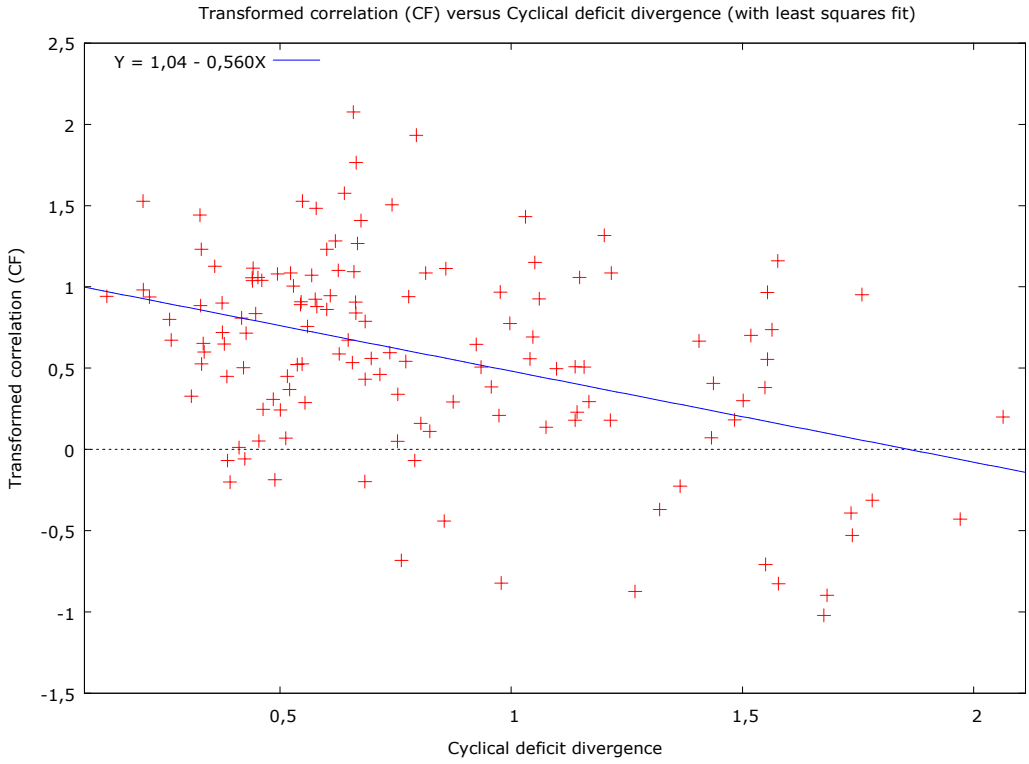


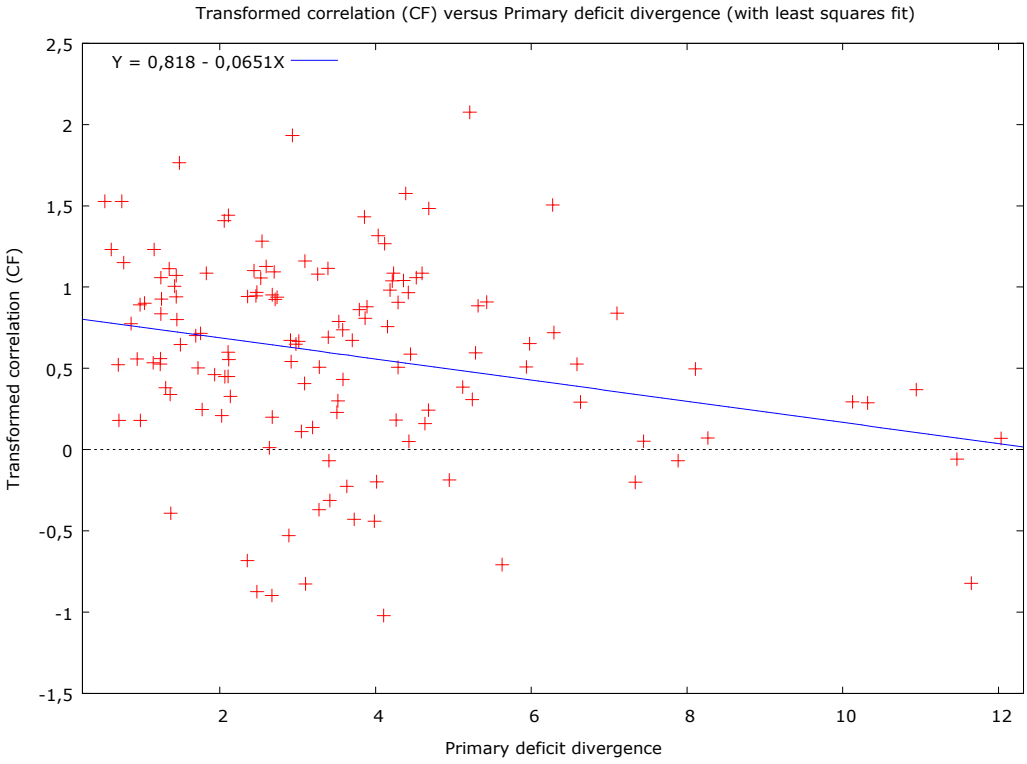
Transformed correlation (CF) versus Primary deficit divergence (with least squares fit)

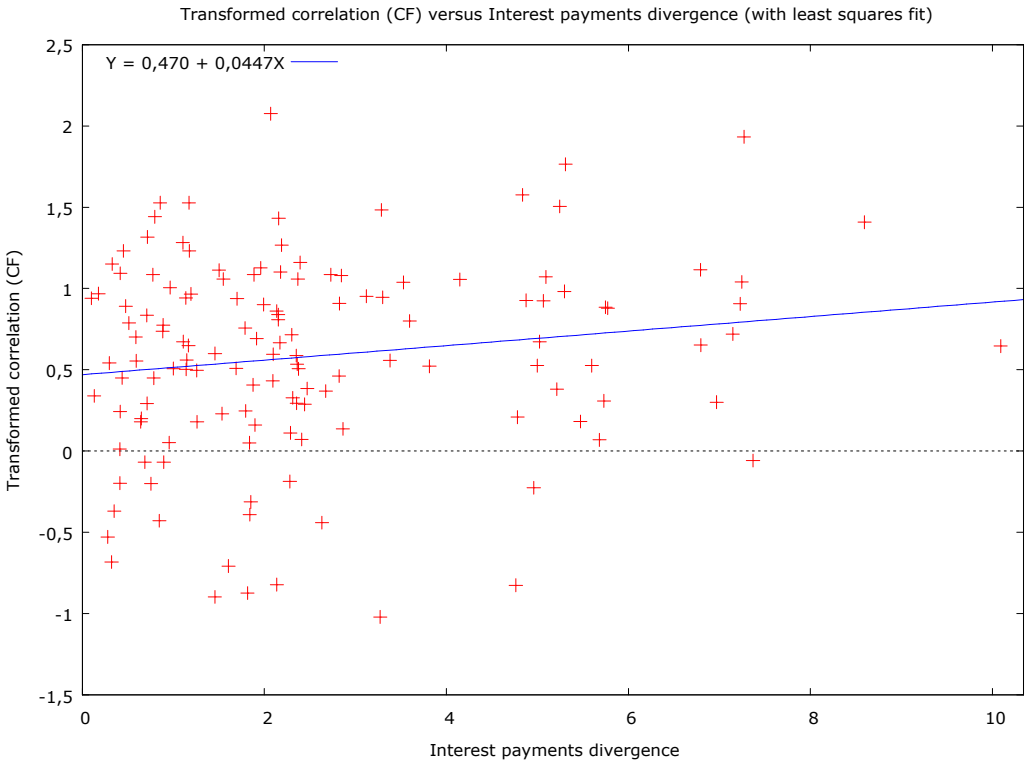


Period 2 (1991-1999):

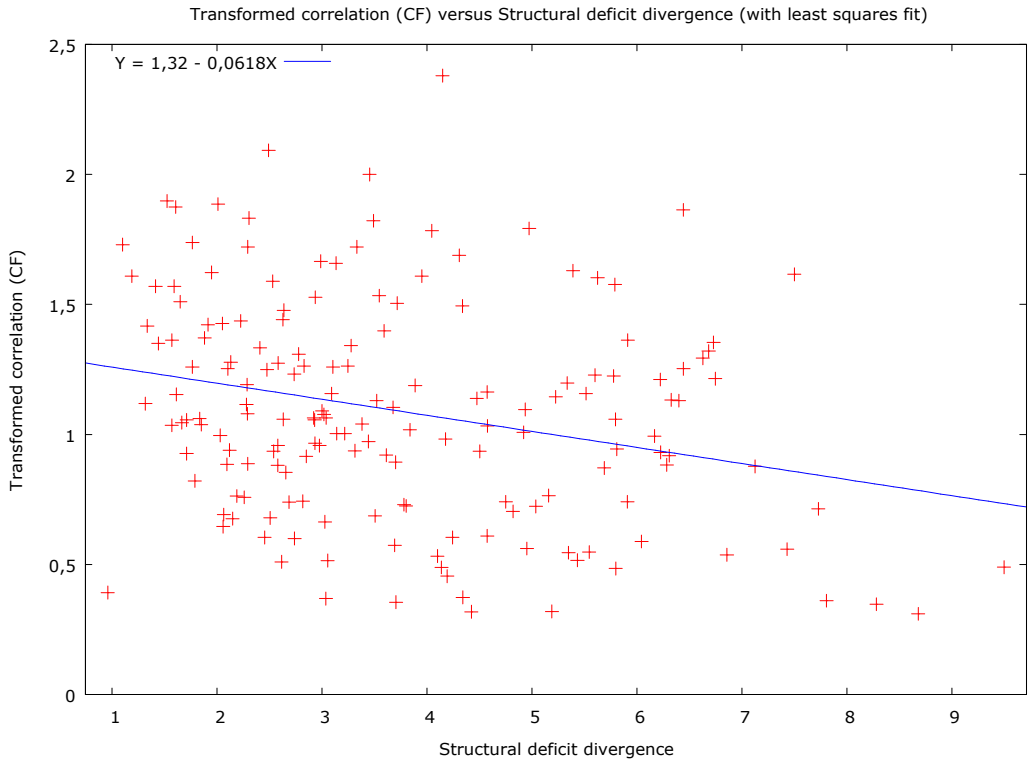


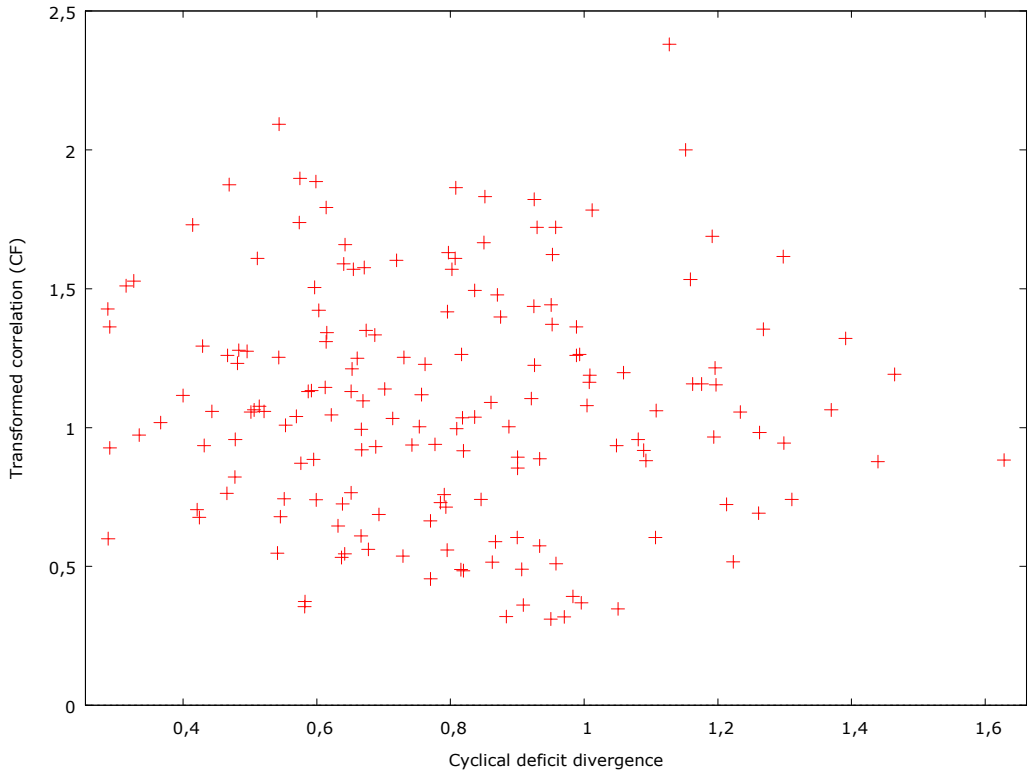


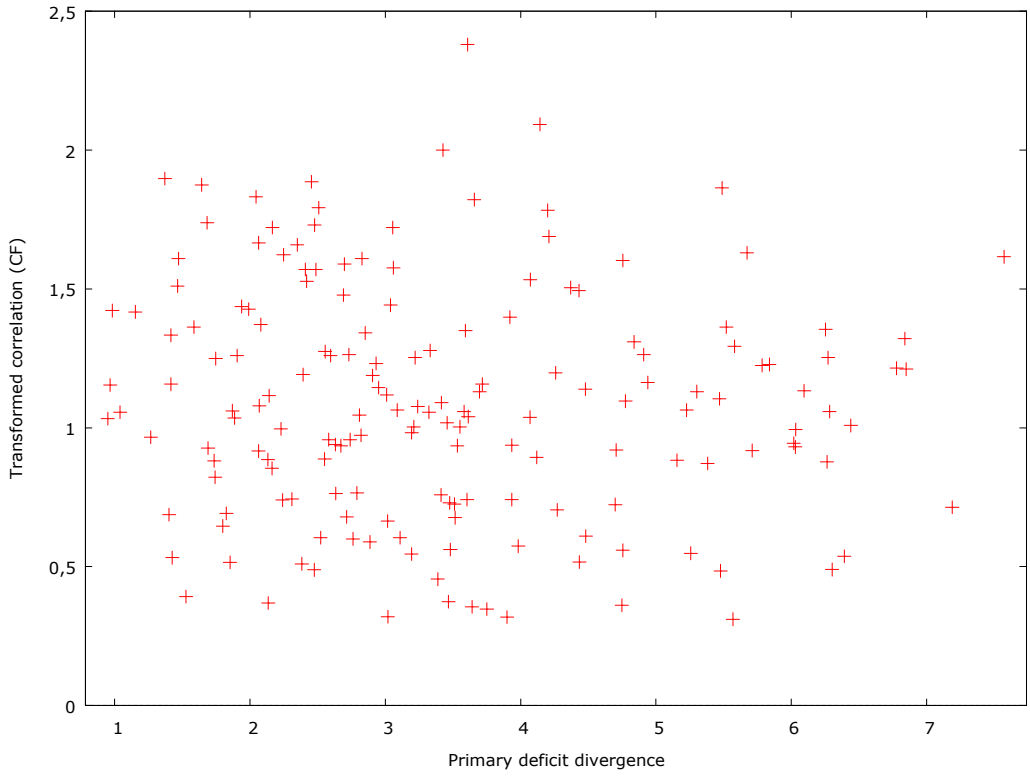

Transformed correlation (CF) versus Primary deficit divergence (with least squares fit)
Y = 0,818 - 0,0651X
Transformed correlation (CF)
Primary deficit divergence
2,5
2
1,5
1
0,5
0
-0,5
-1
-1,5
2
4
6
8
10
12


Transformed correlation (CF) versus Interest payments divergence (with least squares fit)
Y = 0,470 + 0,0447X
Transformed correlation (CF)
Interest payments divergence
2,5
2
1,5
1
0,5
0
-0,5
-1
-1,5
0
2
4
6
8
10

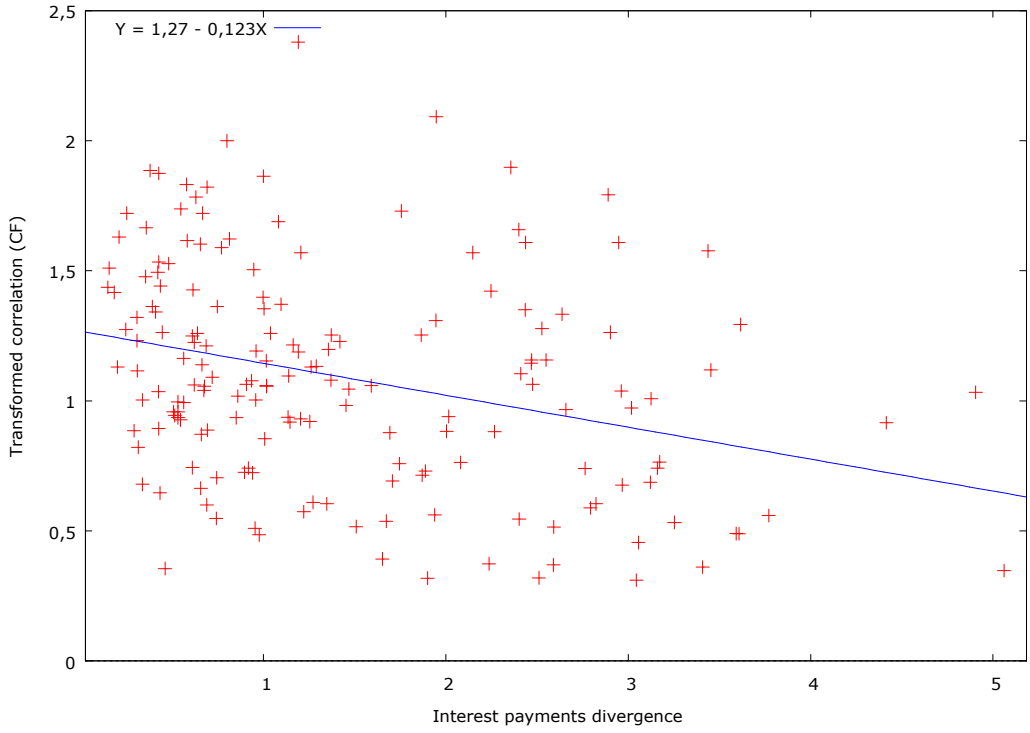
Period 3 (2000-2010):



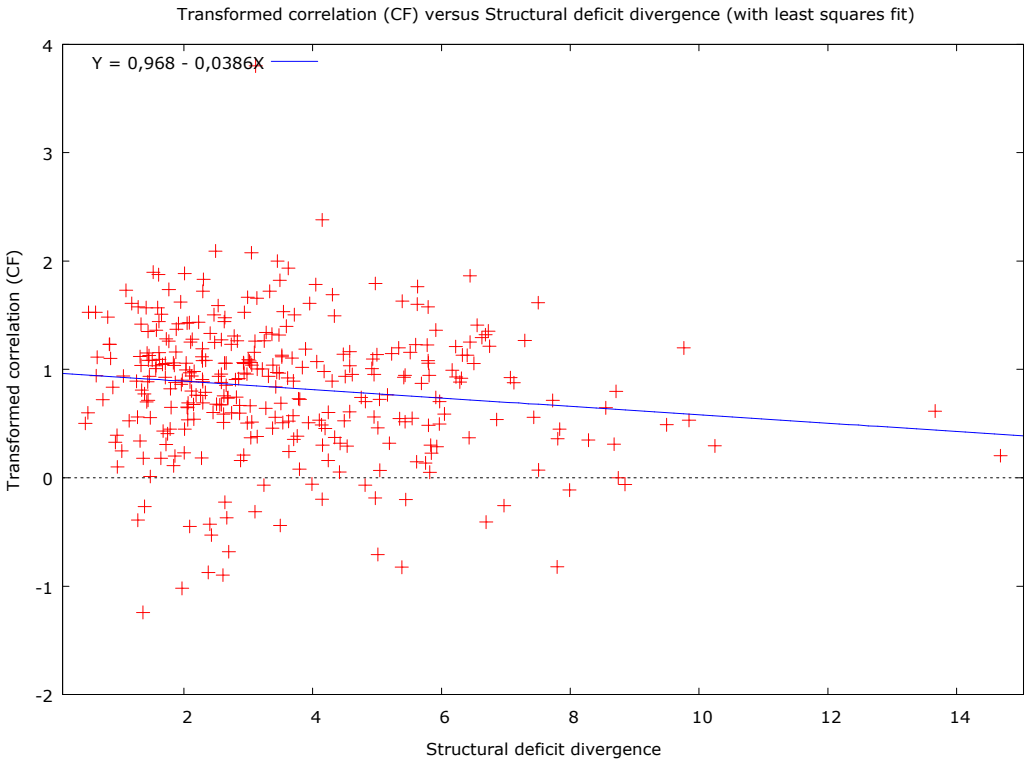


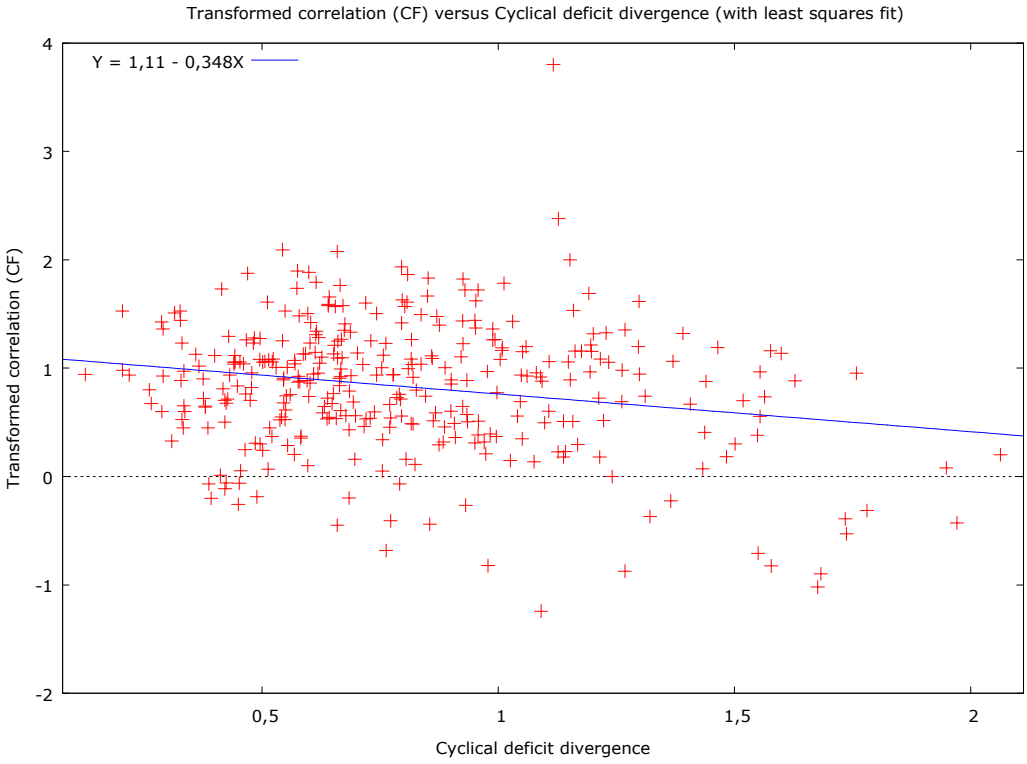


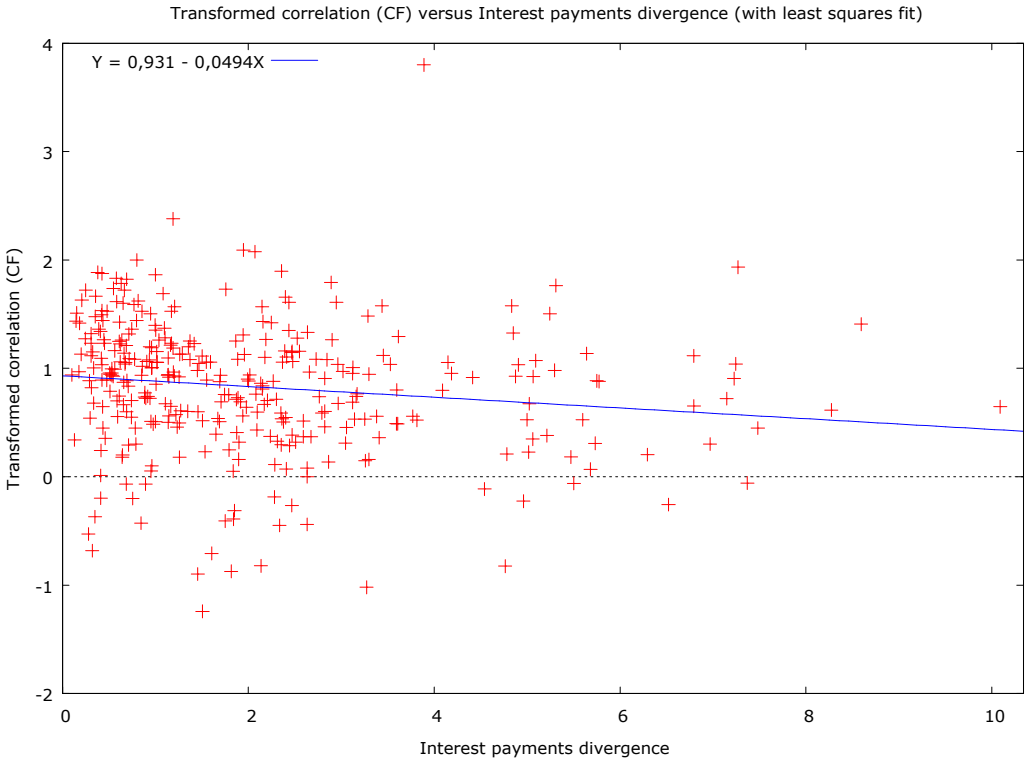
Transformed correlation (CF) versus Interest payments divergence (with least squares fit)

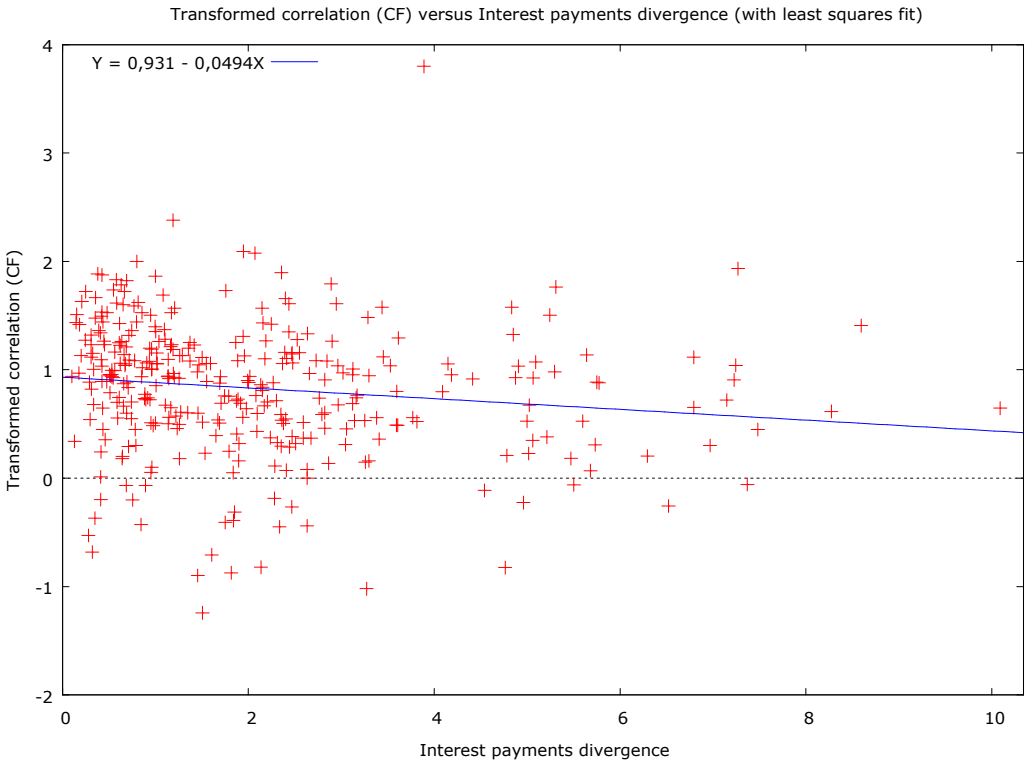


All periods:

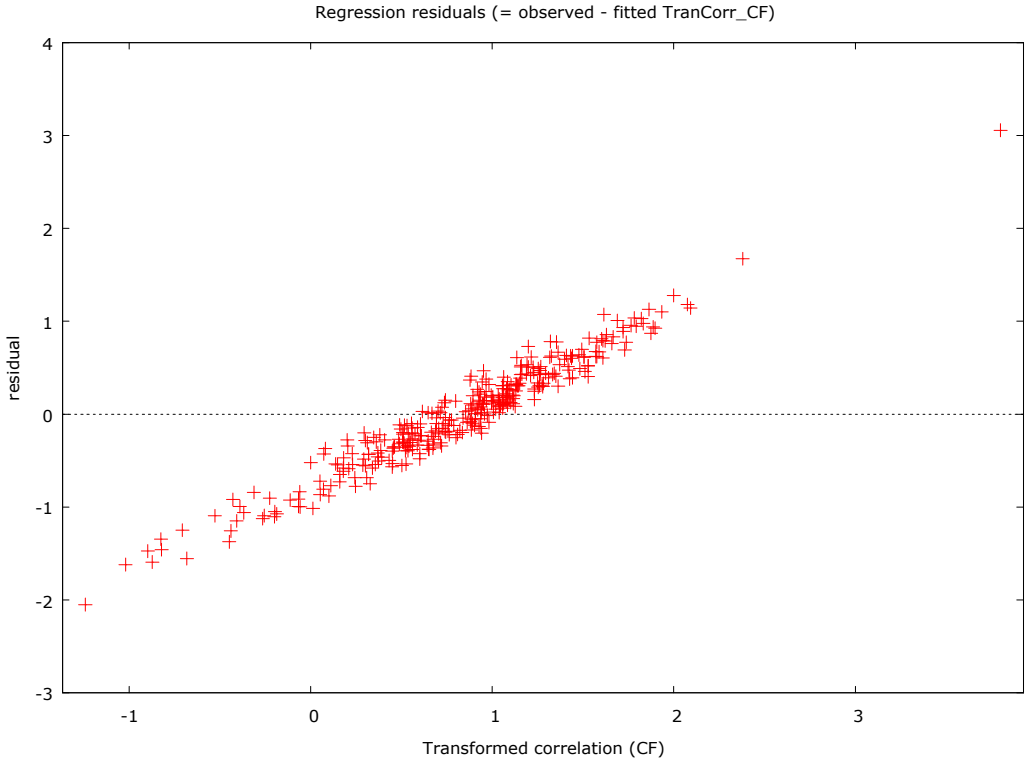

Transformed correlation (CF) versus Structural deficit divergence (with least squares fit)
Y = 0,968 - 0,0386X
Transformed correlation (CF)
Structural deficit divergence
4
3
2
1
0
-1
-2
2
4
6
8
10
12
14

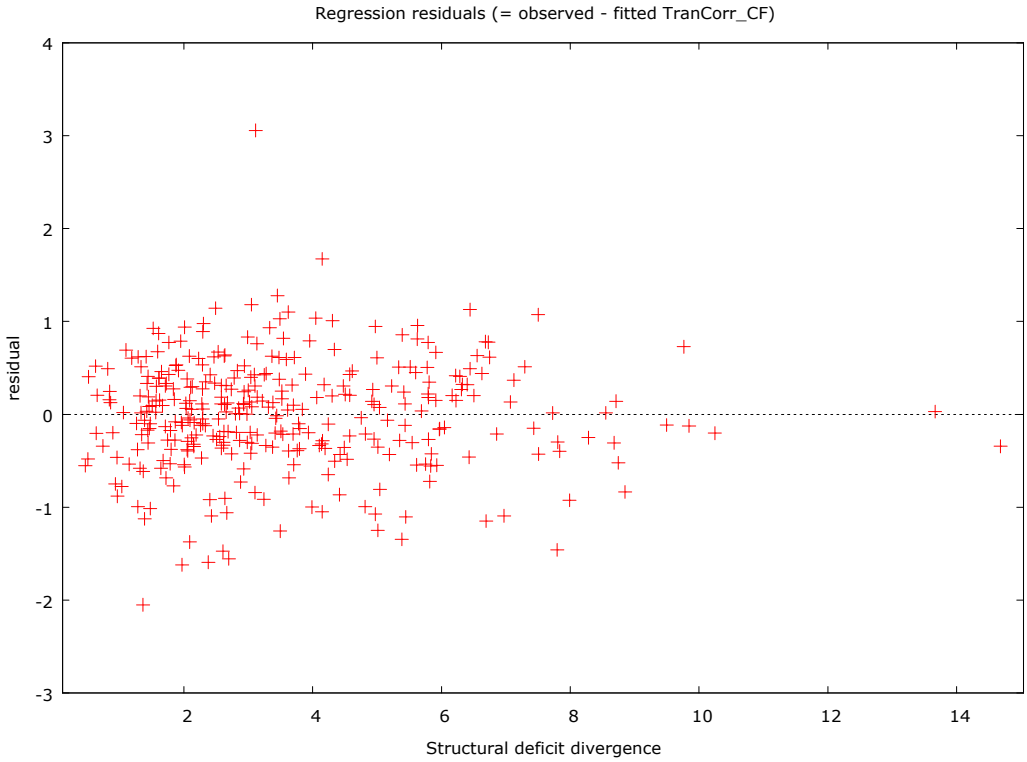

Transformed correlation (CF) versus Cyclical deficit divergence (with least squares fit)
Y = 1,11 - 0,348X
Transformed correlation (CF)
Cyclical deficit divergence
4
3
2
1
0
-1
-2
0,5
1
1,5
2

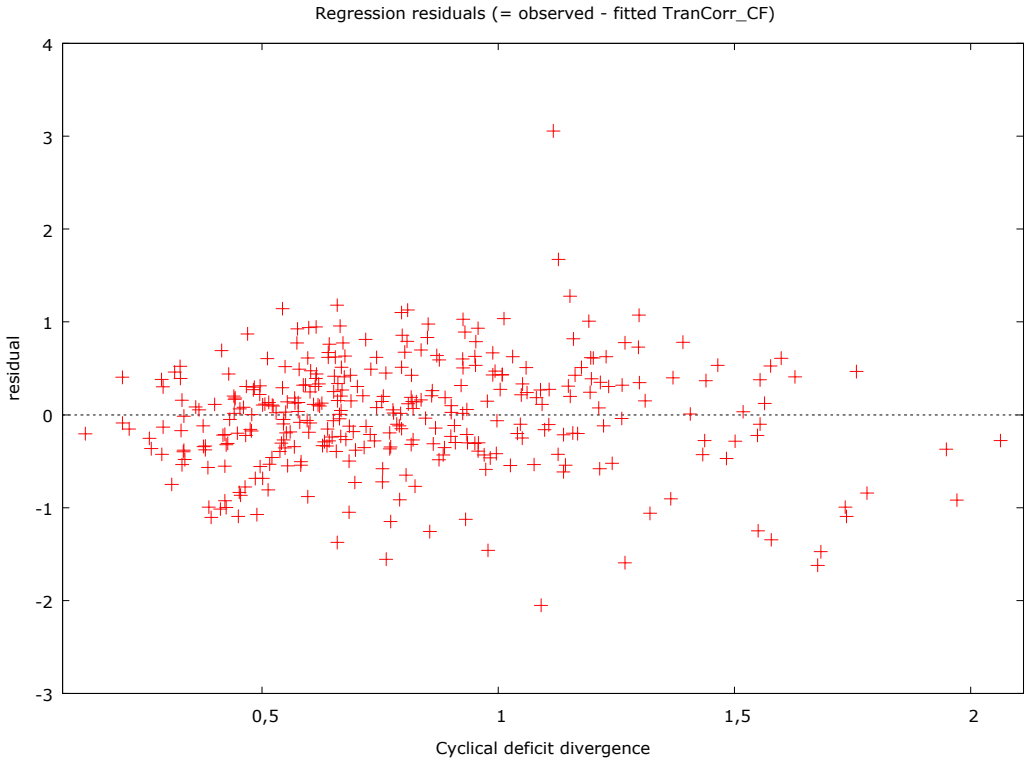

Transformed correlation (CF) versus Interest payments divergence (with least squares fit)
Y = 0,931 - 0,0494X
Transformed correlation (CF)
Interest payments divergence
4
3
2
1
0
-1
-2
0
2
4
6
8
10

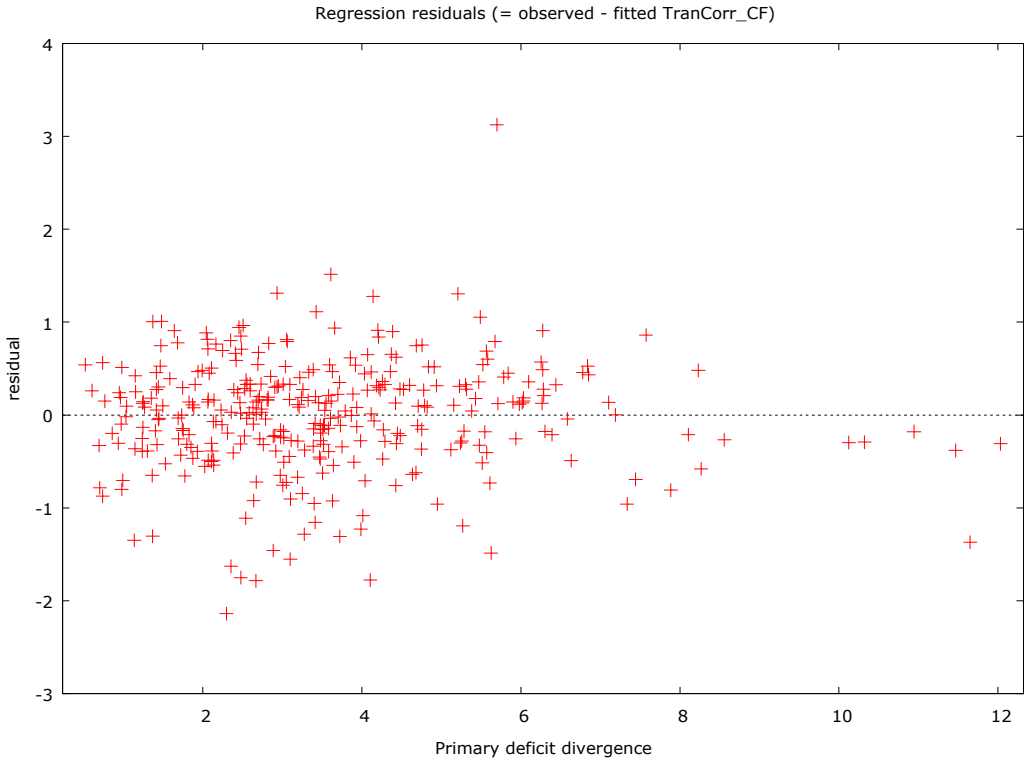

Transformed correlation (CF) versus Interest payments divergence (with least squares fit)
Y = 0,931 - 0,0494X
Transformed correlation (CF)
Interest payments divergence
4
3
2
1
0
-1
-2
0
2
4
6
8
10

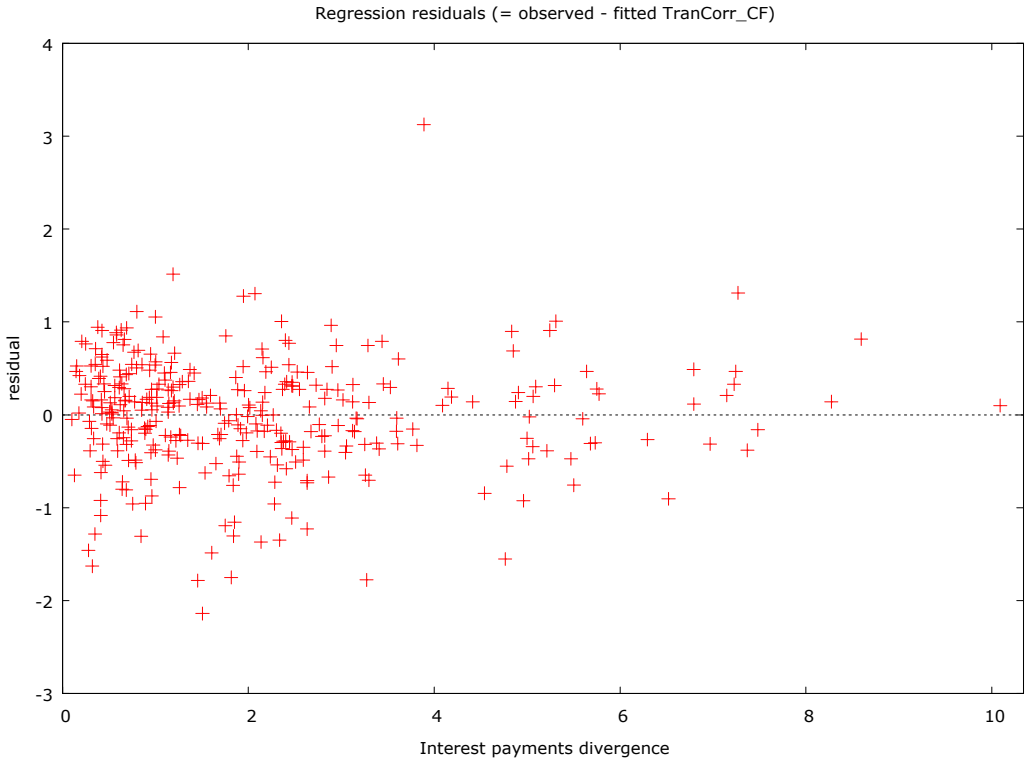
Appendix 8: Residual plots






Regression residuals (= observed - fitted TranCorr_CF)
residual
Cyclical deficit divergence
4
3
2
1
0
-1
-2
-3
0,5
1
1,5
2


Regression residuals (= observed - fitted TranCorr_CF)
residual
Primary deficit divergence
4
3
2
1
0
-1
-2
-3
2
4
6
8
10
12


Regression residuals (= observed - fitted TranCorr_CF)
residual
Interest payments divergence
4
3
2
1
0
-1
-2
-3
0
2
4
6
8
10

Appendix 9: Robustness check – differences in the entry order of control variables

TABLE 8a: FIXED EFFECTS ESTIMATION EQUATION 3 (ENTRY ORDER CONTROL VARIABLES: TRADE INTENSITY, CAPITAL CONTROLS, INDUSTRIAL SIMILARITY)								
Variables								
Intercept	1.175***	(0.183)	-6.019***	(0.871)	-3.060**	(1.128)	-4.358***	(1.281)
Structural deficit divergence	-0.042	(0.027)	-0.007	(0.027)	0.041	(0.027)	0.052†	(0.027)
Cyclical deficit divergence	-0.243	(0.160)	-0.344*	(0.139)	-0.354**	(0.133)	-0.422**	(0.135)
Trade intensity			24.487***	(2.965)	15.691 ***	(3.626)	17.785***	(4.088)
Capital controls					-0.903***	(0.232)	-1.111***	(0.257)
Industrial similarity							0.014	(0.014)
R^2	0.414		0.601		0.637		0.676	
Adjusted R^2	-0.208		0.152		0.224		0.342	
F statistics	0.665855		1.339*		1.541**		2.024***	
N	335		328		328		277	
TABLE 8b: FIXED EFFECTS ESTIMATION EQUATION 4 (ENTRY ORDER CONTROL VARIABLES: TRADE INTENSITY, CAPITAL CONTROLS, INDUSTRIAL SIMILARITY)								
Variables								
Intercept	1.131***	(0.122)	-5.060***	(1.049)	-3.129*	(1.199)	-4.778***	(1.388)
Primary deficit divergence	-0.035	(0.030)	0.016	(0.030)	0.043	(0.030)	0.050†	(0.030)
Interest payments divergence	-0.174***	(0.035)	-0.079*	(0.037)	-0.052	(0.037)	-0.046	(0.039)
Trade intensity			20.655***	(3.392)	14.961***	(3.785)	19.076***	(4.287)
Capital controls					-0.741**	(0.241)	-0.816**	(0.267)
Industrial similarity							-0.001	(0.014)
R^2	0.492		0.595		0.619		0.648	
Adjusted R^2	-0.048		0.141		0.186		0.286	
F statistics	0.911		1.310*		1.428*		1.791	
N	335		328		328		277	

† p < .1 * p < .05 ** p < .01 *** p < .001

TABLE 9a: FIXED EFFECTS ESTIMATION EQUATION 3 (ENTRY ORDER CONTROL VARIABLES: INDUSTRIAL SIMILARITY, CAPITAL CONTROLS, TRADE INTENSITY)								
Variables								
Intercept	1.175***	(0.183)	0.705†	(0.409)	1,041**	(0.326)	-4.358***	(1.281)
Structural deficit divergence	-0.042	(0.027)	-0.049†	(0.028)	0.064*	(0.025)	0.052†	(0.027)
Cyclical deficit divergence	-0.243	(0.160)	-0.305†	(0.172)	-0.437**	(0.137)	-0.422**	(0.135)
Industrial similarity			0.023	(0.017)	0.037**	(0.013)	0.014	(0.014)
Capital controls					-1.847***	(0.198)	-1.111***	(0.257)
Trade intensity							17.785***	(4.088)
R^2	0.414		0.413		0.634		0.676	
Adjusted R^2	-0.208		-0.146		0.281		0.342	
F statistics	0.666		0.739		1.795***		2.024***	
N	335		284		284		277	

TABLE 9b: FIXED EFFECTS ESTIMATION EQUATION 4 (ENTRY ORDER CONTROL VARIABLES: INDUSTRIAL SIMILARITY, CAPITAL CONTROLS, TRADE INTENSITY)								
Variables								
Intercept	1.131***	(0.122)	1.441***	(0.410)	1.108**	(0.371)	-4.778***	(1.388)
Primary deficit divergence	-0.035	(0.030)	-0.037	(0.031)	0.036	(0,031)	0.050†	(0.030)
Interest payments divergence	-0.174***	(0.035)	-0.188***	(0.038)	-0.065	(0,040)	-0.046	(0.039)
Industrial similarity			-0.002	(0.015)	0.020	(0.014)	-0.001	(0.014)
Capital controls					-1.399***	(0.230)	-0.816**	(0.267)
Trade intensity							19.076***	(4.287)
R^2	0.492		0.493		0.597		0.648	
Adjusted R^2	-0.048		0.011		0.207		0.286	
F statistics	0.911		1.022		1.533**		1.791	
N	335		284		284		277	

† p < .1 * p < .05 ** p < .01 *** p < .001

TABLE 10a: FIXED EFFECTS ESTIMATION EQUATION 3 (ENTRY ORDER CONTROL VARIABLES: INDUSTRIAL SIMILARITY, TRADE INTENSITY, CAPITAL CONTROLS)								
Variables								
Intercept	1.175***	(0.183)	0.705†	(0.409)	-7.994***	(1.028)	-4.358***	(1.281)
Structural deficit divergence	-0.042	(0.027)	-0.049†	(0.028)	0.008	(0.027)	0.052†	(0.027)
Cyclical deficit divergence	-0.243	(0.160)	-0.305†	(0.172)	-0.367*	(0.143)	-0.422**	(0.135)
Industrial similarity			0.023	(0.017)	-0.002	(0.014)	0.014	(0.014)
Trade intensity					29.178***	(3.326)	17.785***	(4.088)
Capital controls							-1.111***	(0.257)
R^2	0.414		0.413		0.631		0.676	
Adjusted R^2	-0.208		-0.146		0.257		0.342	
F statistics	0.666		0.739		1.685**		2.024***	
N	335		284		277		277	

TABLE 10b: FIXED EFFECTS ESTIMATION EQUATION 4 (ENTRY ORDER CONTROL VARIABLES: INDUSTRIAL SIMILARITY, TRADE INTENSITY, CAPITAL CONTROLS)								
Variables								
Intercept	1.131***	(0.122)	1.441***	(0.410)	-6.781***	(1.260)	-4.778***	(1.388)
Primary deficit divergence	-0.035	(0.030)	-0.037	(0.031)	0.024	(0.030)	0.050†	(0.030)
Interest payments divergence	-0.174***	(0.035)	-0.188***	(0.038)	-0.081*	(0.039)	-0.046	(0.039)
Industrial similarity			-0.002	(0.015)	-0.015	(0.014)	-0.001	(0.014)
Trade intensity					25.721***	(3.805)	19.076***	(4.287)
Capital controls							-0.816**	(0.267)
R^2	0.492		0.493		0.624		0.648	
Adjusted R^2	-0.048		0.011		0.243		0.286	
F statistics	0.911		1.022		1.638**		1.791***	
Df (residual)								
N	335		284		277		277	

† p < .1 * p < .05 ** p < .01 *** p < .001

TABLE 11a: FIXED EFFECTS ESTIMATION EQUATION 3 (ENTRY ORDER CONTROL VARIABLES: CAPITAL CONTROLS, INDUSTRIAL SIMILARITY, TRADE INTENSITY)								
Variables								
Intercept	1.175***	(0.183)	1.805**	(0.170)	1.041**	(0.326)	-4.358***	(1.281)
Structural deficit divergence	-0.042	(0.027)	0.049†	(0.025)	0.064*	(0.025)	0.052†	(0.027)
Cyclical deficit divergence	-0.243	(0.160)	-0.319*	(0.134)	-0.437**	(0.137)	-0.422**	(0.135)
Capital controls			-1.541***	(0.183)	-1.847***	(0.198)	-1.111***	(0.257)
Industrial similarity					0.037**	(0.013)	0.014	(0.014)
Trade intensity							17.785***	(4.088)
R^2	0.414		0.594		0.634		0.676	
Adjusted R^2	-0.208		0.157		0.281		0.342	
F statistics	0.666		1.360*		1.795***		2.024***	
N	335		335		284		277	

TABLE 11b: FIXED EFFECTS ESTIMATION EQUATION 4 (ENTRY ORDER CONTROL VARIABLES: CAPITAL CONTROLS, INDUSTRIAL SIMILARITY, TRADE INTENSITY)								
Variables								
Intercept	1.131***	(0.122)	1.577***	(0.120)	1.108**	(0.371)	-4.778***	(1.388)
Primary deficit divergence	-0.035	(0.030)	0.031	(0.030)	0.036	(0.031)	0.050†	(0.030)
Interest payments divergence	-0.174***	(0.035)	-0.078*	(0.036)	-0,065	(0.040)	-0.046	(0.039)
Capital controls			-1.194***	(0.206)	-1.399***	(0.230)	-0.816**	(0.267)
Industrial similarity					0.020	(0.014)	-0.001	(0.014)
Trade intensity							19.076***	(4.287)
R^2	0.492		0.579		0.597		0.648	
Adjusted R^2	-0.048		0.128		0.207		0.286	
F statistics	0.911		1.282†		1.533**		1.791***	
N	335		335		284		277	

† p < .1 * p < .05 ** p < .01 *** p < .001

TABLE 12a: FIXED EFFECTS ESTIMATION EQUATION 3 (ENTRY ORDER CONTROL VARIABLES: CAPITAL CONTROLS, TRADE INTENSITY, INDUSTRIAL SIMILARITY)								
Variables								
Intercept	1.175***	(0.183)	1.805**	(0.170)	-3.060**	(1.128)	-4.358***	(1.281)
Structural deficit divergence	-0.041	(0.027)	0.049†	(0.025)	0.041	(0.027)	0.052†	(0.027)
Cyclical deficit divergence	-0.243	(0.160)	-0.319*	(0.134)	-0.354**	(0.133)	-0.422**	(0.135)
Capital controls			-1.541***	(0.183)	-0.903***	(0.232)	-1.111***	(0.257)
Trade intensity					15.691 ***	(3.626)	17.785***	(4.088)
Industrial similarity							0.014	(0.014)
R^2	0.414		0.594		0.637		0.676	
Adjusted R^2	-0.208		0.157		0.224		0.342	
F statistics	0.666		1.360*		1.541**		2.024***	
N	335		335		328		277	

TABLE 12b: FIXED EFFECTS ESTIMATION EQUATION 4 (ENTRY ORDER CONTROL VARIABLES: CAPITAL CONTROLS, TRADE INTENSITY, INDUSTRIAL SIMILARITY)								
Variables								
Intercept	1.131***	(0.122)	1.577***	(0.120)	-3.129*	(1.198)	-4.778***	(1.388)
Primary deficit divergence	-0.035	(0.030)	0.031	(0.030)	0.043	(0.030)	0.050†	(0.030)
Interest payments divergence	-0.174***	(0.035)	-0.078*	(0.036)	-0.052	(0.037)	-0.046	(0.039)
Capital controls			-1.194***	(0.206)	-0.741**	(0.241)	-0.816**	(0.267)
Trade intensity					14.962***	(3.785)	19.076***	(4.287)
Industrial similarity							-0.001	(0.014)
R^2	0.492		0.579		0.619		0.648	
Adjusted R^2	-0.048		0.128		0.186		0.286	
F statistics	0.911		1.282†		1.428*		1.791***	
N	335		335		328		277	

† p < .1 * p < .05 ** p < .01 *** p < .001

Appendix 10: Robustness check – differences in sample

TABLE 13a: FIXED EFFECTS ESTIMATION EQUATION 3 FOR PERIOD TWO AND THREE								
Variables								
Intercept	0.649**	(0.221)	-5.695***	(0.786)	-7.710***	(0.920)	-3.670 **	(1.230)
Structural deficit divergence	0.084*	(0.040)	0.068*	(0.032)	0.064*	(0.032)	0.046	(0.023)
Cyclical deficit divergence	-0.087	(0.168)	-0.318*	(0.140)	-0.374**	(0.139)	-0.579***	(0.136)
Trade intensity			22.904***	(2.761)	27.192***	(3.228)	16.791 ***	(3.770)
Industrial similarity					0.007	(0.015)	0.014	(0.014)
Capital controls							-1.511***	(0.334)
R^2	0.500		0.671		0.709		0.753	
Adjusted R^2	-0.141		0.242		0.360		0.452	
F statistics	0.780		1.565**		2.038***		2.504***	
N	307		307		256		256	
TABLE 13b: FIXED EFFECTS ESTIMATION EQUATION 4 FOR PERIOD TWO AND THREE								
Variables								
Intercept	1.340***	(0,120)	-4.068***	(0.954)	-5.670***	(1,138)	-3.895**	(1.338)
Primary deficit divergence	-0.033	(0,032)	0.004	(0.029)	0.008	(0,029)	0.026	(0.029)
Interest payments divergence	-0.185***	(0,037)	-0.107**	(0.036)	-0.118**	(0,039)	-0.090*	(0.040)
Trade intensity			17.834***	(3.127)	22.754 ***	(3,555)	17.520 ***	(4.110)
Industrial similarity					-0.014	(0,015)	-0.007	(0.015)
Capital controls							-0.901*	(0.375)
R^2	0.574		0.658		0.694		0.708	
Adjusted R^2	0.028		0.213		0.326		0.353	
F statistics	1.051		1.479**		1.889***		1.993***	
N	307		307		256		256	

† p < .1 * p < .05 ** p < .01 *** p < .001

TABLE 14a: FIXED EFFECTS ESTIMATION EQUATION 3 (3 OR MORE YEARS PER OBSERVATION)								
Variables								
Intercept	1.149***	(0.196)	-7.569***	(0.868)	-9.227***	(1.038)	-3.900***	(1.269)
Structural deficit divergence	-0.039	(0.028)	-0.027	(0.027)	-0.024	(0.028)	0.042	(0.027)
Cyclical deficit divergence	-0.238	(0.171)	-0.555***	(0.157)	-0.628***	(0.166)	-0.715***	(0.145)
Trade intensity			30.780 ***	(3.051)	33.845***	(3.322)	18.327***	(3.886)
Industrial similarity					0.001	(0.017)	0,009	(0.015)
Capital controls							-1.553***	(0.259)
R^2	0.406		0.406		0.700		0.773	
Adjusted R^2	-0.253		0.249		0.327		0.487	
F statistics	0.617		1.575**		1.879***		2.705***	
N	328		301		252		252	
TABLE 14b: FIXED EFFECTS ESTIMATION EQUATION 4 (3 OR MORE YEARS PER OBSERVATION)								
Variables								
Intercept	1.360***	(0.120)	-6.465***	(1.083)	-7.443***	(1.290)	-4.518**	(1.429)
Primary deficit divergence	-0.032	(0.031)	0.023	(0.031)	0.033	(0.031)	0.059†	(0.030)
Interest payments divergence	-0.208***	(0.036)	-0.101*	(0.042)	-0.121**	(0.044)	-0.085†	(0.043)
Trade intensity			25.472***	3.500	28.074***	(3.788)	19.113***	(4.245)
Industrial similarity					-0.017	(0.017)	-0.007	(0.016)
Capital controls							-1.041***	(0.267)
R^2	0.520		0.666		0.683		0.721	
Adjusted R^2	-0.013		0.211		0.290		0.369	
F statistics	0.975		1.463*		1.736**		2.051***	
N	328		301		252		252	

† p < .1 * p < .05 ** p < .01 *** p < .001

TABLE 15a: FIXED EFFECTS ESTIMATION EQUATION 3 EXCLUDING DENMARK, SWEDEN AND THE UK								
Variables								
Intercept	0.813	(0.235)	-5.079***	(0.832)	-7.023***	(0.982)	-2.476*	(1.076)
Structural deficit divergence	0.303	(0.223)	0.002	(0.030)	0.001	(0.029)	0.052*	(0.025)
Cyclical deficit divergence			0.004	(0.192)	0.011	(0.195)	-0.308†	(0.168)
Trade intensity			2.6296***	(3.043)	28.311***	(3.314)	14.149***	(3.511)
Specialization					-0.027†	(0.016)	-0.002	(0.013)
Capital controls							-1.539***	(0.240)
R^2	0.339		0.577		0.641		0.760	
Adjusted R^2	-0.430		0.051		0.239		0.485	
F statistics	0.441		1.097		1.594		2.761***	
N	226		221		179		179	

TABLE 15b: FIXED EFFECTS ESTIMATION EQUATION 4 EXCLUDING DENMARK SWEDEN AND THE UK								
Variables								
Intercept	1.490***	(0.134)	-3.992***	(0.964)	-5.490***	(1.139)	-2.629*	(1.165)
Primary deficit divergence	-0.053	(0.034)	-0.014	(0.032)	-0.008	(0.030)	0.027	(0.027)
Interest payments divergence	-0.173***	(0.040)	-0.078†	(0.040)	-0.098*	(0.040)	-0.051	(0.037)
Trade intensity			18.525***	(3.235)	24.838***	(3.450)	15.132***	(3.640)
Specialization					-0.035*	(0.015)	-0.016	(0.014)
Capital controls							-1.150***	(0.234)
R^2	0.454		0.595		0.666		0.741	
Adjusted R^2	-0.181		0.092		0.291		0.444	
F statistics	0.715		1.182		1.778**		2.497***	
N	226		221		179		179	

† p < .1 * p < .05 ** p < .01 *** p < .001

Appendix 11: Robustness checks – inclusion of other controls

TABLE 16a: FIXED EFFECTS ESTIMATION EQUATION 3 WITH LAGGED DEPENDENT VARIABLE								
Variables								
Intercept	0.227	(0.541)	-14.070***	(2.026)	-15.340***	(2.063)	-11.583***	(2.326)
Structural deficit divergence	0.179†	(0.091)	0,142*	(0.058)	0.101 †	(0.059)	0.108†	(0.054)
Cyclical deficit divergence	0.059	(0.433)	-0.576†	(0.287)	-0.714*	(0.285)	-0.717**	(0.259)
Trade intensity			48.718***	(6.806)	47.282***	(6.5834)	37.667***	(6.943)
Industrial similarity					0.054†	(0.028)	0.053*	(0.026)
Capital controls							-1.332**	(0.487)
Lagged Y	0.438*	(0.161)	0.085	(0.113)	0.100	(0.109)	0.014	(0.104)
R^2	0.629		0.857		0.869		0.895	
Adjusted R^2	-0.922		0.238		0.346		0.459	
F statistics	0.406		1.385		1.661†		2.051*	
N	172		172		156		156	
TABLE 16b: FIXED EFFECTS ESTIMATION EQUATION 4 WITH LAGGED DEPENDENT VARIABLE								
Variables								
Intercept	1.412***	(0.229)	-15.999***	(2.660)	-16.868***	(2.780)	-15.557***	(3.079)
Primary deficit divergence	-0.026	(0.058)	0.177**	(0.050)	0.167**	(0.050)	0.167**	(0.050)
Interest payments divergence	-0.203**	(0.067)	-0.204***	(0.045)	-0.191***	(0.046)	-0.170**	(0.051)
Trade intensity			54.367***	(8.292)	52.610***	(8.454)	49.103***	(9.165)
Industrial similarity					0.028	(0.027)	0.031	(0.027)
Capital controls							-0.588	(0.593)
Lagged Y	0.226	(0.143)	-0.084	(0.106)	-0.077	(0.106)	-0.107	(0.111)
R^2	0.693		0.869		0.870		0.874	
Adjusted R^2	-0.589		0.301		0.351		0.351	
F statistics	0.541		1.529†		1.677*		1.670†	
N	172		172		156		156	

† p < .1 * p < .05 ** p < .01 *** p < .001

TABLE 17a: FIXED EFFECTS ESTIMATION EQUATION 3 WITH TIME DUMMIES								
Variables								
Intercept	0.247	(0.253)	-0.694	(1.134)	-1.627	(1.370)	-0.512	(1.499)
Structural deficit divergence	-0.008	(0.025)	-0,003	(0.028)	-0.013	(0.028)	-0.005	(0.028)
Cyclical deficit divergence	-0.046	(0.122)	-0.066	(0.130)	-0.079	(0.134)	-0.191	(0.148)
Trade intensity			3.387	(4.025)	8.539*	(4.303)	6.675	(4.398)
Industrial similarity					-0.022	(0.014)	-0.017	(0.014)
Capital controls							-0.609†	(0.344)
Dummy period 2	0.355*	(0.146)	0.333*	(0.160)	0.153	(0.177)	-0.100	(0.226)
Dummy period 3	0.988***	(0.142)	0.909***	(0.174)	0.753***	(0.180)	0,425	(0.257)
R^2	0.694		0.697		0.712		0.726	
Adjusted R^2	0.360		0.349		0.427		0.436	
F statistics	2.082***		2.000***		2.458***		2.501***	
N	335		328		277		277	

TABLE 17b: FIXED EFFECTS ESTIMATION EQUATION 4 WITH TIME DUMMIES								
Variables								
Intercept	0.044	(0.181)	-0.194	(1.137)	-1.425	(1.343)	-0.492	(1.477)
Primary deficit divergence	-0.024	(0.024)	-0.026	(0.027)	-0.019	(0.027)	-0.004	(0.028)
Interest payments divergence	0.065†	(0.036)	0.074†	(0.038)	0.068†	(0.039)	0.074†	(0.039)
Trade intensity			0.923	(3.950)	6.700	(4.251)	4.854	(4.410)
Industrial similarity					-0.019	(0.014)	-0.018	(0.014)
Capital controls							-0.483	(0.325)
Dummy period 2	0.406***	(0.119)	0.364**	(0.137)	0.226	(0.150)	0.025	(0.201)
Dummy period 3	1.114***	(0.134)	1.069***	(0.169)	0.929***	(0.176)	0.696**	(0.235)
R^2	0.701		0.705		0.725		0.730	
Adjusted R^2	0.375		0.365		0.438		0.443	
F statistics	2.152***		2.075***		2.528***		2.548***	
N	335		328		277		277	

† p < .1 * p < .05 ** p < .01 *** p < .001

Appendix 12: Robustness check – different measure of dependent variable

TABLE 18a: FIXED EFFECTS ESTIMATION EQUATION 3 WITH TRANSFORMED CORRELATION COEFFICIENT (HP FILTERED DATA) AS DEPENDENT VARIABLE								
Variables								
Intercept	0.823***	(0.196)	-8.879***	(0.820)	-10.779***	(0.961)	-6.359***	(1.138)
Structural deficit divergence	0.018	(0.029)	0.064*	(0.025)	0.054*	(0.025)	0.106***	(0.024)
Cyclical deficit divergence	-0.202	(0.172)	-0.391**	(0.131)	-0.466***	(0.134)	-0.533***	(0.120)
Trade intensity			33.379***	(2.792)	34.370***	(3.107)	20.518***	(3.632)
Industrial similarity					0.037**	(0.013)	0.057***	(0.012)
Capital controls							-1.351***	(0.228)
R^2	0.229		0.601		0.632		0.707	
Adjusted R^2	-0.590		0.153		0.258		0.406	
F statistics	0.280		1.342*		1.691**		2.348***	
N	335		328		277		277	

TABLE 18b: FIXED EFFECTS ESTIMATION EQUATION 4 WITH TRANSFORMED CORRELATION COEFFICIENT (HP FILTERED DATA) AS DEPENDENT VARIABLE								
Variables								
Intercept	1.329***	(0.118)	-6.537***	(0.927)	-7.776***	(1.114)	-6.186***	(1.235)
Primary deficit divergence	-0.006	(0.029)	0.064*	(0.026)	0.059*	(0.026)	0.080**	(0.027)
Interest payments divergence	-0.280***	(0.034)	-0.198***	(0.032)	-0.196***	(0.034)	-0.169***	(0.035)
Trade intensity			25.587***	(2.997)	26.637***	(3.364)	21.362***	(3.816)
Industrial similarity					0.014	(0.013)	0.025†	(0.013)
Capital controls							-0.648**	(0.238)
R^2	0.456		0.644		0.664			
Adjusted R^2	-0.121		0.244		0.323			
F statistics	0.791		1.612**		1.949***			
N	335		328		277			

† p < .1 * p < .05 ** p < .01 *** p < .001

Appendix 13: Preliminary Thesis Report

Students Registration Number:
Jeanette Pjaaka Hauge
Pia-Suzann Valheim Skulevold

BI Norwegian School of Management - Preliminary Thesis Report

Synchronization of business cycles and shocks in EMU

Hand-in date:
17.01.11

Supervisor:
Catherine B. Arnesen

Campus:
BI Oslo

Exam code and name:
GRA 19002 Preliminary Thesis Report

Study Programme:
Master of Science in Political Economy

Content

Summary

The Preliminary Thesis Report forms the basis of our final Master of Science Thesis in Political Economy. Our problem definition is: Do shocks and business cycles constitute an explanation for the euro and debt crisis?

We have developed four research questions:

1. Is there correlation in business cycles between countries in the EMU?
2. Is there correlation in economic shocks between countries in the EMU?
3. Is there correlation in political shocks between the countries in the EMU?
4. Do shocks explain potential differences in business cycles in the EMU?

The three first questions will be answered by performing a quantitative correlation analysis of shocks (economic and political) and business cycles in the EMU member states. Our research will be a large N-study in which we include quarterly observations from 16 member states of the EMU from year 2000 to 2010. The fourth question will be answered by interpreting the results of the correlation analyses.

The Preliminary Thesis Report presents an open-economy model to explain mechanisms of interaction between countries in a global economy. Further on, the report presents the theory of an optimum currency area in order to explore some important aspects of the stability of a currency area. We also include a review of empirical analyses based on the OCA theory, and criticism that focus on the importance of autonomy in performing fiscal policy within monetary unions.

After the literature review, the report presents the history of the creation of EMU and introduces some of the unions' most important characteristics.

The models and theories presented in this report will form part of the analysis of findings in the final thesis.

1. Introduction

The thesis is inspired by the American columnist James Surowiecki in the *New Yorker* and his essay about the euro crisis (Surowiecki 2010, May 24). Surowiecki highlights German attitudes towards rescuing Greece: why should Germans pay for "Greek fecklessness"? Merkel's statements on bailout were followed by volatility in the market. Despite announced rescue packages to Greece and Portugal, the volatility did not seem to disappear. In November 2010, *The Economist* had various articles about the determinants of the euro crisis and how to save the euro. The articles focus on the differences between the Greek and Irish government's responses to the debt crisis. The Greek government begged for a bail-out, while the Irish government preferred to attempt an independent solution to the problem. We became interested in why two governments, facing what appeared to be a similar economic crisis, would want to react differently to improve their country's economic situation.

The euro crisis seemed to be subject to strong political influences in addition to the economic context. This turns to the age old discussion of the role the government should play in the market. Adam Smith's invisible hand seems to be on a downhill ride, while the Keynesian thought of government seems to be going uphill. The case of the euro crisis is unique, as the countries in trouble are restrained to pursue traditional economic tools to stabilize the economy. This is due to the membership in the European Monetary Union and overall the economic directives of the European Union. The fate of the economically troubled countries seems to be in the hands of politicians.

1.1 Problem definition and research questions

The current situation drew our interest to check for political and economic denominators for countries in the EMU. Our focus is on shocks and fluctuations in an open economy.

Problem definition:

Do shocks and business cycles constitute an explanation for the euro and debt crisis?

Research questions:

5. Is there correlation in business cycles between countries in the EMU?
6. Is there correlation in economic shocks between countries in the EMU?
7. Is there correlation in political shocks between the countries in the EMU?
8. Do shocks explain potential differences in business cycles in the EMU?

The three first questions will be answered by performing a quantitative correlation analysis of shocks (economic and political) and business cycles in the EMU member states. The fourth question will be answered by interpreting the results of the correlation analyses.

1.2 Research theme

The research question is of current interest. During the last year, the stability of the euro has been highly debated because of Greece's deficit that steered the country towards bankruptcy. In the wake of the EU's and IMF's bailout of Greece, the attention was drawn to Ireland, Spain and Portugal. When this is written, both Ireland and Portugal have received a rescue package.

Before the introduction of the euro, there were many skeptics to the introduction of a common currency for member states of the EU. In 1997, when it was still uncertain whether the economic and monetary union would begin in January 1999, Feldstein stated the following about the sustainability of the EMU:

> *My own judgment is that, on balance, a European Monetary Union would be an economic liability. The gains from reduced transaction costs would be small and might, when looked at from a global point of view, be negative. At the same time, EMU would increase cyclical instability, raising the cyclical unemployment rate* (Feldstein, The Political Economy of the European Economic and Monetary Union: Political Sources of an Economic Liability, 1997, pp. 32-33).

After years of growth and economic prosperity in the early years of the euro it seems that the trends are in favor of the skeptics.

There exists an extensive amount of research on the correlation of economic and political shocks in the EMU and the influence of shocks on the stability of the monetary union. However, this research is mostly conducted prior to the recent

euro crisis. We intend to contribute to existing research by including recent data in our analysis.

2. Definitions

2.1 Shocks

Economic shocks are unexpected events that affect the economy positively or negatively and thus cause deviations of output from its trend path, or as explained below, business cycles. The economic shocks can be either exogenous shocks or endogenous shocks, the latter being shocks caused by national policy-making (Buti and Sapir 1998).

2.2 Business cycles

Business cycles are economy-wide fluctuations in economic activity, meaning that the state of the economy repeatedly alternates between business cycle expansions characterized by rapid growth, and business cycle recessions characterized by declining economic activity (Sørensen and Whitta-Jacobsen 2010). Understanding business cycles may help economists to offer advice to policy-makers on the possibility of reducing business fluctuations through macroeconomic stabilization policy, that is, monetary and fiscal policy.

The American economists Arthur Burns and Wesley Mitchell (1946) emphasize several points in their definition of business cycles. Firstly, business cycles are characterized by a co-movement of a large number of economic activities. Secondly, business cycles are a phenomenon occurring in decentralized market economies. Thirdly, business cycles are characterized by periods of expansion of economic activity followed by periods of contradiction in which activity declines. Fourthly, a full business cycle lasts for more than a year. Lastly, business cycles are far from being strictly periodic although they repeat themselves. Thus, the task of business cycle theory is to explain the fluctuations around a growing time trend.

3. Literature review

This thesis is about an open economy with a common currency region. In this section, we present an open-economy model, which stems from the works of the economists Robert Mundell and Marcus Fleming. Further on, we present Mundell's theory of optimum currency areas (OCA) and literature pursuing this theory. We also take into account the criticism of the OCA theory which focuses on the importance of fiscal policy as a stabilizing mechanism.

3.1 Open economy model

Robert Mundell and Marcus Fleming developed a macroeconomic model for an open economy. Their model includes product and demand, and the money market. In addition, it takes into account balance of payments.

In an open economy, nations try to achieve both internal and external balance. The internal goals include keeping domestic production up to the economy's capabilities in order to achieve full employment of labor and other resources, to keep the economy growing over time, and to achieve price stability. The external goal is to achieve balance of payments at a national level (Pugel 2007). The model requires the assumption that the nation does not have influence on the world level of prices, rates and income. The prices are constant and there exists some slack in the economy. According to these assumptions, the supply will be equal to demand in equilibrium, which is expressed:

$$Y = C + I_d + G + (X - M)$$

Where Y denotes GDP, C denotes consumption, I_d denotes domestic investment, G denotes government spending on goods and services, and (X – M) denotes net export (export – import). Government spending on goods and services and decisions about taxations is treated as political decisions and constitutes the fiscal policy (Pugel 2007). Exports depend on the income of foreign countries.

The Mundell-Fleming model consists of three markets (Pugel 2007)[28]. The three markets give the level of domestic product, the interest rate and the overall

[28] In the article *Capital mobility and stabilization policy* Mundell presents a fourth market, the capital market. The capital market is in equilibrium when foreigners and domestic banks are

balance of payments. The economy will converge towards equilibrium in the first and second market, giving the level of GDP and interest rate. This will decide the level of payments (Pugel 2007).

The first market is the product-demand market. The aggregated demand for a nation's production depends on national income and the interest rate, since a high interest rate discourages spending (Pugel 2007). The investment-spending curve (IS-curve) shows all combinations of domestic product levels and interest rate levels when the domestic product market is in equilibrium. In a graphic presentation the horizontal axis gives values of GDP (Y), and the vertical axis gives values of interest rate (i). The IS-curve slopes downward. Given that national savings equals the sum of domestic investment and net exports, the equilibrium in the domestic product market is:

$$S(Y) = I_d + X - M(Y)$$

In this model, changes in the aggregate demand not caused by interest rate will cause a shift. The changes are usually called exogenous shocks and include: expansionary fiscal policy, an exogenous increase in household consumption, an exogenous increase in domestic real investment, an exogenous increase in export, and an exogenous decrease in imports (Pugel 2007, 531). These variables cause a shift in the IS-curve to the right.

The second market is the money-supply market. The supply side of the market for units of a nation's money is "money supply". The most important influences of the money supply are monetary policies (set by the central banks), and regulations and actions that determine the availability of bank deposits and currency in circulation (Pugel 2007, 531). The nominal demand of money depends on the nominal GDP (which is the price level times real GDP). The larger the domestic product is during a time period, the greater the amount of money balances that firms and households will want to keep on hand for larger level of transactions. The value of transactions should be correlated with the value of income or production (Pugel 2007, 532). There is an opportunity cost of holding money, namely the lost interest that would be gained by investing the money. Thus a high

willing to accumulate the increase in net debt of the government and the public (R. A. Mundell 1963).

interest rate will lower the increase for money (as it is an incentive to hold interest-earning bonds). How people decide to hold their money is termed the money demand function (Pugel 2007). The demand for nominal money is expressed:

$$L = L(PY,i)$$

This gives the equilibrium between money supply and money demand:

$$M^s = L(PY,i)$$

The liquidity-money curve (LM-curve) gives the combinations of production levels and interest rates for which the money market is in equilibrium, given the money supply, the price level and the money demand function. In this curve money demand is understood to be the demand for the most highly liquid financial assets in the economy (Pugel 2007). The LM-curve slopes upwards. Changes in any other factor than interest rates and domestic product represent exogenous shocks which cause shifts in the LM-curve. These shocks can be expansionary monetary policy, decrease in the country's average price level, and exogenous decrease in money demand (Pugel 2007). These changes will cause a shift to the left.

The third market is the foreign exchange market. It is also called balance of payments when the country's official settlements balance is used to reflect the net private trading between the country's currency and a foreign currency. The official settlement balance (B) is the sum of the country's current account balance (CA) and the country's capital account balance (KA).

The current account balance includes the net value of flows of goods, services, income and unilateral transfers, in other words the balance on goods and services trade. The current account balance must add to zero, because it is double entry book-keeping. The current account depends negatively on the domestic product, through the demand for imports. If the current account is in surplus, then the country's foreign assets are growing faster than its foreign liabilities. In this scenario the net foreign investment is positive, and the country is acting as a lender to other countries. In the opposite scenario, when the net foreign

investment is negative, the country is a net borrower from other countries (Pugel 2007).

The capital account balance includes the net value of flows of financial assets and similar claims.[29] The capital accounts are mostly assets traded; it is any flows of earnings on foreign assets. The international capital flows depend on the interest rates. The capital account excludes official international reserve asset flows (Pugel 2007).

The official settlement balance is expressed:

$$B = CA(Y) + KA(i)$$

The equation shows that an increase in the domestic product will lower the current account surplus. This is because of an increase in demand of foreign goods and services. A higher interest rate attracts foreign capital inflow. This is in the short run. Over the long run this effect will stop, and be reversed (Pugel 2007, 534).

The foreign exchange curve (FE-curve) shows all interest and production combinations in our country that result in a zero value for the country's official settlement balance. The FE-curve slopes upward. Examples of exogenous shocks that shift the FE-curve to the right are: an exogenous increase in exports, an exogenous decrease in imports, and exogenous changes that result in an increase in capital inflows or a decrease in capital outflows (Pugel 2007, 535).

If a country adopts a fixed exchange rate, any divergence between the IS-LM intersection and the FE-curve shows that official intervention is needed to defend the fixed exchange rate. The official settlements balance will not be zero, and official intervention to defend the fixed exchange rate results in official reserves transactions (Pugel 2007).

Official reserves transactions are money-like assets that are held by governments and that are recognized by governments as fully acceptable for payments between them (Pugel 2007). Official refers to assets held by monetary-type officials,

[29] IMF uses the term financial account for most of this part of the balance of payments.

including more than the government. The purpose of the distinction between official and non-official is to focus on the monetary task of regulating currency values. In the early twentieth century, gold was the major official reserve assets, today most countries use foreign exchange assets as official reserve assets. Foreign exchange assets are financial assets denominated in a foreign currency that is readily acceptable in international transactions (Pugel 2007, 361). The official settlements balance plus official reserves assets should equal zero.

$$B = CA + KA$$

$$B + OR = 0$$

When the Mundell-Fleming model is applied to regions, one will get a monetary union with fixed exchange rates and with a single monetary authority that conducts a single union-wide monetary policy. Thus, each country has given up on the ability to use exchange rates to correct for domestic imbalances.

3.2 Optimum Currency Areas

In 1961, the article "A theory of optimum currency areas" by Robert Mundell was published. In the article, Mundell argues that the optimum area for a single currency is a region. The argument is based on balance of payments.

Mundell stresses that a flexible exchange rate is often presented as a "device whereby depreciation can take the place of unemployment when the external balance is in deficit, and appreciation can replace inflation when it is in surplus" (Mundell, 1961, s. 657). In a currency area the exchange rate will be fixed, which leads to the question of what is the proper domain of a currency area.

The first part of the thesis concerns currency areas and common currencies. Mundell points out that a single currency implies a single central bank, which will challenge possible need of adjustment between countries. In a scenario with two countries and balance of payments equilibrium, there is a shift in demand from country B to A. The prices and wages are set in the short run. B must reduce real income, and if this cannot be done by trade, it must be done by reduction in output employment. Another scenario follows: several regions in a closed economy with one currency. Mundell explains that in this scenario, where the government

pursues full employment policy, the money supply will be increased. This will provoke inflationary pressure in A, creating a multiregional bias. “The pace of inflation is set by the willingness of central authorities to allow unemployment in deficit regions” (Mundell, 1961, s. 659). He then discusses the world economy, and concludes that inflation and unemployment between its members cannot be avoided, thus eliminating the world as an optimum currency area.

When discussing national currencies and flexible exchange rate, Mundell presents the argument that if there is a demand shift between two countries and with respective national currencies, the imbalance can be corrected for by either depreciation or appreciation. In this case, Mundell refers to an example of two countries where one currency fluctuates next to the other, and two regions without national boundaries. He explains that a shift in demand between the regions will lead to inflation or unemployment between the countries due to the exchange rate or a combination of both between the regions. The flexible exchange rate system will not correct balance of payments between regions, but between the two countries.

In the next scenario, Mundell says that if the regions had two currencies and the exchange rate was pegged, then there may not be inflation or unemployment in the case of shift in demand, but appreciation. He explains that the system of flexible exchange rates was propounded as an alternative to the gold standard, which has been argued to cause the great depression in 1929. However, because of the foreign trade multiplier[30], the common currency would face the same challenge. Interregional balance of payments would be invisible because of “the no escape from self-adjusting effects of interregional money flows” (Mundell, 1961, s. 660). If the case for flexible exchange rate is strong, then the flexible exchange rate should be based on regional currencies, not national currencies.

When discussing the practical application of his theoretical scenarios, Mundell stresses that the theory of international trade is based upon the Ricardian assumption that factors of production are mobile internally, but immobile

[30] Foreign trade multiplier can be described as the effect an increase in home demand has on a country's foreign trade.

internationally. He argues that the argument for flexible exchange rate is only as valid as the Ricardian assumption about factor mobility (Mundell, 1961, s. 661). In this scenario, the flexible interest rate would be effective if regions cut across boundaries or countries are multiregional and reorganize the currency on a regional level. The reorganization should be possible if it is accompanied by a *profound political change* as the currency is an expression of national sovereignty (Mundell, 1961, s. 661). Mundell then presents an argument on the common currency and Western Europe, and discuss whether the capital mobility in Europe is enough present for a fixed exchange rate. He refers to Meade (1957) who does not believe Europe is ready, and to Scitovsky (1958) who acknowledges that labor mobility and supranational employment policies must be improved, but believes that a common currency would stimulate capital mobility.

Mundell argues that the stabilization argument for flexible exchange rate is only valid if the world is divided in regions. A separate currency that fluctuates relative to other currencies, could be obtained of the factor mobility is high intraregionally, and it is immobility interregionally.

3.3 The Mundell trade-off

Others authors base their research on Mundell's theory of an optimum currency area. There are two sets of reasons, economic and political, which are offered for the development of a single currency and central bank (McNamara, 2006). The more trade and investment activity there is across an area, the more desirable a single currency should be. The economic benefits from a single currency and monetary institution derive from eliminated transaction costs of doing business in many different currencies and eliminated risks to business associates with fluctuating currencies. Whether the increased trade within the monetary union is a good thing or not depends on the relative importance of trade-creating effects, meaning the increased trade among the member countries, and trade diverting-effects, meaning the diversion of existing imports from countries outside the monetary union to countries inside it (Feldstein, 1997). However, the economic costs of giving up national currency might be substantially higher than the benefits. Moving monetary policy authority to a central bank means that monetary policy and the exchange rate cannot be tailored to fit national conditions but must

be collectively decided for the whole union. The trade-off between stabilization losses and transaction costs reductions is called the Mundell trade-off. Many researchers argue that a collective monetary policy is most appropriate if regional trade levels are high, labor is very mobile, economic shocks affect the different geographic parts of currency union in similar ways, there are compensating fiscal transfers across the monetary union to make up for uneven economic development.

3.4 Business cycles, shocks and stabilization

Business cycles and shocks are important aspects of the OCA theory. All economies experience fluctuations in economic activity, and these fluctuations may persist for periods of several quarters to several years. There is a definite tendency for the business cycles of developed economies to move together (Baxter 1995). When economic fluctuations in two or more countries are symmetric, the need for stabilization policy is also symmetric (Buti and Sapir 1998). On the other hand, when cycle is not synchronized, the needs for stabilization policies will differ. If economic fluctuations in countries within a monetary union are asynchronous, the member states will have little incentive to adopt common policies and to cooperate in the operation of the union.

Many authors have pointed out that the costs of a monetary union depend on how symmetric or asymmetric the shocks hitting the member countries are (Funke 1997). The reasoning for this statement is that the loss involved in not making use of the nominal exchange rate as an instrument of macroeconomic adjustment will be, *ceteris paribus*, smaller when shocks require little movement of the real exchange rate to establish equilibrium. Normally, this tends to happen when shocks are symmetric rather than asymmetric.

The literature on business cycle synchronization and shocks is extensive. Many authors have done comparisons between the business cycles in the states of the US and the countries of the EMU, the only monetary unions in the world today. For example, Bayoumi and Eichengreen (1993) found that demand and supply shocks are more correlated between states in the US than in Europe, and that the US states adjust more quickly to economic fluctuations than European countries.

Wynne and Koo (2000) also found that business cycles are more aligned in the United States than in the euro zone (of 11 member states).

Other researchers have looked at changes in correlation patterns over time. One example on this issue is the findings of Furceri and Karras (2006). Analyzing cyclical output for the EU-15 countries they found that business-cycle synchronization has increased for many countries from 1980–1991 to 1992–2003.

The literature has also considered the implications of the EMU for fiscal policy (Furceri & Karras, 2008). The EMU does not have a central fiscal authority. Nevertheless, much literature has shown that the ability of the national policies of the EMU member states to smooth asymmetric shocks is modest. This means that business-cycle synchronization is very important because it reduces the probability of asymmetric shocks and because it is reasonable to suppose the European Central Bank to implement stabilizing intervention with caution when responding to collective shocks.

The literature is much thinner on whether the single currency has actually made the EU countries more or less similar in business-cycle terms. Literature has not converged on a single interpretation of the likely effects of the creation of a monetary union on the business cycles of EMU countries (Altavilla, 2004). Some authors argue that increasing intra-EMU trade along with decreasing capital controls leading to a more integrated economic system will result in a homogeneous currency area where asymmetric shocks are hard to verify. Others, like Krugman (1991), assert that the business cycles of the EMU countries will become less synchronized as the result of a specialization process followed by the increasing commercial integration of the participating economies. However, Furceri and Karras (2008) found that all countries in their EU sample are better synchronized with the EMU-wide economy in the post-EMU period than they were before the euro. They also showed that this increase in synchronization is present in all components of aggregate demand and supply, but is more pronounced in the trade components, that is imports and exports. In addition, they showed that the increase in trade within the EMU area is at least partly responsible for the increase in cyclical synchronization.

3.5 Fiscal policy

Cooper and Kempf (2004) argue that high correlation of shocks across countries is not a necessary condition for the existence of net gains to a monetary union. In their opinion, the emphasis on the Mundell trade-off is misplaced because it ignores the significance of fiscal policy in determining the welfare gains from a monetary union. Thus, the Mundell trade-off between stabilization losses and transaction costs reductions from a common currency disappears once national fiscal policies are taken into account, and they stress the importance of the interactions between fiscal and monetary policies. Taking fiscal policies into account, they find that a monetary union is welfare increasing regardless of the correlation of shocks.

Their multiple-country overlapping generations model has two key ingredients: risk sharing between unemployed and employed agents through unemployment insurance financed by income taxes (stabilization policy), and agent-specific taste shocks. Whether there is a stabilization loss from a monetary union depends on how well risks can be shared once monetary policy is delegated to a single central bank. Hence, the existence of country-specific fiscal policy instruments is the key. Agent-specific taste shocks are to create potential gains from reduction in trading frictions.

In their theoretical analysis of a monetary union with fiscal policy incorporated into the analysis, the two co-authors find that, if the central bank holds the money supply constant and fiscal policy is used for internal stabilization, the risks are efficiently allocated within and across the economies, and the transactions gains from a common currency are realized without a stabilization loss. This means that a monetary union is welfare increasing regardless of the correlation of shocks. The net gains to a monetary union will depend on the design of fiscal and monetary institutions.

To correct for imbalances in a specific country within a monetary union, fiscal policy is the only mechanism that can be used. According to Pugel there are two concerns with a monetary union without a common fiscal policy (Pugel 2007,

628). Since it is not a union-wide fiscal policy, there are few "automatic stabilizers" across countries. Higher tax revenues from the growing countries are not automatically shifted to the recession countries through lower taxes and larger spending. The second concern is if nations use their fiscal policy effectively. Pugel stresses that a major constraint is political, since fiscal changes can only be done through political decision-making. The constraints take the form of the process of enacting changes and the bureaucratic process of implementing them.

4. Economic and Monetary Union of the European Union

Monetary integration has two essential components: exchange rate union (one currency or fixed exchange rates) and capital market integration (El-Agraa, 2007). In the world today, there only exist two monetary unions, the dollar in the United States of America and the euro in the Economic and Monetary Union of the European Union. The EMU is special because it exists of different national states, while the US is one federation. Thus, unlike other monetary unions, the EMU does not have a central fiscal authority, but 17 member states[31] of the EMU perform fiscal policy individually with some restrictions.

4.1 The creation of EMU

4.1.1 The Werner Report

The 1957 Treaty of Rome has little to say about money. This is because the post-war order for the market economies of Europe, North America and Japan was founded on the Bretton Woods system which provided the international framework for currency stability, with gold and the US dollar as the predominant monetary standards (The European Commission 2011a).

From 1967, the prevailing world order for exchange rates, established as part of the Bretton Woods agreement in 1944, began to fall apart (El-Agraa and Mayes 2007). The European Community (EC) looked at the possibility of trying to create a locally stable system with the same sort of architecture for itself. At the

[31] The euro zone consists of Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia and Spain. Estonia became a member in 2011.

European Summit in Hague in 1969, Heads of State and Government of the EC agreed to prepare a plan for economic and monetary union. They set up a committee led by Pierre Werner, at that time prime minister of Luxembourg, to consider the issues involved. The committee presented the final version of their plan, the Werner Report, in October 1970. This was endorsed by the Council in February 1971. The Council decided that the EMU could be attained during that decade, if the plan had the permanent political support of the member governments (El-Agraa and Mayes 2007). However, the EMU project experienced serious setbacks from the crises arising from the non-convertibility of the US dollar into gold in August 1971 and from rising oil prices in 1972. An attempt to limit the fluctuations of European currencies, using a 'snake in the tunnel'[32], failed.

4.1.2 The European Monetary System

A new proposal for EMU was put forward in 1977 by the then president of the European Commission, Roy Jenkins. It approved in a limited form and launched as the European Monetary System (EMS) in March 1979, with the participation of all Member States' currencies except the British pound, which joined later in 1990 but only stayed for two years. This system was based on stable but adjustable exchange rates of the national currencies in relation to the newly created European Currency Unit (ECU). Currency fluctuations were controlled through the Exchange Rate Mechanism (ERM). The EMS was a radical innovation because exchange rates could only be changed by mutual agreement between participating Member States and the Commission (The European Commission, 2011b).

4.1.3 The Delors Report

At the EC summit in Hanover in 1988, the heads of state decided to appoint a committee chaired by Jacques Delors, then president of the EC Commission, to study and propose concrete stages leading towards a monetary union (El-Agraa and Mayes 2007). The Delors Report pointed out that the creation of the EMU

[32] 'The snake in the tunnel' was an attempt at creating a single currency band for the European Economic Community (EEC), essentially pegging all the EEC currencies to one another. The Smithsonian agreement set bands of ±2.25% for currencies to move relative to their central rate against the US dollar. This provided a tunnel in which European currencies to trade.

must be seen as a single process in three stages which led to the ultimate goal of a single currency with an independent European Central Bank, and that the decision to enter upon the first stage should commit a member state to the entire process. Further on, the EMU would require a common monetary policy and a high degree of compatibility of economic policies and consistency in other policy areas, particularly in the fiscal field (El-Agraa and Mayes 2007).

The three stages towards the EMU were:
Stage 1 (1990-1994): This stage included the completion of the internal market and the removal of restrictions of further financial integration.
Stage 2 (1994-1999): This stage included the establishment of the European Monetary Institute to strengthen central bank co-operation and prepare for the European System of Central Banks (ESCB). In addition, it included defining the future governance of the euro area and achieving economic convergence between the member states.
Stage 3 (1999 and continuing): This stage included fixing the final exchange rates and transition to the euro, establishing the ECB and ESCB with independent monetary policy-making, and implementing binding budgetary rules in the member states (The European Commission, 2011c).

4.1.4 The Maastricht Treaty

The Madrid European Council of June 1989 decided to proceed to the first stage of EMU in July 1990 and the Treaty of the European Union (TEU) or the Maastricht Treaty set the 'Maastricht convergence criteria' that member states would have to meet in order to adopt a single currency (see 4.2.4). The heads of state and government at the European Council at Maastricht in December 1991 approved the TEU in which it also was decided that Europe would have a stable single currency by the end of the century.

4.2 Governance of the EMU and the European Central Bank

The European Central Bank (ECB) makes the monetary policy for the EMU member states. Together with the national central banks the ECB make up the European System of Central Banks (ESCB). The Treaty Establishing the European Community (TEC) gives the ESCB power to 'define and implement

monetary policy of the Community', and ensures that the ESCB will act without instruction 'from Community institutions or bodies, from any government of a Member State, or from any other body'. This means that the Governing Council of the ESCB is the sole judge of what it should and should not do. Technically, monetary policy actions are taking by the Governing Council of the ESCB[33], but in practice, monetary policy decisions are communicated by the president of the ECB or by its press office. Therefore, it is convenient to ascribe the responsibility of the monetary policy of the euro zone to the ECB (Jones, 2006). The ECB aims to provide a stable economic environment across the EU (McNamara, 2006).

4.2.1 The powers of the ECB

In the past two decades, there has been an increasing consensus in Europe on the importance of price stability and central bank independence. This consensus has been an important underlying contributor to exchange rate stability in advance of EMU (McNamara, 2006). There is a belief that monetary policy cannot have any long-lasting influence on real economic variables such as output growth and employment. The executive board of the ECB developed a two-track operational approach: monetary targeting (amount of money is measured) and inflation targeting.

4.2.2 Rules governing the euro zone

The rules governing the euro zone are unambiguous. The TEC declares that 'the primary objective' of the common monetary policy is 'to maintain price stability' (Jones, 2006). Thus, the ECB goal when managing the interest rate is to maintain low inflation. The TEC also mentions the possibility that euro zone monetary policy will be used to 'support the general economic policies of the Community'. However, any such action should be 'without prejudice to the objective of price stability' (Jones, 2006).

The ECB has defined price stability according to two different monetary indicators: the growth of monetary liquidity and the expected rate of inflation. Liquidity growth should be measured against a reference value of 4,5 per cent

[33] The Governing Council of the ESCB includes representatives of each member state central banks in the euro zone, plus the six members of the executive board of the ECB.

increase *per annum* and medium-term estimates should place the inflation rate below 2 per cent *per annum* (Jones, 2006). If the liquidity growth and inflation are above target, the ECB may see a threat to price stability and respond by raising interest rate, while if the liquidity growth and inflation are below target, the ECB may lower interest rate in order to encourage the pace of economic activity in the euro zone.

4.2.3 Exchange rate policy

The rules governing exchange rate policy are most notable for their absence. The Treaty on European Union was unclear in the area of exchange rate policy making for the euro than for monetary policy. What matters here concerns relations between the euro and third countries' currencies. This means relations between the euro and the dollar (Jones, European Macroeconomic Governance, 2006). The presumption was always that an explicit exchange rate policy would not be necessary given the relative size of the euro zone and its limited exposure to the outside world. Exchange rate policy matters only as it impacts on the priority given to maintain price stability (Taylor 2004). The decision to enter into a formal exchange rate agreement with non-EU countries is the responsibility of The Economic and Financial Affairs Council (Ecofin), and any such agreement would be binding on the ECB. The Council could formulate general guidelines to limit exchange rate movements. However, these guidelines orientations shall also be without prejudice to the primary objective of the ESCB to maintain price stability (Jones, 2006).

4.2.4 Fiscal policy

In a country, economic and monetary integration would involve having a countrywide fiscal policy as well as a single monetary policy. However, in the case of EMU, the EU has not attempted this level of integration. The centralized budget amounts to only around 1 per cent of EU GDP and at this level cannot constitute a real macroeconomic policy instrument (El-Agraa, 2007). The EU adopts a different approach, which is to constrain the ability of the member states to run independent fiscal policies. These constraints are to avoid excessive fiscal deficits and 'to respect the medium-term budgetary objective of close to balance or in surplus' (Jones, European Macroeconomic Governance, 2006, p. 332). There

are three types of constraints: the Maastricht criteria, the Stability and Growth Pact, and annual settings of Broad Economic Policy Guidelines.

The Maastricht criteria were designed to ensure that a member state's economy was sufficiently prepared for the adoption of the euro. These are constraints designed to impose prudence on fiscal policy so that no one country's debt can start to raise the interest rates or lower the credit rating of the other EMU countries. These 'fiscal convergence criteria' limit the budget deficit to be below 3% of GDP and the gross public debt to be below 60% of GDP. The deficit criterion implicitly amounts to a current balanced budget rule, that is, the current revenues should equal current expenditure (Corsetti and Roubini 1995).

The Stability and Growth Pact operationalizes the membership requirements for the continuing behavior of the member states inside EMU. The coordination among the member states takes place through the framework of Ecofin, assisted by the Commission, and includes the ability to impose financial penalties on member states that do not adhere to the prudent limits. A government whose budget deficit exceeds 3% of GDP or whose public dept exceeds 60% of GDP may be required to correct its situation, and may be subject to sanctions and penalties if it fails to do so.

Annual setting of Broad Economic Policy Guidelines: Every year there is discussion among the member states to try to set a framework for policy consistent with the longer-term objectives of the EU and an informal dialogue between the fiscal and monetary authorities

5. Methodology

In order to define the method of the thesis, we repeat the problem definition and the research questions.

Problem definition:
Do shocks and business cycles constitute an explanation for the euro and debt crisis?

Research questions:

1. Is there correlation in business cycles between countries in the EMU?
2. Is there correlation in economic shocks between countries in the EMU?
3. Is there correlation in political shocks between the countries in the EMU?
4. Do shocks explain potential differences in business cycles in the EMU?

The three first questions will be answered by performing a quantitative correlation analysis of shocks (economic and political) and business cycles in the EMU member states. Below we explain how we plan to develop this study. The fourth question will be answered by interpreting the results interpreting of the correlation analyses.

5.1 Variables

5.1.1 Measuring business cycles

Literature defines two main types of business cycle: the growth (or deviation) cycle and the classical cycle. The growth cycle defines alternating periods of expansion and contraction in macroeconomic activity with respect to deviations of the GDP growth rate from an appropriately defined trend rate of growth. The classical cycle, instead, identifies turning points on the basis of an absolute fall or rise in the value of GDP (Sørensen and Whitta-Jacobsen 2010).

Interesting variables to measure is thus:

- Real GDP
- GDP growth

Alternative variables are:

- Consumption
- Investment
- Labor input

As stated above, the task of business cycle theory is to explain the fluctuations around a growing time trend. There is no single correct way of separating the cyclical component of a variable measuring business cycles, like GDP, and the growth trend. We need a method which allows for variation over time in the

underlying growth trend, but which nevertheless ensures that the short-term fluctuations are categorized as temporary cyclical deviations from the trend. One such method is the so-called Hodrick-Prescott filter[34], named after the American economists Robert Hodrick and Edward Prescott (Sørensen and Whitta-Jacobsen 2010). We plan to use this method when measuring business cycles. We need to keep in mind that researchers have found that the HP filter tends to give imprecise estimates of the trend at the end-point series. For this reason, we plan to exclude the first and the last 12 estimated cyclical components of all quarterly time series, in line with common practice (Sørensen and Whitta-Jacobsen 2010).

5.1.2 Measuring shocks

We begin with the premise that any empirical analysis of the correlation of shocks across countries or regions is intimately tied up with the challenge of identifying the actual shocks that were experienced.

The shocks will be operationalized into variables. As stated above, shocks can be economic and political. We operationalize the variables by identifying the exogenous shocks that cause shifts in the three markets in Mundell and Fleming's model.

In the first market shocks can be:

- Expansionary or restrictive fiscal policy
    - Government spending
    - Tax
- An exogenous increase or decrease in household consumption
    - Consumer expectations about the future of the economy
    - Wealth
- An exogenous increase or decrease in domestic real investment
    - Business expectations about the future of the economy
- An exogenous increase or decrease in export
    - Foreign income
    - Shift in tastes of foreign consumers towards the country's products

[34] For a full explanation of this method see Sørensen and Whitta-Jacobsen (2010: 361-366).

    - The international price competitiveness of the country's products
- An exogenous decrease or increase in imports
    - Shift in the tastes of local consumers away from imported products
    - The international price competitiveness

In the second market the shocks can be:

- Expansionary or restrictive monetary policy
    - Increase or decrease in the money supply
- Decrease or increase in the country's average price level
    - Consumer price index
- Exogenous decrease or increase in money demand
    - Possible to borrow money

In the third market exogenous shocks can be:

- An exogenous increase or decrease in exports
    - Changes in foreign income
    - Shift in tastes of foreign consumers towards the country's products
    - Improvement in the international price competitiveness of the country's products
- An exogenous decrease or increase in imports
    - Shift in the tastes of local consumers away or towards from imported products
    - Improvement in the international price competitiveness of the country's products
- An exogenous changes that result in an increase in capital inflows or a decrease in capital outflows
    - Changes in the foreign interest rate
    - Changes in the expected rate of appreciation or depreciation of the country's currency
    - Changes in the perceived riskiness if investing in the country's financial assets

From this identification we will in the final thesis classify shocks into economic and political categories.

5.2 Data and databases

Due to the fact that there exits an extensive amount of research about business cycles and shocks in relation to monetary unions, it is appropriate to conduct a quantitative study. Our research will be a large N-study in which we include observations of the aforementioned variables from 16 member states of the EMU.[35] We plan to use quarterly time-series data for the EMU member countries from the time interval 2000- 2010.[36]

Various public databases may provide us with the requested data. One of them is the statistic database of the International Monetary Fund. The IMF publishes a range of time series data on economic and financial indicators.

Another database that may provide us with necessary information is Eurostat. This is the statistical office of the European Unions, and it offers a range of statistics for the EMU countries.

The statistics provided by the European Central Bank may also be an appropriate database for our study.

6. Project progress

The final deadline for the thesis is set to September 1st 2011.

January 17th:	Due date preliminary thesis report
February:	Finish literature review and state of the art, and finish theory and methodology chapters
March:	Collecting data, and begin quantitative analysis
April:	Conduct quantitative analysis
May:	Finish quantitative analysis, review theory and methodology chapters
June :	Conclude analysis

[35] Estland will be excluded because the country became a member of the EMU in 2011.
[36] We take into account that Cyprus became a member in 2008, Greece in 2001, Malta in 2008, Slovakia in 2009, and Slovenia in 2009. Data from these countries will only be included from the year they entered into the EMU.

July: Write final thesis

September 1st: Final deadline for handing in thesis

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