ΟΙΚΟΝΟΜΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ
ΤΜΗΜΑ ΔΙΕΘΝΩΝ ΚΑΙ ΕΥΡΩΠΑΪΚΩΝ ΟΙΚΟΝΟΜΙΚΩΝ ΣΠΟΥΔΩΝ
ΜΠΣ ΣΤΗΝ ΕΥΡΩΠΑΪΚΗ ΟΙΚΟΝΟΜΙΚΗ ΠΟΛΙΤΙΚΗ

Business Cycles Fluctuations Determinants in the EMU: A Fixed-Effects Panel Data Analysis

Παπαγεωργίου Θεοφάνης
(Α.Μ. 4100029)

Επιβλέπουσα καθηγήτρια: Κατσίμη Μαργαρίτα

Αθήνα, Δεκέμβριος 2011

Acknowledgements

To everyone it may concern,

I would like to thank my supervisor, M. Katsimi, Assistant Professor of AUEB, for her guidance and useful comments and suggestions. I would also like to thank Professor P. Michaelides, Assistant Professor of NTUA, for his mentoring, fruitful discussions and hints on previous drafts. Of course, all remaining errors and inaccuracies remain to our responsibility.

Contents

Abstract:

This master thesis purposes to address some fundamental questions concerning the determinants of the business cycles fluctuations. In a public policy context the relationship between fiscal policy variables with these fluctuations are of particular importance. Furthermore, in a monetary union fiscal policy is the foremost tool to deal with country-specific fluctuations. This thesis is trying to acknowledge the particular importance of fiscal policy in the EMU context estimating panel data equations for the twelve countries of the EMU for the years 1995-2009. Additionally, other variables such as trade openness and the dummy variables, elections and EMU formation are added to extract a clearer image. Also, aspects of divergence and synchronization are extracted through using fixed-effects analysis. To that end, various econometric techniques were used among others EGLS, GLM, spectral analysis, fixed-effect models. Synchronization issues recurrently come up, suggesting a core-periphery distinction among the EMU countries. Social benefits are found to be the most effective fiscal variable in the governments' hands, while, capital expenditures and indirect taxes are the most pro-cyclical variables from the variable set. Openness is found to be counter-cyclical, in accordance with at least a part of the literature. Also, elections are found to be pro-cyclical giving evidence for the existence of opportunistic political business cycle. Next, we found that EMU countries exert different periodicities in the movements of output. The different periodicities make common monetary policy inappropriate and thus make countries in a monetary union asynchronous. At the same time differences in the effectiveness of fiscal policy variables in countries of the EMU, measured by deviations from the equation – fixed effects – make the picture even vaguer. More precisely the countries that form the acronym PIGS are found with the largest deviation from the business cycle determination. This fact has severe implications against the neoclassical hegemony of budget cuts as a response to the current crisis. In any case, a core-periphery distinction is suggested among the participants of the EMU in terms of deviations, as already suggested from the literature. Of course, our findings deserve careful screening given that business cycle synchronicity is an important indicator of the optimality of monetary union.

I. Introduction

Business cycle theory has attracted increasing attention among economists since the very beginning of *Economics* as a science. Business cycles volatility is considered an important determinant of a wide variety of economic outcomes (Giovani and Levchenko 2008). Numerous studies identify the effects of business cycles volatility on long-run growth (Ramey and Ramey 1995), welfare (Pallage and Robe 2003, Barlevy 2004), as well as inequality and poverty (Gavin and Hausmann 1998, Laursen and Mahajan 2005). There is clear evidence that output volatility has decreased in most countries, doubts remains as to the determining factors in the moderation (Cavallo 2008) even though great attention has been shown on the business cycle determinants (see for example Ramey and Ramey 1995, Barro and Sala-i-Martin, 1995; Temple, 2000; Levine and Renelt, 1992; Levine et al, 2000). Burns (1960) was suggesting that increase in stability may be attributed to changes in the composition of output, in the extent of automatic stabilizers and in opportunities of consumption smoothing. Output volatility has greatly declined over the past three decades compared to that of the previous decades, and this period of decreasing volatility is often called 'The Great Moderation', while there is consensus on the phenomenon, there is not much consensus on the possible causes. Furthermore, Gonzalez-Cabanillas and Ruscher (2008) argue that the analysis of the phenomenon of 'Great Moderation' has mainly focused on the US economy and has produced relatively little evidence on the euro area.

Business cycles fluctuations are often related to trade openness, resulting from the surging growth in word-trade the last decades. The issue of trade openness and business cycles volatility may shed light on the debate of specialization in a monetary union and thus on synchronization issues. Albeit, the pro(counter)cyclical character of trade openness remains open (see for example Rodrik 1998; Easterly, Islam and Stiglitz 2001; Kose, Prasad and Terrones 2003; Bejan 2006; Bekaert, Harvey and Lundblad 2006 and Cavallo 2008) same as the debate of specialization in the EMU. Furthermore, business cycles are often attributed to fiscal policy variables. In the meantime, a huge literature shows how fiscal variables co-move with the output cycle (see for example Lane 2003; Galli and Perotti 2003; and Alesina, Campante and Tabellini 2008, amongst many others). This direction of causality focuses on the reaction of fiscal policy variables to business cycles fluctuations.

On the determinants of output growth volatility; Kose et al. (2003) argue that business cycles volatility differs from emerging markets to developed ones and at the same time output growth volatility has declined in the decade of the 90's relatively to the precedent ones. Business cycle volatility is also related to financial integration, and in that way financial openness, departing from the surge in the volume of financial flows; without reaching a consensus on the operator of the relation. Also, business cycle volatility may be explained by the terms of trade shocks (Kose 2001) and by the role of foreign demand shocks (Senhadji 1998). Furceri and Karras (2007) attribute business cycle volatility to the size of the population of a country and thus to economies of scale.

According to the IMF, (World Economic Outlook 2005) the determinants of output volatility may be broadly grouped in four categories: namely, the stability of macroeconomic policies (higher volatility in fiscal policies increases output volatility Fatás and Mihov 2003), trade and financial integration (there is no clear trend in their effects on output volatility), financial sector development (countries with more developed financial sectors, measured as higher initial ration of private sector credit to GDP have significantly lower output volatility, see for example Easterly, Islam, and Stiglitz, 2000; Kose, Prasad, and Terrones, 2003; and Raddatz, 2003), and finally the quality of institutions (countries with poor quality institutions conspire to weaken policies and undercut economies' reliance to exogenous shocks, though in a statistically insignificant way see for example Acemoglu, Johnson, Robinson, and Thaicharoen, 2003). Also, other structural characteristics are to be cited autonomously including the volatility of terms of trade, the flexibility of exchange rates).

Also, the issue of the synchronization among the counterparts of a monetary union may be related with the determinants of business cycles unveiling the importance of a common fiscal policy in the Union. Among other topics, business cycles synchronization in a currency area, such as the EMU, has induced a long standing controversy. Until now, the issue of business cycle synchronization has been mainly focused on aspects such as industrial specialization and trade integration among the counterparts of the Union.

In that framework a question of great importance is whether fiscal variables are related to business cycles volatility. Furthermore, the operator on the relationship between fiscal policy variables and business cycles is of great importance to evaluate fiscal policy in terms of pro(counter)cyclicality. Magud (2008) argues that the smoothing effects of fiscal policy on business cycles fluctuations depends on the initial conditions at the time of a positive/negative shock, expansionary fiscal policy may be expansionary or contractionary in terms of output according to the fiscal fragility of the government. In other words, an expansionary fiscal policy will not always be expansionary in terms of output and could end up being contractionary. Also, the question of whether the formation of the EMU has led to sharper business cycles is of great interest. Gonzalez-Cabanillas and Ruscher (2008) argue that the 'Great Moderation' of the EMU business cycles may be attributed to particular improvements in the conduct of monetary policy and to more powerful automatic fiscal stabilizers.

The current debt-crisis in the countries of the EMU suggests various readings for the crisis beginning from the neoclassical conception of the "problematic" countries to the more Keynesian reasoning of the EMU architecture. Checking for the implications of fiscal policy, in terms of business cycles volatility, sheds light on the particular character of the crisis. At the same time, it provides scientific reasoning for/against the nature of public spending that brings up crisis phenomena, along with the role of the state in alleviating/bringing crisis. In other words it provides answers to questions of optimal public and fiscal policy.

The debate on the synchronization in the EMU goes as follows: on the one hand Krugman (1991) argues that increasing integration will lead to regional concentration of industrial activities which, in turn, will lead to sector- (or even region-) specific

shocks, thereby increasing the likelihood of asymmetric shocks and diverging business cycles. In this spirit, Kalemli-Ozcan et *al.* (2001) argue that increased economic integration leads to better income insurance through greater capital integration which will, in turn, lead to a more specialised production structure and an increase in trade and therefore less synchronised business cycles. Papageorgiou et al. (2010) find a clear-cut decrease in the synchronization of the counterparts of the Union after its formation.

On the other hand, there is the view expressed, among others, by Frankel and Rose (1998), Coe and Helpman (1995), suggesting that the removal of trade barriers will lead to more trade such that demand shocks are more easily transmitted across countries. In this approach, economic integration leads to more symmetric fluctuations which will, in turn, lead to more synchronised business cycles. In a similar vein, Inklaar et *al.* (2008) argue that as economic policies in the euro area are likely to become even more similar, business cycle synchronization will increase. See also Trichet (2001). Moreover, another question of great interest is the possible existence of a core–periphery distinction among European countries' business cycles (Dickerson et *al.* 1998), or a possible grouping of the countries in clusters (Camacho et *al.* 2006). Kose and Yi (2003) argue that the theoretical impact of trade integration on macroeconomic volatility depends greatly on patterns of trade specialization and the nature of shocks. In the nexus of Krugman country specific shocks could lead to higher output volatility, whereas in the nexus of Frankel and Rose (1998), previously elaborated in Razin and Rose (1994) the volatility of output could decline if increased trade is associated with increased intra-industry specialization across countries. On the whole, "these results indicate that the impact of trade integration on volatility is also ambiguous in theory" (Kose et al., 2003, p.5).

Elections are related with fiscal policy building a wide literature called 'political business cycles' (see for example Nordhaus 1975; Rogoff and Sibert 1988; Rogoff 1990; Persson and Tabellini 1990; Rosenberg 1992). In that context, elections spot an increase in current expenditures and/or a decrease in tax revenues especially in direct taxation. Katsimi and Sarantides (2011) find that elections spot a shift towards higher current expenditures at the cost of public investment. Efthyvoulou (2011) argues that the formation of the EMU has led to decreased partisan cycles. A matter of importance in our understanding is the relation of elections to the volatility of business cycles taking into account that elections are positively related with current expenditures and negatively related to taxation.

This master thesis is bridging the gap in the literature in the following ways. Firstly it investigates business cycles determinants among production and fiscal variables, for the countries that are forming the EMU, for the 1995-2012 time-span. Fiscal policy variables are checked for pro(counter)cyclicality suggesting fiscal policy implications. Secondly, it checks the consequences of the formation of EMU on the volatility of the business cycle. Thirdly it relates elections events with business cycles volatility. Also, the variables investigated are checked under different mathematical hypotheses improving the robustness of the results. Finally, it provides a framework for the conceptualization of the current crisis in terms of fiscal policy variables.

The remainder of this master thesis is structured as follows: section 2 provides a review of the literature; section 3 sets out the methodological framework; section 4 presents the empirical results; section 5 analyses the empirical findings; finally, section 6 concludes the master thesis.

II. Review of the Literature

We may define three broad literal categories that are connected with the current master thesis. Firstly, the literature of the business cycles volatility determinants and the role of fiscal policy and trade openness. Secondly, the relation of fiscal policy with elections namely the political business cycles literature. Thirdly, EMU literature including core-periphery issues and synchronization within the currency area.

i. A Brief Business Cycles Review

The business cycle relates to repetitive fluctuations of expansion and recession in an economy. Over the longer term an economy would normally experience a positive growth in output. Therefore, the business cycle can be defined as the 'short-term fluctuation of total output around its trend path' (Begg et al, 1997, 518). According to Burns and Mitchell (1946) business cycles are defined as:

> "Business cycles are a type of fluctuation found in the aggregate economic activity of nations that organize their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle; the sequence is recurrent but not periodic; in duration business cycles vary from more than a year to ten or twelve years; they are not divisible in shorter cycles of similar characteristics with amplitudes approximating their own." (Burns and Mitchell 1946, p.3)

Business cycles are normally categorized into two brief groups: classical business cycles and growth cycles (Cooley 1995). Growth cycles are measuring the fluctuations of the growth rate around a long-run trend; classical business cycles are focusing on the fluctuations of the level of the total economic activity. Our analysis is making use of the classical analysis.

According to the affiliations of a school of thought and the basis on which it has been built there are three basically reasons for the existence of cyclical movements in the output variable. The Keynesian school of thought based on the model of the accelerator – multiplier attributed fluctuations of the output to the variations of investment in an economy. Here, investment policy is based on the expectations which are product of past experience. The simple model of the accelerator – multiplier explains cyclical fluctuations with the variations between investment demand and effective demand. In the neoclassical thought, even if crisis phenomena are out of the scope of equilibrium where individuals are rational, cyclical fluctuations may be related to the state intervention. In the neoclassical nexus every fluctuation in output is a fluctuation of the potential output (Long & Plosser, 1983). Cyclical fluctuations are related to the monetary policy; abrupt fluctuations in the aggregate demand are a

consequence of abrupt fluctuations in the money supply. Finally, a mingle between neoclassical and keynsian oriented analysis is the real business cycles analysis. Cyclical fluctuations are attributed to shocks, abrupt technological changes or changes in the productivity of the factors of an economy.

ii. Openness and Business Cycles Volatility

In an early study, Razim and Rose (1994), link business cycle volatility to barriers on international mobility of capital and goods. Their empirical results show that a strong and significant relation between the volatility of consumption, output and investment with the degree of capital mobility and the degree of goods mobility exists. The reason suggested is the common nature and persistence of shocks worldwide.

Bejan (2006) find a negative relationship between trade openness and business cycle volatility should government size and some measures of external risk, such as terms of trade volatility and export concentration index are controlled. Also, Cavallo (2008) presents empirical evidence that suggests that, after appropriately accounting for the likely endogeneity of trade, the net effect of trade openness on output volatility is stabilizing; thus more open economies are not necessarily more volatile, as is commonly thought.

Kose, Prasad and Terrones (2003) mention that financial openness measured as a ratio of gross capital flows to GDP is associated with an increase in the ratio of consumption volatility to income volatility with a non-linear way. Also, they report that business cycles volatility differs from emerging markets to developed ones and at the same output growth volatility has declined in the decade of the 90's relatively to the precedent ones.

Beckaert, Harvey and Lundblad (2006) examine the effects of both equity market liberalization and capital account openness on real consumption growth variability. They show that financial liberalization is mostly associated with lower consumption growth volatility. The results are robust, controlling for business-cycle effects, economic and financial development, the quality of institutions, and other variables.

Giovani and Levchenko (2008) investigate the mechanisms through which output volatility is related to trade openness using industry level data. They find that there is a positive and economically significant relationship between trade openness and overall volatility.

Easterly, Islam, and Stiglitz, (2000), report that openness reduces volatility through the enhancement of growth. Also, wage flexibility is not related in a statistically significant way with volatility; excessive private credit can increase volatility, in the context that financial institutions have a central role in the economic volatility.

iii. Fiscal Policy and Business Cycles Fluctuations

Magud (2008) created an investment model to capture the asymmetric dynamics of business cycles. In the model, the role for fiscal policy in smoothing the effects of business cycles fluctuations depends on initial conditions at the time of the shock. Based on the degree of fiscal fragility of the government, expansionary fiscal policy

may be expansionary or contractionary in terms of output. For highly indebted countries reducing government expenditures appears to be a better policy because of its expansionary effect on output. For low-indebted countries, the Keynesian policy of increasing government expenditures does work.

Gali and Perotti (2003) do not find support for the view that the Stability Growth Pact impaired the ability of the EU governments to conduct effective discretionary countercyclical fiscal policy. Also, discretionary fiscal policy in EMU countries has become more countercyclical over time, following what appears to be a trend that affects other industrialized countries as well. Furthermore, the decline in public investment cannot be attributed to the constraints implied by the Maastricht treaty and the Stability and Growth Pact.

Fatás and Mihov (2003), aimed at studying the effects of discretionary fiscal policy on output volatility and economic growth. They have found that governments that use fiscal policy lower economic growth and induce macroeconomic instability. Also, prudent use of fiscal policy is explained to a large extent by the presence of political constraints and other political and institutional variables. As a result, they support institutional restrictions as a way to reduce output volatility.

iv. Structural Determinants of Business Cycles Volatility

Furceri and Karras (2007) suggest a strong, statistically significant and negative relationship between country size and business cycle volatility. Thus smaller countries are subject to more volatile business cycles than larger ones. Also, trade openness is reported not likely to be among the main reasons why small countries are more volatile.

Malik and Temple (2006) examine the structural determinants of output volatility in developing countries and especially the roles of geography and institutions. They find that countries with weak institutions are more volatile but also find evidence of geographical characteristics on output volatility. Countries remote from the sea are more volatile and remoteness is associated with lack of export diversification. Also, they don't find that volatility is sensitive to a diversification between high and low income countries.

Hakura (2009) testifies that output volatility and the size of output drops have declined across groups of non-transition countries studied over the past three decades, but have remained considerably higher in developing countries than in industrial countries. The favorable trends in output volatility and large output drops in developing countries are found to have resulted from lower country-specific volatility and more benign country-specific events. Evidence from cross-section regressions over the 1970–2003 period suggests that the volatility of discretionary fiscal spending and terms of trade volatility together with exchange rate flexibility were key determinants of volatility and large output drops.

Acemoglu, Johnson, Robinson, and Thaicharoen, (2003) move the relationship from output volatility and distortionary macroeconomic policies, including high inflation, large budget deficits and misaligned exchange rates to output volatility and

institutions. They find that weak institutions cause volatility through a number of microeconomic, as well as macroeconomic, channels.

According to Blanchard and Simon (2001) the most recent expansions of the US economy have lasted more because of the underlying decline of output volatility. The first, from 1982 to 1990, lasted thirty-one quarters. The second started in 1991 and, although showing signs of faltering, has recorded its fortieth quarter as this volume goes to press and is already the longest U.S. expansion on record. Furthermore, they contend that this decline is not a recent development— the by-product of a "New Economy" or of Alan Greenspan's talent. Rather it has been a steady decline over several decades, which started in the 1950s (or earlier, but lack of consistent data makes this difficult to establish), was interrupted in the 1970s and early 1980s, and returned to trend in the late 1980s and the 1990s. The magnitude of the decline is substantial: the standard deviation of quarterly output growth has declined by a factor of three over the period.

Gallegati et *al.* (2004) found that output volatility varies markedly across Mediterranean countries in accordance to their stage of development. Greece is found to display greater synchronization with Algeria, Egypt and Tunisia than with other European countries. Additionally, the average reduction of the degree of synchronization among Mediterranean countries seems to suggest a weakening of the economic links among Mediterranean countries, and thus a reduction of the economic importance of the links in this area in comparison to the European continental area.

Leon (2007) focused on the length, the volatility and the transmission mechanism of stochastic shocks between Greece and the Euro-zone for the time period 1980–2005 and showed that both areas exhibit decreasing volatility over time. Also, synchronization of the cycles in terms of correlation and transmission seems to become weaker over time.

v. Business Cycles Synchronization in the EMU[1]

In an early study, Bayoumi and Eichengreen (1997a) developed a procedure to test the core implications of the theory of O.C.A. to cross-country data. Their findings imply that E.M.U. constitutes a virtuous, self-reinforcing circle. Finally, they find three groups of countries with respect to their participation to E.M.U., the first consists of Germany, Austria, Belgium, the Netherlands, Ireland and Switzerland, the second is formed by UK, Denmark, Finland, Norway and France. The last group consists of Sweden, Italy, Greece, Portugal and Spain.

Duecker and Wesche (1999) provided evidence in favour of the view that European economies become more harmonised over time, but there is no guarantee that this pattern will hold in the future. Christodoulakis et *al.* (1995) compared business cycle features of the EU economies using quarterly and annual data since 1960. Their findings suggest that there are remarkable similarities between the business cycle pattern of several countries, despite significant differences in the patterns of fiscal and

[1] This section draws upon a previously published paper by the author (see also Papageorgiou et al. 2010).

monetary policies and the terms of trade. According to Camacho et *al.* (2006) a "Euro economy" that acts as an attractor to other economies of the area does not exist. Also, they argued that the relative co-movements across EU economies were prior to the establishment of the Monetary Union.

Bergman (2004) focused on the change in the degree of synchronization since the early 1960's among European business cycles. In particular, he found that economic and monetary integration during the last ten (10) years has affected business cycle behaviour and has lead to increases in the degree of synchronization. Furthermore, he argued that the magnitude of the business cycles is significantly higher for the countries after their entrance to the E.U.

Canova et *al.* (2009) showed that slow changes in the features of business cycles and transmission of shocks have taken place gradually over time not necessarily related to the institutional changes in Europe. On the other hand, Montoya and de Haan (2008) defined a "Maastricht effect" with low variance and high correlation with the Euro zone. They also found that synchronization has increased for the time period 1975–2005 with some exceptions during the eighties and the beginning of the nineties. Artis and Zhang (1997, 1999) investigated the impact of exchange rate regimes on the symmetry of business cycles. The main finding was that successful exchange rate regimes impose policy disciplines that are likely to lead to conformity in the business cycles of participating countries. Furthermore, they argued that business cycle affiliation of E.R.M. member states has shifted from the United States of America (U.S.A.) to Germany since the formation of E.R.M.

Massmann and Mitchell (2003) emphasized that Euro-zone has entered a period of convergence after the clear period of divergence in the early 1990's in the aftermath of Germany's unification and at the time of a currency crisis in Europe.

Crowley and Lee (2005) analysed the frequency components of European business cycles with a wavelet analysis and observed that euro-area countries fall into three clusters: high and dynamic correlations at all frequency cycles (e.g. France, Belgium and Germany), low static and dynamic correlations with little sign of convergence (e.g. Greece) and those with low static correlation but convergent dynamic correlations (e.g. Italy and Ireland).

Gouveia and Correia (2008) argued that since the inception of the E.M.U. business cycles of the larger member-states have been increasingly synchronised with the aggregate Euro area cycle, with the only exception of Spain, while the results are rather mixed in the case of smaller countries. They also argued that since 1997 the synchronization has become weaker in a number of countries such as Belgium, the Netherlands and Greece. The business cycles of Finland, Greece and Portugal are found to be those with the lowest correlations with the Euro area business cycle, and those experiencing greater volatility.

Bower and Guillemineau (2006) investigated the potential determinants of cycle synchronization in the context of E.M.U. Another study that challenges the stylised fact of increased synchronization among the European countries is the one by Kalemli – Ozcan et *al.* (2001) that showed that regions with a more specialised structure exhibit

output fluctuations that are less correlated with those of other regions with less symmetric fluctuations.

Dickerson et *al.* (1998) argued that examining only the raw correlations between business cycles can give a misleading picture of the correspondence of business cycles. The major finding of this study is that the correlations are not as correspondent as has sometimes been suggested. Furthermore, a clear core – periphery distinction within E.U. exists in both the timing and the magnitude. Finally, they denote that a flexible policy making to accommodate differences between European economies is needed.

Artis and Zhang (1998b) utilised a fuzzy cluster analysis in order to identify homogenous groups within the set of E.U. countries eligible to participate in the E.M.U. Their analysis provides evidence that there is a substantial core of countries some of which do not participate in the E.M.U. The more distanced from the core are Ireland and Finland. Likewise, Spain, Italy and Portugal are set aside because of their distinctive behaviour.

Crowley and Christi (2003) used model-based cluster analysis to group European countries according to the business cycle correlations with Germany. The results showed that in the time period 1983-1992 the E.U. consisted of four groups and a hard core was identified; in the 1993-2001 period European countries formed either two or four clusters.

Conraria and Soares (2009), using a wavelet analysis, identified two groups of countries in the Euro area: the core countries consisting of Germany, France, Spain, Austria and the Benelux countries, and the less synchronous periphery consisting of the rest of the countries. Furthermore, with the exception of Portugal all countries are converging to the Euro area core; the convergence is particularly strong in the case of Ireland and Italy. Germany and Austria are found to be notably synchronous and the same is in force for Netherlands. Belgium, Spain and Luxembourg are more correlated with France than with Germany. The convergence is proposed both at low and high frequencies.

III. Methodological Framework

i. Defining Business Cycles

A popular approach regards business cycles as fluctuations around a trend, the so-called "deviation cycles" (Lucas 1997). The estimation of this trend for each time series is of great importance because it is necessary for the extraction of the cyclical component. Meanwhile, the business cycle component is regarded as the movement in the time series that exhibits periodicity within a certain range of time duration based on the seminal work by Burns and Mitchell (1946), and in line with the National Bureau of Economic Research (NBER).

ii. Checking for Stationarity

First, we examine the stationarity characteristics of each time series. If the results suggest that the time series are stationary in their first differences then, de-trending is

highly suggested. As we know there are several ways to test for the existence of a unit root. Here, we use the popular Augmented Dickey – Fuller methodology (ADF) (Dickey and Fuller, 1979).[2]
The ADF test is based on the following regression (Dickey and Fuller 1979):

$$\Delta Y_t = a + bt + \rho Y_{t-1} + \sum_{i=1}^{m} \gamma \Delta Y_{t-i} + \varepsilon_t \quad (1)$$

where Δ is the first difference operator, t is time and ε_t is the error term.

(a) If b≠0 and ρ=-1 implies a trend stationary (TS) model.
(b) If b=0 and -1<ρ<0 implies an ARMA Box/Jenkins class of models.
(c) If b=0 and ρ=0 implies a difference stationary (DS) model where Y variable is integrated of degree one I(1).

If the cyclical component is stationary, the secular component has a unit root and Y follows a random walk process, i.e. it revolves around zero in a random way. Furthermore, if α≠0, then Y follows a random walk process with a drift. The lag dependent polynomial is inserted in order to deal with the potential serial correlation of the residuals.

However, it is well-known that standard unit root tests which are tests based on individual time series do not work particularly well in panel data series. As a result we employed panel data unit root tests that are employed in the investigation of statistical properties in panel data analysis. Since panel data increases the power of the test by enhancing the time series dimension of the data by the cross section, the results will be more reliable. Some of the most popular panel unit root tests are as follows: the LLC (Levin, Lin and Chu, 2002), the IPS (Im, Pesaran and Shin, 2003), ADF - Fisher Chi-square (Maddala and Wu,1999), and PP – Fisher Chi-square (Choi, 2001)

The LLC for panel data is:

$$\Delta Y_{i,t-1} = \rho Y_{i,t-1} + \delta X + \sum_{i=1}^{m} \lambda_{i,j} \Delta Y_{i,t-j} + \nu_{i,t} \quad (2)$$

where ρ = b - 1 is a common coefficient to the series, but different orders of lags (p_i) of Dy_{it} are allowed in the cross-section; and **X** is a vector of deterministic variables (for example, seasonal or trend dummies). The hypothesis to evaluate is
H_0: $\rho = 0$, against
H_1: $\rho < 0$ (that the series are weakly stationary or trend stationary).

The IPS test suggested by Im, Pesaran and Shin (2003) is a test that allows for residual serial correlation and heterogeneity of the dynamics and error variances across groups, as denoted by the subscript of ρ_i in equation 3:

$$\Delta Y_{i,t-1} = \rho_i Y_{i,t-1} + \delta X + \sum_{i=1}^{m} \lambda_{ij} \Delta Y_{i,t-j} + \nu_{i,t} \quad (3)$$

[2] Alternatively, the test of Zivot and Andrews (1992) could be used or some other unit root tests such as the IPS test (Im et al. 1997), the MW test (Maddala and Wu, 1999), or the Choi test (Choi, 2001).

The Fisher-ADF and Fisher-Phillips-Perron tests use the ρ values (ρ_i) of the augmented Dickey-Fuller and Phillips-Perron tests, respectively, applied to each series in order to construct a test that under the null hypothesis is asymptotically chi-squared distributed with $2N$ degrees of freedom (where N, in our case, is the number of regions):

$$-2\sum_{i=1}^{N}\log(\pi_i) \rightarrow \chi^2_{2N} \quad (4)$$

The ADF-Fischer Chi-square test combines the ρ values from the individual unit root tests. Both the IPS and the ADF-Fischer Chi-square test allow for individual unit root processes so that ρ may vary across cross-sections.

iii. De-trending

We follow previous studies and focus on "deviation cycles" measuring the cycle as deviation from a trend. The trend is important for the propagation of shocks (Nelson and Plosser 1982). Many de-trending methods exist in the literature, e.g. the traditional ones (i.e. linear, exponential, quadratic and logarithmic) and the relevant filtering techniques (e.g. the HP filter, etc). In this paper, we use the Hodrick - Prescott (HP) filter because of its widespread acceptance in the literature (See, for instance, Montoya and de Haan (2008), Danthine and Girardin (1989), Danthine and Donaldson (1993), Blackburn and Ravn (1992), Backus and Kehoe (1992), Dimelis et *al.* (1992), Fiorito and Kollintzas (1994), Christodoulakis et *al.* (*199*8) Dickerson et *al.* 1998).[3] The robustness of the HP de-trending method is confirmed, among others, by Artis and Zhang (1997) and Dickerson et *al.* (1998).

In other words, the linear, two-sided HP-filter approach is a widely used method by which the long-term trend of a series is obtained using only actual data. The trend is obtained by minimizing the fluctuations of the actual data around it, i.e. by minimizing the following function:

$$\sum[\ln y(t) - \ln y^*(t)]^2 - \lambda\sum\{[\ln y^*(t+1) - \ln y^*(t)] - [\ln y^*(t) - \ln y^*(t-1)]\}2 \quad (5)$$

where y* is the long-term trend of the variable y and the coefficient λ>0 determines the smoothness of the long-term trend. This method decomposes a series into a trend and a cyclical component. The parameter used for annual data is equal to λ=100 (Hodrick and Prescott, 1997; Kydland and Prescott, 1990).

Another popular method for extracting the business cycle component of macroeconomic time series is the Baxter-King Filter (Baxter and King 1999). The Baxter King filter is based on the idea to construct a band-pass linear-filter that extracts

[3] Of course, HP filtering has some disadvantages, as well. For overviews of the HP filtering method shortcomings see Harvey and Jaeger (1993), King and Rebelo (1993), Cogley and Nason (1995) and Billmeier (2004).

a frequency range dictated by economic reasoning. Here, this range corresponds to the minimum and maximum frequency of the business cycle.

There is widespread agreement that a business cycle lasts between 8 and 32 quarters and the length of the (moving) average is 12 quarters (Baxter and King 1999). This is due to the seminal works of Burns and Mitchell (1946).[4] Consequently, these are the values (2 to 8 years) that we use in the de-trending methods described above. A large number of studies have used the Baxter-King filtering method (see e.g. Stock and Watson 1999, Wynne and Koo 2000, Agresti and Mojon 2001, Benetti 2001, Massmann and Mitchell 2004).

The algorithm consists in constructing two low-pass filters, the first passing through the frequency range $[0, \omega_{\max}]$ (denoted as $\overline{a}(L)$, where L is the lag operator) and the second through the range $[0, \omega_{\min}]$ (denoted as $\underline{a}(L)$). Subtracting these two filters, the ideal frequency response is obtained and the de-trended time series is:

$$y^{BP}(t) = [\overline{a} - \underline{a}]y(t) \quad (6)$$

iv. Cyclicality

White noise is a data generating process where autocorrelation is zero between lagged versions of the signal (except when the lag is zero). White noise does not permit any temporal dependence and so its auto-covariance function is trivially equal to zero for the various lags. The sample autocorrelation function measures how a time series is correlated with its own past history. In order to test for autocorrelation we use the Ljung and Box (1978) test (Q-stat) which practically tests the null hypothesis of white noise for a maximum lag length k.

$$Q = n(n+2) \sum_{j=1}^{h} \frac{\hat{\rho}_j^2}{n-j} \qquad (7)$$

where n is the sample size, $\hat{\rho}_j$ is the sample autocorrelation at lag j, and h is the number of lags being tested. For significance level α, the critical region for rejection of the hypothesis of randomness is $Q > x_{1-\alpha,h}^2$ where $x_{1-\alpha,h}^2$ is the α-quantile of the chi-square distribution with h degrees of freedom. The alternative hypothesis is that at least one of these autocorrelations is non-zero, so that the series is not white noise. In case the null hypothesis is rejected then the underlying time series is not white noise and is considered a cycle. Of course, in case we are dealing with a trending time series, then we study not the raw series but its deviations from trend, i.e. the residuals from which sample autocorrelations can be computed.

v. Spectral analysis

Next, we investigate the periodicities of business cycles. The length of the period in an economic series may, in general, be variable. Therefore, we understand by the term

[4] For a critique to this approach see Agresti and Mojon (2001).

"period" the average length of the cycles and the periodogram can assist in finding these average lengths. The period is measured through the value R in the time frequency and checking for the highest picks:

$$R_i = \sqrt{a_i^2 + b_i^2} \quad a_i = \frac{2}{n}\sum_{t=1}^{n} X_t \cos\left(\frac{2\pi t}{i}\right) \quad b_i = \frac{2}{n}\sum_{t=1}^{n} X_t \sin\left(\frac{2\pi t}{i}\right) \quad (8)$$

$$i = 1,2,\ldots m \; m = n/2$$

where a_i, b_i are the coefficients of the Fourier-transformed function X_t (Rudin 1976). Spectral analysis has often been used in business cycles analysis and in *Economics* in general. See, for instance, Burley (1969), Iacobucci (2003), Owens and Sarte (2005).

vi. Panel Data Regressions

In this section we provide a more formal regression analysis to understand the determinants of business cycles volatility. In particular, using panel data regressions we check the roles of trade openness, elections and the consequences from the formation of the EMU on business cycles volatility. We eschew the use of fixed effects estimators in order to avoid restricting the empirical analysis to within-country volatility. We exclude from our analysis monetary variables since all the countries under investigation are participating in the European Monetary Union and thus they share in common monetary circulation the one of the ECB. Furthermore, we used cross-section weights in full accordance with the Arellano asymptotics (Arellano 1987). If T (number of periods) is greater than N (number of cross sections) and less than $2N$ then cross-section weights should be used.

Also, White diagonal as coefficient covariance method must be used. We also added the lagged variable of the business cycle coefficient (cyclical component of the GDP). The rationale for doing this is threefold: (i) it allows explanatory variables to have effects that extend beyond the current period, (ii) it can serve as a proxy for omitted variables associated with the cross-sectional unit, and (iii) it can serve as a control for serial correlation. Also, we solved the equations in various forms of Ordinary Least Squares, with different sets of variables and the Generalized Linear Model as well.

$$Ycycle_t = C + a_1 ST_t + a_2 SB_t + a_3 CE_t + a_4 DT_t + \mathbf{a_5 IT_t} + \mathbf{a_6 opp_t} + \mathbf{a_7 ele_t} + a_8 EMUform_t + a_9 AggEMUGDPcycle_t + \mathbf{a_{10} Ycycle_{t-1}} \quad (9)$$

$$Ycycle_t = C + a_1 ST_{t-1} + a_2 SB_{t-1} + a_3 CE_{t-1} + a_4 DT_{t-1} + a_5 IT_{t-1} + a_6 opp_t + a_7 ele_{t-1} + a_8 EMUform_{t-1} + a_9 AggEMUGDPcycle_{t-1} + a_{10} Ycycle_{t-1} \quad (10)$$

$$\mathbf{Ycycle_t} = C + a_1 (ST_t/Y_t) + a_2 (SB_t/Y_t) + a_3 (CE_t/Y_t) + a_4 (DT_t/Y_t) + a_5 (IT_t/Y_t) + a_6 opp_t + a_7 ele_t + a_8 EMUform_t + a_9 AggEMUGDPcycle_t + a_{10} Ycycle_{t-1} \quad (11)$$

$$Ycycle_t = C + a_1(ST_{t-1}/Y_{t-1}) + a_2(SB_{t-1}/Y_{t-1}) + a_3(CE_{t-1}/Y_{t-1}) + a_4(DT_{t-1}/Y_{t-1}) + a_5(IT_{t-1}/Y_{t-1}) + a_6 opp_t + a_7 ele_{t-1} + a_8 EMUform_{t-1} + a_9 AggEMUGDPcycle_{t-1} + a_{10} Ycycle_{t-1} \quad (12)$$

Where the variables[5] are: social benefits *(SB)* i.e social benefits other than transfers in kind at constant 2005 prices; real output (*Y*) i.e. output at constant 2005 prices; Social transfers in kind *(ST)* i.e. social transfers at constant 2005 prices; direct taxes *(DT),* direct taxes revenues for the general government at constant 2005 prices, indirect taxes *(IT),* indirect taxes revenues for the general government at constant 2005 prices; capital expenditures (*CE*) i.e. government capital expenditures at constant 2005 prices; openness (opp) as given from the Penn World dataset showing trade openness: Exports plus Imports divided by GDP is the total trade as a percentage of GDP. The export and import figures are in national currencies from the World Bank and United Nations data archives at constant 2005 prices., *Y cycle* is the cyclical component of the GDP, de-trended with the HP and the BK filter and $AggEMUGDPcycle$ is the cyclical component of the aggregate EMU GDP, again de-trended with the HP and the BK filter Finally, $t-1$ denotes that the variable is lagged by one year. Equations 11, 12 are mathematically normalized dividing independent variables with the GDP of each year and each country.

The GLM is an extension of the LM in which a linear predictor is related to the expected value of the response through a link function η,

$$\eta(E[Y]) = X\beta \quad (13)$$

where the distribution of the elements of Y is a member of the exponential family, which consists of distributions whose probability density functions can be written in the form for some specific choice of functions

$$f(y;\theta) = \exp\left[\alpha(y)\beta(\theta) + c(\theta) + d(y)\right] \quad (14)$$

a, b, c, and d (McCullagh & Nelder, 1989). The GLM is a flexible generalization of ordinary linear regression. The GLM generalizes linear regression by allowing the linear model to be related to the response variable via a link function and by allowing the magnitude of the variance of each measurement to be a function of its predicted value.

In order to deal the possibility of endogeneity issues, we further checked the relation between variables lagged by one year and the cyclical component of the GDP.

---

[5] The estimation of the determinants of business cycles fluctuations may involve mainly three types of variables as discussed in the introduction and the literature part of the thesis. Broadly, fiscal policy variables, trade openness and elections spot three distinct phenomena related to business cycles fluctuations. The relationship between fiscal policy and business cycles fluctuations presupposes the distinction between expenditures and revenues, at the broadest, at least level. This distinction is needed both from a theoretical and a literal point of view. At a second level of theoretical intuition the determinants of revenues and expenditures must be investigated from the viewpoint that turning on expenditures there are two basic categories namely, spending and investment. On the other hand a major distinction of revenues is the one between direct and indirect taxation which has a strong theoretical background as well as strong policy implications. Finally, the dichotomy of public spending between social benefits other than in kind and social transfers in kind is in our opinion is needed because of the special character of each variable. We think that each one has a different role; social transfers are supposed to have the most redistributive character among all fiscal variables. Part of the literature ascribes particular importance to social transfers (see for example Ilzetzki 2011, Wibbels 2006). Adding the variable 'social benefits' the thesis addresses the conventional wisdom that relates social benefits with decreased incentives to work.

Except for the cyclical component of the GDP calculated in HP terms we also used the cyclical component calculated in BK terms and solved the same equations. It is common knowledge that BK filtering is a bandpass filter which allows suppression of both the low frequency trend components and the high frequency components in an economic series. Checking at the same time the relations of the cyclical component counted in two different ways gives much more robustness in our results. Finally, solving an equation with cross-section excludes the possibility of having a dummy variable with common observation across the cross-section. In that sense, we did not add a variable of the type "well established democracy[6]".

vii. The Problem of Endogeneity

Econometric models, based on theory divide the variables on those that are exogenous, variables whose values are determined outside the model, and endogenous, variables determined inside the model by the current workings of the model being studied – and "exogenous" variables. Mainly, in econometrics there is a fear of endogeneity, in the sense that results are biased. Also, in economic theory it is unclear whether a variable is endogenous or exogenous it depends mainly on the standpoint of the analyst and his theoretical affiliations, and also on the assumptions and the parameters. From a formal standpoint the exogenous variables are assumed to be statistically independent of all stochastic disturbance terms of the model, while the endogenous variables are not statistically independent of those terms.

IV. Empirical Results

The data are on annual basis, come from AMECO and cover the time period 1995-2009, and capturing traces of the current crisis.

To begin with, the stationarity properties of the various macroeconomic variables were checked. Tables 1– 6 show the results of the ADF test for panel data. The ADF test was applied both on the original variables and their first differences. Most macroeconomic variables are non-stationary, however all their first differences are stationary irrespectively of the test applied. We used the HP filter, as well as the BK filter to decompose any particular time series into its trend and the cyclical component. The results of the Ljung and Box test indicate a rejection of the null hypothesis of white noise for all the de-trended variables under investigation. In other words, the existence of cyclical regularities is a valid hypothesis from a statistical viewpoint for the GDP. (Table 7)

Next, we created cross-correlation tables for the variables under examination with the cyclical component for every country under examination. (Tables 8 - 19) Also, we run spectral analysis to define the periodicities of the GDP in the EMU countries; the data for the GDP is for the period 1960-2009 in order to assess properly the periodicities of the cycles. Furthermore, we conducted *OLS* and *GLM* equation

[6] Variables of that kind have a particular interest and an explanatory value, that being the reason for a wide use in models of that kind. (see for example Katsimi and Sarantides 2011)

estimation to define the relation between the fiscal variables under investigation and the cyclical component of the GDP of the countries. Data was paneled, and thus weighted cross section estimation was needed. In that purpose we used as dependent variable the cyclical coefficient of the GDP de-trended both using HP and BK filters – on the whole with 4 different models. (Tables 20, 21) Also, to deal with endogeneity possibilities we run the same equations having lagged independent variables by a year (Tables 20, 21) and we conducted the GLM model (Table 22) both for the HP and the BK de-trended data. The results of the co-variance matrix are showing the co-movement of the independent variables across the cross-section data. In table 23 we show the co-variance matrix of the independent variables and matrix reveals that the variables do not co-move as long as the values of covariance are very small. Finally, we created tables showing the cross section effects for every equation estimated. (Tables 24-31)

V. Result Analysis and Discussion

To begin with, focusing on the correlation coefficients results of the aggregate EMU GDP cyclical component and the one of the countries, France, Netherland and Spain have the largest correlation coefficients (0.98, 0.88 and 0.84 respectively), whereas the lowest coefficients are to be found for Germany, Italy and Greece (0.49, 0.55, 0.60 respectively). Also, the peak observations are the one at lag 0 denoting the immediate character of the transmission of the aggregate EMU business cycle to the cycle of the EMU members. Also, Finland, Belgium, Austria, Luxembourg and Ireland have a rather high correlation coefficient. Furthermore, for Spain a high correlation was found on the relation between the cyclical component of the GDP, the direct and indirect taxation and the capital expenditure of the general government, namely (0.67, 0.59 and 0.67) with no or a small time interval. More precisely, indirect taxation has a lag of one year to reach the highest coefficient value, whereas the other two variables have local maximum at zero lag (Tables 19.1-19-6). In Portugal, social benefits and social transfers are found to be countercyclical (-0.35, -0.39), though the top values are found with a relatively high time interval of 5 years. (Tables 18.1, 18.2) In Belgium the government's capital expenditures are found to correlate with the cyclical component of the GDP with a relatively significant way (0.46) though with a time interval of three years. (Table 9.4) For Finland the government's revenue from direct taxation seems to correlate highly with the cyclical component of the GDP (0.47) and in an immediate way. (Table 10.5) In France its highest value is to be found with a time interval of one year (0.36). (Table 11.5) Next, for Germany social benefits are highly countercyclical (-0.44) and with an immediate character and capital expenditures are highly pro-cyclical having a high value (0.57) at lag zero (Table 12.4). In Greece, there is no kind of social transfers and that is the reason why there is not a correlation coefficient with the cyclical component of the GDP. Also, the cyclical component shows a high coefficient with capital expenditures (0.41) with a time interval of five years. Approximately, the same picture is seen in Ireland where the coefficient's value is (0.47) and the time interval is four years and Luxemburg (0.43) and takes two years to be seen in the cyclical component of the GDP. (Tables 13.4, 14.4 and 16.4) Finally, in Italy taxation correlates highly with the cyclical component of the GDP and in an immediate way (0.48 for direct taxation and 0.58 for indirect). (Tables 15.5, 15.6)

The spectral analysis reveals the periodicity of the cycles and is shown in Figs. 1.1-1.12. The de-trended output seems to follow short-term, mid-term and long-term

cycles in all the countries. Short term cycles exhibit similar patterns concerning both the timing and the number of cycles. More specifically, all the countries share one cycle in the short term except France, Germany and Finland that share two; all the short term cycles exhibit local maxima at the frequencies of two (2) to four (4) years.

The picture is slightly different when focusing on mid-term cycles. There are two main groups: the first group exhibits one (1) cycle and consists of Belgium, Greece, Austria, Spain, Finland, Luxembourg and Portugal, whereas, the rest of them exhibit at least (2) two cycles, the periods of which are between five (5) and eight (8) years. Finally, in the long term cycles the image is quite mixed. Spain, Portugal, Finland and Germany exhibit only one (1) cycle, Belgium and Austria three (3) and the rest two (2) cycles.

Next, on the panel regressions we may derive several interesting conclusions. Firstly, in model 1 (Table 21) all the variables are significant. The social benefits and social transfers are countercyclical as expected and highly significant. Also, openness is countercyclical in the EMU countries and in that vein our results are in line with Bejan (2006) and Cavallo (2008). It must be noted that wherever statistically significant openness is found to be countercyclical. In other words, when trade openness increases the business cycles is becoming smoother. If there has been a specialization process in the last decades in the industries of the EMU countries as Krugman (1991) suggests, the increase in openness works as follows: countries have specialized and in that sense they are in need of greater imports and at the same time they have more markets to sell their products. So, they are less 'vulnerable' to country specific shocks and their business cycles are less volatile. However, even if we find the aforementioned schema plausible and explanatory, we may not ascertain for the correctness of the statement should not focus on the transmission mechanisms of the business cycles in the EMU country. This investigation remains outside the scope of the current thesis, remaining an open matter of great interest.

Furthermore, we checked the effects of elections on business cycles volatility. Elections are found to be highly pro-cyclical whenever significant. In model 1, the elections coefficient is rather high and statistically significant. At the same time, capital expenditures are found to be pro-cyclical and statistically significant as expected. Also, we come up onto the same evidence when turning on taxation. Taxation, both direct and indirect is found to be highly pro-cyclical and significant. Katsimi and Sarantides (2011) find evidence of a political business cycle on the roots of a shift of public spending towards current expenditures at the cost of public investment, in the sense that current expenditures are more visible to the voters. Also, they denote that there is a fall in direct taxation and thus a negative effect on revenue related with the electoral process. In our model elections are found to be pro-cyclical the same as taxation and capital expenditures.

Elections denote a shift from declining in taxation and/or capital expenditures and higher spending in the form of social benefits to an increase in taxation and a tightening in 'visible' spending irrespectively of the political affiliation of the incumbent, as would be in a rational opportunistic political business cycle model[7]. Elections are a shift in fiscal policy and as such they make the business cycle more volatile. On the one hand, they change radically the fiscal policy mix from countercyclical to pro-cyclical policies and on the other, the change in itself may be pro-cyclical. In other words, it is the increases in taxation immediately after the

[7] The incumbent is motivated to distort fiscal policy in order to get re-elected. Nordhaus (1975) was the first to formulate the opportunistic model of political business cycles. See also, Alesina et al. 1993, Brender and Drazen (2005), Shi and Svensson (2006) Katsimi and Sarantides (2010), Efthyvoulou (2011).

elections and/or the reverse in the shift in the mix of investment from capital investment to social benefits which are the reasons for the pro-cyclicality of elections. Also, it is in that sense that whenever lagged elections are found to be insignificant; the elections effects have been transformed in decline in social transfers and social benefits and increasing taxation or declining social benefits/transfers in favor of increasing capital investment. Our results are in accordance with the political business cycles literature denoting that the elections spot a manipulation of fiscal instruments. (See for example: Rogoff and Sibert 1988, Katsimi and Sarantides 2010, Efthyvoulou 2011). Furthermore, after the formation of the EMU and the common monetary policy, governments were incapable of manipulating monetary policy and thus inflation[8], and thus fiscal variables were more 'vulnerable' in manipulation for re-election. The above fact, along with the fact that capital linearization limits the ability of a government to influence the domestic economy and leads to policy convergence[9], makes the hypothesis of opportunistic political business cycle models, at least in the EMU, more credible.

Furthermore, the effects of the EMU cyclical component on the GDP cycle are rather statistically significant but not very high in value; also it is found to be pro-cyclical, more volatile EMU business cycle will bring more volatile countries' business cycles. Finally, regarding the effects of the formation of the EMU the results are rather ambiguous. At first sight, in model 1 the EMU formation is seen as a countercyclical process. If the current crisis had not taken place the answer would be more than obvious, the formation of the EMU was a step towards less volatility, however the current crisis has spotted a tremendous increase in the volatility of the business cycles of some at least of the countries that form the EMU[10]. Model 1 and model 3 are similar from the viewpoint that they check the same variables and do not have a time interval between dependent and independent variables. Finally, the R squared of the model as well as the F-stat are particularly high (0.86, 46.05 respectively).

In model 3 the variables that are insignificant are: the dummy variable 'formation of the EMU' and the indirect taxation. The R-squared is high (0.69) and the same is the F-stat (19.09). On what it concerns the Durbin-Watson statistic the value in model 3 is 1.68 and it is greater than the 1.46 in model 1. The main difference is that the cyclical component is extracted with the Baxter-King filter. Models 2 and 4 check the question of determinants of the cyclical component using for the lagged by one year values of the independent variables as a tool to deal with endogeneity issues. The theoretical intuition is that business cycle fluctuations are causing also movements in the fiscal policy in that nexus a lagged variable excludes the possibility of bidirectional causation. The common finding in the two models, where there is an alternation between the HP and the BK filtering is that social benefits and indirect taxes are significant as determinants of the cyclical component of the GDP. In model 4 where we applied the BK filtering, social transfers appear to determine in a significant way the cyclical component. The significant effects of indirect taxation and social benefits are confirmed from this view and thus the robustness of the results is further confirmed against the endogeneity issues. Finally the statistical robustness of the models is given by the R squared values (0.47 and 0.14 respectively); the F-stat (12.04 and 1.92 respectively) and the Durbin-Watson stat (1.70 and 1.89 respectively). It is common

[8] Inflation was the most pronounced manipulated variable in the classical political business cycles models. See for example Nordhaus (1975).

[9] See for example Goodman and Pauly (1993) and Andrews (1994).

[10] Until 2007, trends are clearer, depicted by the magnitude of the coefficient of the variable 'formation of the EMU". They are given upon request.

place that R squared values of the value of 0.14 are very low and insignificant even for panel data.

Furthermore, models 5 and 7 come from the equation 11 where the independent variables have been normalized being divided with the GDP; unveiling a more 'logically' consistent view of the move of fiscal policy in accordance with the GDP fluctuations. The mathematical operator of the variables has remained unchanged implying largely the robustness of the results. Again, in model 5 capital expenditures and indirect taxation have been found to be pro-cyclical and significant; whereas social benefits are counter-cyclical. Also, openness is found to be countercyclical and significant. In short, elections, direct taxes and social transfers are the variables that are not significant. The R-squared is relatively high (0.67), the F-stat the same (16.8). In model 7 the image is somehow altered; capital expenditures, openness and the cyclical component of the aggregate EMU economic climate are the variables that are statistically significant determining the cyclical component of the output of the countries. Also, the statistical properties are quite significant (R-squared 0.49; F-stat 10.49 and Durbin-Watson 1.47). Finally models 6 and 8 depict the lagged normalized variables. In model 8 only indirect taxes are found to have effects on the cyclical component of the GDP whereas in model 6 where the HP filtered data are being employed, social benefits, capital expenditures and indirect taxes are shaping in a statistically significant way the cyclical component. Also, openness and the formation of the EMU have consequences on the cyclical component. Openness again is found to be negatively related to business cycle movement and the formation of the EMU is positively related to business cycle volatility. This last result is in accordance with Bergman (2004) who finds evidence of greater volatility after the introduction of the euro coin.

Summarizing we may say that indirect taxes and capital expenditures are found to be very pro-cyclical whereas social benefits and openness are the most counter-cyclical variables in our dataset irrespectively of the method applied. These results are eloquently confirmed by the Generalized Linear Model results shown in table 22. Here, we find that social benefits are the main countercyclical actor in an economy whereas indirect taxes and capital expenditures are the main pro-cyclical actors. Also, the cyclical component of the aggregate EMU GDP has a positive effect on the cyclical component of the GDP. The procyclicality of capital expenditures is widely confirmed by the literature (see for example: Lane 2003, who argues that government investment is very procyclical; Abbott and Jones 2011, arguing that capital spending is more likely to be procyclical for the larger spending categories).

Papageorgiou et al. (2011) mention increasing divergence after the formation of the EMU, even though in the post-Maastricht period until 2000 there is an increase in the synchronization. There is crucial question hidden: how is business cycle volatility related to the issue of synchronization. In other words more volatile business cycles mean more synchronous business cycles? In our opinion it seems to be the opposite more credible; i.e. more volatile business cycles will mean more asynchronous business cycles. Albeit a silent presupposition is made here: that all business cycles depart from the same starting point. A greater synchronization after the post-Maastricht period is a result of sharper business cycles of some countries such as Greek and Ireland and/or more dull business cycles in the countries of the core of the EMU. The formation of the EMU has made more volatile the business cycles of some countries and at the same time it has made less volatile the business cycles of some others. Our ambiguous results can only be understood and evaluated in that context.

In order to evaluate and assess the former question but also the validity of the aforementioned models we are focusing now on the fixed effects resulting from the estimated equations. Each model has a separate table of fixed effects (see tables 24-31). It is well known that fixed effects are obtained by OLS on the deviations from the means of each unit or time period. As a general observation, larger countries are expected to have larger deviations (fixed effects) than smaller countries. Focusing on the various models we should make the following remarks. Firstly, in the majority of the models, Spain, Italy and France are found to deviate more while having a negative operator, whereas Luxembourg and Germany are the ones that deviate more, having a positive operator[11]. Also, in model 5 Greece, Finland and Portugal are found to deviate significantly and with a negative operator. Also, Italy, Spain and France deviate largely from the mean with a negative operator. Netherlands, Germany. Belgium and Luxemburg have the largest positive deviations. With the exception of model 5 Greece is found not to deviate significantly having positive and negative operators. Finally, in model 1 where all the variables are found to be statistically significant, Italy, Spain and France have the largest negative divergence, with Italy being very high (-81) and Germany, Luxembourg and Netherlands being particularly high and positive. In that context a common finding is that there is somehow a distinction of core and periphery in the EMU, with Italy and Spain being profoundly among the periphery participants. This result is in accordance with the majority of the literature Bayoumi and Eichengreen (1993), Dickerson et *al.* (1998), Artis and Zhang (1998a, 1998b), Crowley and Christi (2003), Massmann and Mitchell (2003), Camacho et *al.* (2006) and Concaria and Soares (2009). See also Canzoneri et *al.* (1996), Bayoumi and Eichengreen (1997a, 1997b), Taylor (1995). According to Artis and Zhang (1998b), Ireland and Finland are the countries which seem furthest from the core. In another study, Artis and Zhang (1998a) provide evidence of the existence of a core group formed by Germany, France, Austria, Belgium and Netherlands, and of two peripheral groups: the Northern (U.K., Ireland, and the Scandinavian countries) and the Southern (Italy, Greece, Spain, Portugal) based on a set of variables suggested by the O.C.A. theory. (see further Papageorgiou et al. 2010)

Another important dimension of the results is the fact that after the formation of the EMU, when monetary policy has been common in the EMU countries, the only policy available to deal with country-specific shocks and fluctuations is fiscal policy. Also spectral analysis has shown that GDP cycles of the countries – as well as the cycles of the rest of the variables - have different periodicities implying that shocks and crisis have different lengths, and of course magnitudes. This is to say that having fiscal policy as the main tool to deal with asymmetries and fluctuations whichever diversions from the general rule have an extra importance. The divergences from the fiscal policy are likely to sharpen asymmetries and decrease synchronization. Also, the current debt-crisis that hits some European countries and especially the PIGS, (Greece,

[11] Fixed effects depict deviations from the estimated equation and must sum zero. Positive deviations may be understood as more 'effective' influences of the independent variables on the dependent variables, while negative deviations may be interpreted as less 'effective' influences. In an economic theory context, benefits in kind should be 'more counter-cyclical' in a country that has positive deviations than in a country with negative deviations.

Italy, Portugal and Spain) targets on a 'rationalization' of public economics mainly focusing on sharp decrease in public spending (social benefits) and increase in taxation especially indirect taxes that are more easily collected to deal with excessive debt. In the context of our findings this policy mix is the one to blame for even more volatile business cycles and sharper crisis.

In a political economy context, all the results of economic modeling, economic theory and econometrics have severe policy consequences and are classified in a school of thought. We won't pretend to believe the independence of theory and the detachment of theory from practice. Our results highlight once again that neoclassical hegemony has brought the monetary union to crucial decision: either to give way to a Keynesian paradigm shift or to bring the end of the EMU.

VI. Conclusions

This master thesis made an attempt to answer some fundamental economic questions regarding the determinants of business cycle fluctuations in the countries of EMU. In that framework, the question of the effects of fiscal policy on business cycles movements is crucial. In a period, dominated by the debt-crisis in the countries of EMU and when all monetary tools are given to the European Central Bank fiscal policy has a special role. Fiscal policy variables are the basic means to make a monetary union more synchronous. In the light of these answers, this thesis gave several public policy suggestions.

The topic of the master thesis is related to certain issues, namely: the determinants of business cycle, the effects of trade openness, the political business cycle in EMU countries, the periodicities of the GDP and finally, possible explanations for the crisis. In that purpose the thesis has made use of a large variety of mathematical and theoretical tools. Various types of regression models have been used to give robustness on the results and at the same time various variables. Generalized linear models as well as fixed-effects panel least squares were applied. Also, spectral analysis and cross-section effects have been calculated to give a cleaner image on the well-being of the monetary union. Finally simple correlations have been used giving evidence of the time intervals and effects of the various variables and the country's business cycle for the independent countries.

Estimating the determinants of business cycle fluctuations, the thesis suggests that social benefits are the main counter-cyclical tool while capital expenditures and indirect taxation are the main pro-cyclical variables. Also, openness is negatively related to business cycle movements, this being consistent with at least a part of the literature. The formation of the EMU is found to have ambiguous effects on the business cycle fluctuations.

Elections seem to be pro-cyclical whenever significant giving evidence for the existence of opportunistic political business cycles in the EMU. More precisely elections pose a shift from higher social benefits – visible current expenditures – to higher capital investment after the elections since the reverse image was before the elections. This shift from countercyclical policy to pro-cyclical policy is highlighted in the results.

Next, we found that EMU countries exert different periodicities in the movements of output. The different periodicities make common monetary policy inappropriate and thus make countries in a monetary union asynchronous. At the same time differences

in the effectiveness of fiscal policy variables in countries of the EMU, measured by deviations from the equation – fixed effects – make the picture even vaguer. More precisely the countries that form the acronym PIGS are found with the largest deviation from the business cycle determination. This fact has severe implications against the neoclassical hegemony of budget cuts as a response to the current crisis. In any case, a core-periphery distinction is suggested among the participants of the EMU in terms of deviations, as already suggested from the literature. Of course, our findings deserve careful screening given that business cycle synchronicity is an important indicator of the optimality of monetary union (Artis et *al.* 2004).

Some questions that remain unanswered are the extent to which the current crisis may be attributed to fiscal policy instruments and to the strict monetary context of the EMU and to which extent it may be accounted to the structural relations of the EMU economies to the US economy. Also, a further refinement of this image would take into account possible clusters in fiscal policy among the countries of EMU, giving various insights to the trend of countries towards business cycles fluctuations. Finally, a topic of great interest is the long-run equilibrium relationship between the variables checked and the business cycles. Clearly, future and more extended research on these subjects would be of great interest.

References

Abbott A., Jones P., (2011), "Procyclical Government Spending: Patterns of Pressure and Prudence in the OECD", *Economic Letters,* Vol. 111, No. 3, pp. 230-232.

Acemoglu D., Robinson J., Thaicharoen Y., (2003), "Institutional Causes, Macroeconomic Symptoms: Volatility, Crises and Growth," *Journal of Monetary Economics*, Vol. 50, No. 1, pp.49-123.

Agresti, A-M., Mojon B. (2001), "Some stylized facts on the euro area business cycle", *ECB Working Paper* 95.

Alesina A., Campante F. Tabellini G., (2008), "Why is Fiscal Policy Often Procyclical?," *Journal of the European Economic Association,* Vol. 6, No. 5, pp. 1006-1036.

Alesina, A., Cohen, G. D., Roubini, N,. (1993), "Electoral business cycle in industrial democracies" *European Journal of Political Economy*, Vol. 9, No.1, pp. 1–23.

Andrews D.M., (1994), "Capital mobility and monetary adjustment in Western Europe1973–1991" *Policy Sciences*, Vol. 27, pp. 425–455.

Arellano M., (1987) "Computing robust standard errors for within-groups estimators", *Oxford Bulletin of Economics and Statistics*, Vol. 49. No. , pp.:431-434.

Artis M., Zhang W. (1997), "International business cycle and the ERM: Is there a European business cycle?", *International Journal of Finance and Economics* No. 2, pp. 1-16.

Artis, M., Zhang, W. (1998a), "Core and periphery in EMU: A cluster analysis", *EUI Working Paper RSC* No. 98/37.

Artis M., Zhang W. (1998b), "Membership of EMU: A fuzzy clustering analysis of alternative criteria", *EUI Working Paper RSC No. 98/52.*

Artis M., Zhang W. (1999), "Further evidence on the international business cycle and the ERM: Is there a European business cycle?", *Oxford Economic papers* No. 51, pp. 120-132.

Artis M., Krolzig HM., Toro J., (2004), "The European business cycle", *Oxford Economic Papers,* Vol. 56, No.1 pp 1-44.

Backus, D.K., P.J. Kehoe, (1992), "International evidence on the historical properties on business cycles", *American Economic Review*, 82 (4), pp. 864-888.

Barlevy G., (2004), "The Costs of Business Cycles under Endogenous Growth", *American Economic Review*, Vol. 94, No. 4, pp. 964–90.

Barro R, Sala-i-Martin X (1995) Economic Growth. New York, NY, McGraw-Hill

Baxter, M. and R.G. King, (1999) 'Measuring Business Cycles: Approximate band-pass filters for economic time series', *Review of Economic and Statistics*, 81(4), pp. 575-593.

Bayoumi T. B. Eichengreen (1993), Shocking aspects of European monetary integration. in: F. Torres and F. Giavazzi, Editors, Adjustment and Growth in the European Monetary Union, Cambridge University Press, Cambridge

Bayoumi T. and Eichengreen B., (1997a), "Ever closer to heaven? An optimum-currency-area index for European countries", *European Economic Review*, No. 41, pp. 761-770.

Bayoumi T, Eichengreen B. (1997b). Optimum currency areas and exchange rate volatility; theory and evidence compared. In International Trade and Finance: New Frontiers for Research, Cohen B (ed.). Essays in Honour of Peter Kenen, Cambridge University Press: Cambridge.

Begg, D., Fisher S., Dornbusch, R., (2003) Economics, 7th Edition, London: McGraw-. Hill.

Bejan M., (2006), "Trade Openness and Output Volatility," *MPRA Paper* 2759

Bekaert, G., Harvey C., Lundblad, C. (2006), "Growth volatility and financial liberalization", *Journal of International Money and Finance*, Vol. 25, No. 3, pp. 370-403.

Beneti, L. (2001), "Band-pass Filtering Cointegration and Business Cycle Analysis", *Bank of England, Working Paper* 142.

Bergman M. U. (2004), How similar are the European business cycles? *Economic Policy Research Unit Working Paper series, 2004-13.*

Billmeier, A. (2004), Ghostbusting: Which output gap measure really matters?, *IMF Working paper* WP/04/146.

Blackburn, K., and M. Ravn (1992), Business cycles in the United Kingdom: facts and frictions, *Economica*, 59, pp. 382-401.

Blanchard O., Simon J., (2001), "The Long and Large Decline in U.S. Output Volatility," *Brookings Papers on Economic Activity*, Vol. 1, pp. 135-174.

Böwer U., Guillemineau C. (2006), Determinants of business cycle synchronization across Euro area countries, *Working Paper Series* No. 587 (Feb).

Brender, A., Drazen, A. (2005), "Political budget cycles in new versus established democracies", *Journal of Monetary Economics*, Vol. 52, No.7, pp. 1271–1295.

Burley S. P. (1969), A spectral analysis of the Australian business cycle, *Australian Economic Papers,* Vol. 8, No. 13, pp. 193-218.

Burns, A. F., (1960), "Progress Towards Economic Stability," *American Economic Review*, Vol. 50, No. 1, pp. 2-19.

Burns, A.F., and W.C. Mitchell (1946), "Measuring business cycles", New York: *National Bureau of Economic Research.*

Camacho M., Perez-Quiros G. and Saiz L. (2006), "Are European business cycle close enough to be just one?", *CEPR Discussion Papers* No. 4824.

Canova F., Ciccarelli M. and Ortega E. (2009), "Do institutional change affect business cycles? Evidence from Europe", CREI Working Papers

Canzoneri M., J. Valles, J. Vinals, "Do exchange rates move to address international macroeconomic imbalances?", CERP Discussion Papers, No.1948.

Cerqueira P. A., Martins R., (2011), "Is There a Political Dimension on Business Cycle Synchronization?", *Kyklos*, Vol. 64, No. 3, pp. 329-341

Christodoulakis N., Dimelis S., Kollintzas T., (1995), "Comparisons of business cycles in the EC: Idiosyncacies and regularities", *Economica*, No. 62, pp. 1-27.

Choi, I. (2001), "Unit root tests for panel data", *Journal of International Money and Finance*, 20, pp. 249-272.

Coe D.T., Helpman E., (1995), International R&D spillovers. *European Economic Review,* Vol. 39, No. 5 pp. 859–887.

Cogley, T., Nason, J. M. (1995), "Effects of the Hodrick-Prescott filter on trend and difference stationary time series: implications for business cycles research", *Journal of Economic Dynamics and Control*, 19, pp. 253-278.

Concaria L. A., Soares M. J. (2009), "Business cycle synchronization across the Euro area: A wavelet analysis", *NIPE Working Papers.*

Cooley, T., (1995), *"Frontiers of business cycles",* Princeton University Press, 1st edition,
Crówley P., Christi, C. (2003), European Union Studies Association (EUSA),_Biennial Conference, (8th), March 27-29.

Crowley P., Lee J. (2005), "Decomposing the co-movement of the business cycle: A time-frequency analysis of growth cycles in the euro area", *Bank of Finland Discussion Papers* 12/2005.

Danthine, J.P., M. Girardin (1989), "Business cycles in Switzerland. A comparative study", *European Economic Review*, 33, pp. 31-50.

Danthine, J.P., and Donaldson J. (1993), "Methodological and empirical issues in Real Business Cycle theory", *European Economic Review,* 37, pp. 1-35.

Dickerson A., Gibson H. and Tsakalotos E. (1998), "Business Cycle Correspondence in the European Union", *Economica,* No. 25, pp. 51-77.

Dickey, D.A., Fuller, W. A. (1979), "Distribution of the estimates for autoregressive time series with a unit root", *Journal of the American Statistical Association*, 74, pp. 427-431.

Dimelis S., Kollintzas T., Prodromidis K., Chalikias J., Christodoulakis N. (1992), "Main stylized facts of Greek economic aggregates: 1948-1989", *Institute for Economic Research,* Athens University of Economics and Business.

Duecker M., Wesche K. (1999), European Business Cycles: New indices and analysis of their synchronicity, *Federal Reserve Bank of St Louis Working Papers* No. 99-019.

Fiorito, R., T. Kollintzas (1994), "Stylized facts of business cycles in the G7 from a real business cycle perspective", *European Economic Review*, 38, pp. 235-269.

Gallegati M., Gallegati M., Polasek W. (2004), "Business cycle fluctuations in Mediterranean countries (1960-2000)", *Emerging Markets Finance and Trade,* Vol. 40, No.6, pp. 28-47.

Galli J., Perotti R., (2003), "Fiscal Policy and Monetary Integration in Europe", *Economic Policy*, Vol. 18, No. 37, pp. 533-572.

Gavin M., Hausmann R., (1998) "Growth with Equity: The Volatility Connection," in Nancy Birdsall, Carol Graham, and Richard H. Sabot, eds., *Beyond tradeoffs: Market Reforms and Equitable Growth in Latin America*, (Washington, DC: Inter-American Development Bank and the Brookings Institution), pp. 91–109.

Di Giovanni J., Levchenk, A., (2008), "Trade Openness and Volatility", *IMF Working Papers*, WP 08/146.
Goodman, J.B.,Pauly,L.W., (1993), "The obsolescence of capital controls? Economic management in an age of global markets", *World Politics*, Vol. 46, pp. 50–82.

Easterly W., Islam R., Stiglitz J., (2001), "Shaken and Stirred: Explaining Growth Volatility", in B. Pleskovic and N. Stern, eds., *Annual World Bank Conference on Development Economics.*

Efthyvoulou G., (2011), "Political Cycles under External Economic Constraints: Evidence from Cyprus" *Journal of Economics and Business* Vol. 63, No. 6, pp. 638-662.

Fatás A., Mihov I., (2003), "The Case for Restricting Fiscal Policy Discretion", *Quarterly Journal of Economics*, Vol. 118, No. 4, pp: 1419– 47.

Frankel J., Rose A. (1998), "The Endogeneity of the optimum currency area criteria", *The Economic Journal,* No. 108, pp. 1009-1025.

Furceri, D., Karras G., (2007): "Country size and business cycle volatility: Scale really matters," *Journal of the Japanese and International Economies*, Vol. 21. No. 4, pp. 424–434.

González Cabanillas L., Ruscher E., (2008), "The Great Moderation in the Euro area: What Role have Macroeconomic Policies played?" *European Commission Economic Papers* 331

Gouveia S. and Correia L. (2008), "Business cycle synchronization in the Euro area: the case of small countries.", *International Economics and Economic Policy,* Vol. 5, No.1, pp. 103-121.

Hakura D., (2009), "Output Volatility in Emerging Market and Developing Countries: What Explains the "Great Moderation" of 1970-2003?," Czech Journal of Economics and Finance, Vol. 59, No. 3, pp. 229-254

Harvey, A.C., and Jaeger, A. (1993), Detrending stylized facts and the business cycle, *Journal of Applied Econometrics*, 8, pp. 231-247.

Hodrick R.J., Prescott E.C. (1997), "Post-war U.S. business cycles: An empirical investigation", *Journal of Money, Credit, and Banking*, 29, pp. 1-16.

Iacobucci A. (2003), Spectral analysis for economic time series, OFCE Working Papers, No. 7-2003

Im, K.S., Pesaran, M.H., Shin, Y., (1997), "Testing for unit roots in heterogeneous panel", *Department of Applied Econometrics, University of Cambridge.*

IMF (2005), *World Economic Outlook: Building Institutions*. International Monetary Fund, Washington DC.

Inklaar R, Jong-A-Pin RM, De Haan J, (2008), "Trade and business cycle synchronization in OECD countries A re-examination", *European Economic Review*, Vol. 52, No. 4, pp. 646-666.

Kalemli-Ozcan S., Sorensen B., Yosha O., (2001), "Regional integration, industrial specialization and the asymmetry of shocks across regions", *Journal of International Economics,* Vol. 55, pp. 107–137

Katsimi M., Sarantides V., (2011), Do elections affect the composition of fiscal policy in developed, established democracies, *Public Choice*, Volume 151, No. 1, pp. 325-362.

King, R. G., Rebelo, S. (1993), 'Low frequency filtering and real business cycles', *Journal of Economic Dynamics and Control*, 17, pp. 361–368.

Kose A., (2001), "Explaining Business Cycles in Small Open Economies: How Much do World Prices Matter?," *Journal of International Economics*, Vol. 56, No. 2, pp. 299–327.

Kose A., Yi K. M., (2006), "Can the Standard International Business Cycle Model Explain the Relation Between Trade and Co-movement," *Journal of International Economics*, Vol. 68, No. 2, pp. 267–95.

Kose A., Prasad E., Terrones, M., (2003), "Financial Integration and Macroeconomic Volatility," *IMF Staff Papers*, Vol. 50, No. Special Issue, pp. 119–41.

Krugman P. (1991), Geography and Trade, Cambridge MA: MIT Press.

Kydland, F.E., Prescott E.C. (1990), "Business Cycles: Real Facts and a Monetary Myth", *Federal Reserve Bank of Minneapolis Quarterly Review*, 14, pp. 3-18.

Lane P., (2003), "The Cyclicality of Fiscal Policy: Evidence from the OECD", *Journal of Public Economics*, Vol. 87, No. 12, pp. 2661-2675.

Laursen T., Mahajan S., (2005), "Volatility, Income Distribution, and Poverty," in Joshua Aizenman and Brian Pinto, eds., *Managing Economic Volatility and Crises: A Practitioner's Guide*, Cambridge University Press New York pp. 101–36.

Leon K., (2006), "The European and the Greek business cycles: Are they synchronized?", *MPRA paper* No. 1312

Levine R, Renelt D (1992) A sensitivity analysis of cross-country growth regressions, *The American Economic Review*, Vol. 82, No. 4, pp: 942–963

Levine R, Loayza N, Beck T (2000) Financial intermediation and growth: Causality and causes, *Journal of Monetary Economics* Vol. 46, No. 1, pp. 31–78

Ljung. G., Box, G.E.P., (1978), "On a measure of lack of fit in time series models", *Biometrika* 65, pp. 297–303.

Long, J. & Plosser, C., (1983), "Real Business Cycles", *Journal of Political Economy*, Vol.91, No.1, pp. 39-69.

Lucas Jr, R.E. (1977), Understanding business cycles, in Karl Brunner, K. and Meltzer. A. (eds.), *Stabilization of the Domestic and International Economy*, Amsterdam: North Holland.

Magud, N. E. (2008), "On Asymmetric Business Cycles and the Effectiveness of Counter-Cyclical Fiscal Policies", *Journal of Macroeconomics*, Vol. 30, No. 3, pp. 885-905.

Malik A. Temple J., (2006), "The Geography of Output Volatility", CEPR Discussion Paper 5516.

Maddala, G.S., S. Wu. (1999), "A Comparative Study of Unit Root Tests with Panel Data and a New Simple Test", *Oxford Bulletin of Economics and Statistics*, 61, pp. 631-652.

Massmann, M., Mitchell, J. (2004), "Reconsidering the evidence: are Eurozone business cycles converging?", *Journal of Business Cycle Measurement and Analysis*, Vol. 1, pp. 275-307.

McCullagh, P., Nelder J. (1989), Generalized Linear Models, Second Edition. Boca Raton: Chapman and Hall/CRC

Montoya L. A., De Haan J. (2008), "Regional business cycle synchronization in Europe?" *International Economics and Economic Policy* Vol. 5, No. 1, pp.123-137.

Nelson, C.R., Plosser, C.I. (1982), "Trends and random walks in macroeconomics time series: Some evidence and implications", *Journal of Monetary Economics*, Vol. 10, pp. 139-167.

Nordhaus, W.(1975), "The political business cycle", *Review of Economic Studies*, Vol. 42, pp. 169–190.

Owners R. and Sarte P. D., (2005), 'How well do diffusion indexes capture business cycles? A spectral analysis', Federal Reserve Bank of Richmond *Economic Quarterly* Volume 91/4 Fall 2005

Pallage S, Robe M., (2003), "On the Welfare Cost of Economic Fluctuations in Developing Countries", *International Economic Review* Vol.44, No. 2, pp. 677-698.

Papageorgiou, T.,Michaelides,P.G., Milios,J.G., (2010), "Business cycles synchronization and clustering in Europe (1960–2009)", *Journal of Economics and Business*, Vol. 62, No.4, pp. 419–470

Persson, T., Tabellini G., (1990), Macroeconomic policy, credibility and politics. Chur, Switzerland: Harwood Academic Publishers

Raddatz, C., (2003), "Liquidity needs and vulnerability to financial udnerdevelopment", *Policy Research Working Paper Series* 3161, The World Bank.

Ramey G. Ramey V., (1995), "Cross-Country Evidence on the Link Between Volatility and Growth," *American Economic Review*, Vol. 85, No. 5, pp. 1138–51.

Razin A., Rose A., (1994), "Business Cycle Volatility and Openness: An Exploratory Cross Section Analysis," *NBER Working Papers* 4208

Rodrik D., (1998), "Why Do More Open Economies Have Bigger Governments?", *Journal of Political Economy*, Vol. 106, No. 5, pp. 997–1032.

Rogoff, K. (1990), "Equilibrium political budget cycles", *American Economic Review*, Vol. 80, pp. 21–36.

Rogoff, K., Sibert A. (1988), "Elections and macroeconomic policy cycles", *Review of Economic Studies*, Vol. 55, 1–16.

Rudin, W. (1976), *Principles of mathematical analysis,* McGraw-Hill International Edition.

Senhadji A., (1998), "Time Series Estimation of Structural Import Demand Equations: A Cross-Country Analysis," *Staff Papers*, Vol. 45, pp. 236–268.

Shi, M., Svensson, J. (2006), "Political budget cycles: do they differ across countries and why?" *Journal of Public Economics*, Vol. 90, No. 8–9, pp. 1367–1389.

Stock M. and Watson M. (1999), Business Cycles Fluctuations in U.S. Macroeconomic Time Series ch.1 in J.B. Taylor and Woodford M. (eds), Handbook of Macroeconomics 1, pp. 3-64.

Temple J., (2000), "Growth regressions and what the textbooks don't tell you", *Bulletin of Economic Research*, Vol.52. No.3, pp. 181–205

Trichet J., (2001), "The euro after two years", *Journal of Common Markets Studies* Vol. 39 pp. 1–13

Wynne M., and Koo J. (2000), Business cycles under monetary union: A comparison of the EU and US, *Economica,* 67, pp. 347-374

Tables 1-6: ADF statistics 1-6

Table 1.1 Capital Expenditures Original Variables

Method	Statistic	Prob.	sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t	-1.17818	0.1194	11	176
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-3.72289	0.0001	11	176
ADF - Fisher Chi-square	58.3365	0	11	176
PP - Fisher Chi-square	133.681	0	11	187

Table 1.2 Capital Expenditures 1st differences

Method	Statistic	Prob.	sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t	-2.54086	0.0055	5	75
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat			5	75
ADF - Fisher Chi-square	47.1414	0	5	75
PP - Fisher Chi-square	394.715	0	5	80

Table 2.1 Direct Taxes Original Variables

Method	Statistic	Prob.	sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t	-1.64881	0.0496	11	176
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	1.09246	0.8627	11	176
ADF - Fisher Chi-square	15.508	0.8395	11	176
PP - Fisher Chi-square	17.0056	0.7631	11	187

Table 2.2 Direct Taxes 1st differences

Method	Statistic	Prob.	sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t	-6.40241	0	8	120
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-4.99935	0	8	120
ADF - Fisher Chi-square	53.8674	0	8	120
PP - Fisher Chi-square	88.6579	0	8	128

Table 3.1 Indirect Taxes Original Variables

Method	Statistic	Prob.	sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t	-0.39811	0.3453	11	176
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	2.63002	0.9957	11	176
ADF - Fisher Chi-square	8.83631	0.9941	11	176
PP - Fisher Chi-square	9.99376	0.9864	11	187

Table 3.2 Indirect Taxes 1st differences

Method	Statistic	Prob.	sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t	-7.06024	0	8	120
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-5.49205	0	8	120
ADF - Fisher Chi-square	59.3798	0	8	120
PP - Fisher Chi-square	51.6182	0	8	128

Table 4.1 Social Benefits Original Variables

Method	Statistic	Prob.	sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t	2.46797	0.9932	7	112
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	5.22786	1	7	112
ADF - Fisher Chi-square	2.89123	0.9993	7	112
PP - Fisher Chi-square	0.61023	1	7	119

Table 4.2 Social Benefits 1st differences

Method	Statistic	Prob.	sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t	-4.18835	0	8	120
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-2.83449	0.0023	8	120
ADF - Fisher Chi-square	35.8522	0.003	8	120
PP - Fisher Chi-square	28.6328	0.0265	8	128

Table 5.1 Social Benefits Original Variables

Method	Statistic	Prob.	sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t	1.11686	0.868	10	160
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	5.05613	1	10	160
ADF - Fisher Chi-square	4.57073	0.9999	10	160
PP - Fisher Chi-square	3.77032	1	10	170

Table 5.2 Social Benefits 1st differences

Method	Statistic	Prob.	sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t	-2.57745	0.005	5	75
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.76696	0.0386	5	75
ADF - Fisher Chi-square	20.9285	0.0216	5	75
PP - Fisher Chi-square	17.3122	0.0677	5	80

Table 6.1 GDP Original Variables

Method	Statistic	Prob.	sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t	-0.98727	0.1618	11	176
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	3.24943	0.9994	11	176
ADF - Fisher Chi-square	9.44815	0.9907	11	176
PP - Fisher Chi-square	11.1694	0.9722	11	187

Table 6.2 GDP 1st differences

Method	Statistic	Prob.	sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t	-5.61906	0	8	120
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-4.62537	0	8	120
ADF - Fisher Chi-square	50.4045	0	8	120
PP - Fisher Chi-square	60.6048	0	8	128

Table 7 Panel Data Correlogram for GDP

LAG	AC	PAC	Q-Stat	Prob
1	0.938	0.938	192.64	0
2	0.877	-0.019	361.99	0
3	0.819	-0.014	510.25	0
4	0.762	-0.022	639.11	0
5	0.7	-0.069	748.43	0
6	0.638	-0.036	839.77	0
7	0.579	-0.021	915.23	0
8	0.521	-0.021	976.74	0

Tables 8-19: Correlation Coefficients

Austria

Table 8.1 Y cycle-social benefits

i	lag	lead
0	-0.0244	-0.0244
1	0.1148	-0.0654
2	0.2079	-0.0617
3	0.1843	0.0381
4	0.1596	0.1935
5	0.1404	-0.045

Table 8.2 Y cycle-social transfers

i	lag	lead
0	-0.0508	-0.0508
1	0.1268	-0.083
2	0.2269	-0.0558
3	0.1853	0.0038
4	0.139	0.1003
5	0.1148	-0.1065

Table 8.3 Y cycle- Y cycle EMU

i	lag	lead
0	0.7853	0.7853
1	0.3784	0.2489
2	-0.1117	-0.3565
3	-0.2139	-0.6072
4	-0.0028	-0.4551
5	0.1061	-0.1671

Table 8.4 Y cycle-capital expenditures

i	lag	lead
0	-0.1688	-0.1688
1	0.0571	-0.2528
2	0.2121	-0.0614
3	0.4063	0.0351
4	0.4651	0.0783
5	-0.1494	-0.1385

Table 8.5 Y cycle-direct taxes

i	lag	lead
0	0.0065	0.0065
1	0.0675	-0.0499
2	0.1186	-0.1203
3	0.1254	-0.0869
4	0.1722	0.0336
5	0.1738	-0.0747

Table 8.6 Y cycle-indirect taxes

i	lag	lead
0	-0.0636	-0.0636
1	0.0994	-0.095
2	0.211	-0.0911
3	0.1922	0.0124
4	0.1522	0.1542
5	0.1241	-0.0626

Belgium

Table 9.1 Y cycle-social benefits

i	lag	lead
0	0.0233	0.0233
1	0.1639	-0.0505
2	0.2177	-0.0467
3	0.1962	0.0534
4	0.1314	0.2453
5	0.0673	0.0695

Table 9.2 Y cycle-social transfers

i	lag	lead
0	-0.0508	-0.0508
1	0.1268	-0.083
2	0.2269	-0.0558
3	0.1853	0.0038
4	0.139	0.1003
5	0.1148	-0.1065

Table 9.3 Y cycle- Y cycle EMU

i	lag	lead
0	0.7999	0.7999
1	0.2488	0.4285
2	-0.2479	-0.1732
3	-0.2915	-0.4644
4	0.0334	-0.412
5	0.1467	-0.2366

Table 9.4 Y cycle-capital expenditures

i	lag	lead
0	-0.1317	-0.1317
1	0.1761	0.0022
2	0.4458	-0.1177
3	0.4651	-0.0201
4	-0.2537	-0.0147
5	-0.1677	0.0134

Table 9.5 Y cycle-direct taxes

i	lag	lead
0	0.0756	0.0756
1	0.2225	-0.1083
2	0.2479	-0.1725
3	0.1798	-0.0865
4	0.1274	0.1058
5	0.089	0.0159

Table 9.6 Y cycle-indirect taxes

i	lag	lead
0	0.0324	0.0324
1	0.2457	-0.1168
2	0.2673	-0.1368
3	0.1748	-0.0271
4	0.1033	0.1927
5	0.0576	0.0544

Finland

Table 10.1 Y cycle-social benefits

i	lag	lead
0	-0.0717	-0.0717
1	-0.0754	-0.0841
2	-0.0857	-0.0025
3	-0.1057	0.1882
4	-0.1417	0.5043
5	-0.1577	0.3232

Table 10.2 Y cycle-social transfers

i	lag	lead
0	0.054	0.054
1	-0.0032	0.0015
2	-0.0807	0.0373
3	-0.1387	0.2017
4	-0.1698	0.4553
5	-0.2009	0.2889

Table 10.3 Y cycle- Y cycle EMU

i	lag	lead
0	0.7721	0.7721
1	0.1246	0.3963
2	-0.4763	-0.111
3	-0.5035	-0.2343
4	-0.134	-0.0698
5	0.0594	0.1308

Table 10.4 Y cycle-capital expenditures

i	lag	lead
0	-0.2613	-0.2613
1	-0.3789	-0.0154
2	-0.1882	-0.0181
3	-0.0692	-0.0614
4	-0.0605	0.0018
5	0.187	0.007

Table 10.5 Y cycle-direct taxes

i	lag	lead
0	0.4722	0.4722
1	0.2182	0.2132
2	-0.1202	-0.016
3	-0.2427	0.0377
4	-0.2074	0.249
5	-0.2045	0.1872

Table 10.6 Y cycle-indirect taxes

i	lag	lead
0	0.2108	0.2108
1	0.1322	0.0391
2	-0.0464	-0.0425
3	-0.147	0.134
4	-0.1868	0.4467
5	-0.2013	0.3074

France

Table 11.1 Y cycle-social benefits

i	lag	lead
0	0.111	0.111
1	0.1371	0.1078
2	0.14	0.2114
3	0.0498	0.3853
4	-0.0262	0.5219
5	-0.1	0.2959

Table 11.2 Y cycle-social transfers

i	lag	lead
0	0.1599	0.1599
1	0.19	0.1296
2	0.196	0.1968
3	0.0996	0.3391
4	0.0141	0.4608
5	-0.0873	0.25

Table 11.3 Y cycle- Y cycle EMU

i	lag	lead
0	0.9865	0.9865
1	0.5074	0.4986
2	-0.1621	-0.1049
3	-0.4206	-0.3733
4	-0.2013	-0.2816
5	-0.0142	-0.1002

Table 11.4 Y cycle-capital expenditures

i	lag	lead
0	0.2268	0.2268
1	0.0609	0.3469
2	-0.1827	0.3293
3	-0.1415	0.3798
4	-0.2982	0.3749
5	-0.2775	0.153

Table 11.5 Y cycle-direct taxes

i	lag	lead
0	0.3169	0.3169
1	0.3572	0.0584
2	0.285	-0.0259
3	0.0624	0.1077
4	-0.0094	0.2884
5	-0.0449	0.1917

Table 11.6 Y cycle-indirect taxes

i	lag	lead
0	0.2443	0.2443
1	0.2631	0.1746
2	0.2303	0.1813
3	0.0787	0.2844
4	-0.0368	0.4059
5	-0.1422	0.2204

Germany

Table 12.1 Y cycle-social benefits

i	lag	lead
0	-0.4445	-0.4445
1	-0.074	-0.4157
2	0.1736	-0.3916
3	0.1979	-0.3309
4	0.176	-0.212
5	0.1867	-0.28

Table 12.2 Y cycle-social transfers

i	lag	lead
0	-0.1403	-0.1403
1	0.0582	-0.2587
2	0.1612	-0.3444
3	0.1776	-0.2984
4	0.1826	-0.0951
5	0.202	-0.2108

Table 12.3 Y cycle- Y cycle EMU

i	lag	lead
0	0.4962	0.4962
1	0.0431	0.1149
2	-0.2826	-0.4142
3	-0.214	-0.5276
4	0.1103	-0.2829
5	0.2004	-0.0342

Table 12.4 Y cycle-capital expenditures

i	lag	lead
0	0.5772	0.5772
1	0.2713	-0.0273
2	0.0021	0.0208
3	0.0075	0.0042
4	0.0357	-0.1727
5	0.0795	-0.2773

Table 12.5 Y cycle-direct taxes

i	lag	lead
0	-0.0757	-0.0757
1	0.0245	-0.2078
2	0.02	-0.4011
3	0.0158	-0.3179
4	0.1315	0.0169
5	0.1687	-0.0076

Table 12.6 Y cycle-indirect taxes

i	lag	lead
0	-0.1704	-0.1704
1	0.036	-0.3226
2	0.1072	-0.416
3	0.1411	-0.3349
4	0.1779	-0.1018
5	0.1915	-0.1997

Greece

Table 13.1 Y cycle-social benefits

i	lag	lead
0	0.2102	0.2102
1	0.087	0.4065
2	-0.0226	0.5381
3	-0.0642	0.5214
4	-0.0938	0.3981
5	-0.0923	0.1904

Table 13.2 Y cycle-social transfers

i	lag	lead
0	NA	NA
1	NA	NA
2	NA	NA
3	NA	NA
4	NA	NA
5	NA	NA

Table 13.3 Y cycle- Y cycle EMU

i	lag	lead
0	0.6047	0.6047
1	0.7838	0.1932
2	0.5611	-0.124
3	0.0293	-0.2127
4	-0.443	-0.174
5	-0.3772	-0.2263

Table 13.4 Y cycle-capital expenditures

i	lag	lead
0	0.2924	0.2924
1	-0.0573	0.3497
2	-0.098	0.1108
3	-0.0246	-0.0287
4	0.2426	-0.1095
5	0.4071	-0.1015

Table 13.5 Y cycle-direct taxes

i	lag	lead
0	0.2425	0.2425
1	0.2019	0.3435
2	0.1444	0.3764
3	0.1119	0.3342
4	0.0515	0.2207
5	0.0208	0.0701

Table 13.6 Y cycle-indirect taxes

i	lag	lead
0	0.1544	0.1544
1	0.1431	0.2697
2	0.1156	0.4045
3	0.0716	0.4441
4	-0.0454	0.3652
5	-0.0472	0.1625

Ireland

Table 14.1 Y cycle-social benefits

i	lag	lead
0	-0.0244	-0.0244
1	0.1148	-0.0654
2	0.2079	-0.0617
3	0.1843	0.0381
4	0.1596	0.1935
5	0.1404	-0.045

Table 14.2 Y cycle-social transfers

i	lag	lead
0	-0.0508	-0.0508
1	0.1268	-0.083
2	0.2269	-0.0558
3	0.1853	0.0038
4	0.139	0.1003
5	0.1148	-0.1065

Table 14.3 Y cycle- Y cycle EMU

i	lag	lead
0	0.8212	0.8212
1	0.4544	0.6734
2	-0.0758	0.2306
3	-0.4027	-0.0694
4	-0.4639	-0.1159
5	-0.2672	-0.0501

Table 14.4 Y cycle-capital expenditures

i	lag	lead
0	-0.1688	-0.1688
1	0.0571	-0.2528
2	0.2121	-0.0614
3	0.4063	0.0351
4	0.4651	0.0783
5	-0.1494	-0.1385

Table 14.5 Y cycle-direct taxes

i	lag	lead
0	0.0065	0.0065
1	0.0675	-0.0499
2	0.1186	-0.1203
3	0.1254	-0.0869
4	0.1722	0.0336
5	0.1738	-0.0747

Table 15.6 Y cycle-indirect taxes

i	lag	lead
0	-0.0636	-0.0636
1	0.0994	-0.095
2	0.211	-0.0911
3	0.1922	0.0124
4	0.1522	0.1542
5	0.1241	-0.0626

Italy

Table 15.1 Y cycle-social benefits

i	lag	lead
0	0.3613	0.3613
1	0.0222	0.3317
2	-0.0723	0.386
3	-0.0989	0.4966
4	-0.1501	0.5882
5	-0.232	0.4916

Table 15.2 Y cycle-social transfers

i	lag	lead
0	0.4463	0.4463
1	0.1247	0.425
2	0.0224	0.4608
3	-0.0411	0.5284
4	-0.1356	0.577
5	-0.234	0.426

Table 15.3 Y cycle- Y cycle EMU

i	lag	lead
0	0.5549	0.5549
1	0.259	0.3754
2	-0.1271	0.2102
3	-0.3041	0.1084
4	-0.2225	0.1028
5	-0.1109	0.0295

Table 15.4 Y cycle-capital expenditures

i	lag	lead
0	0.2808	0.2808
1	0.255	0.5183
2	0.1484	0.527
3	-0.1254	0.2857
4	-0.2217	0.2375
5	-0.1633	0.4921

Table 15.5 Y cycle-direct taxes

i	lag	lead
0	0.4783	0.4783
1	0.0553	0.4022
2	-0.1518	0.3679
3	-0.2127	0.49
4	-0.2071	0.5511
5	-0.2192	0.4655

Table 15.6 Y cycle-indirect taxes

i	lag	lead
0	0.575	0.575
1	0.2099	0.5002
2	0.0617	0.4406
3	-0.041	0.3519
4	-0.1255	0.4317
5	-0.2078	0.337

Luxembourg

Table 16.1 Y cycle-social benefits

i	lag	lead
0	0.1578	0.1578
1	0.2246	0.1149
2	0.2722	0.123
3	0.2232	0.1519
4	0.1248	0.3098
5	0.1023	0.0827

Table 16.2 Y cycle-social transfers

i	lag	lead
0	0.1812	0.1812
1	0.2659	0.1078
2	0.2894	0.0799
3	0.2305	0.0959
4	0.1233	0.2766
5	0.0883	0.075

Table 16.3 Y cycle- Y cycle EMU

i	lag	lead
0	0.8295	0.8295
1	0.2329	0.4281
2	-0.213	-0.2359
3	-0.191	-0.6063
4	0.1139	-0.4535
5	0.1863	-0.1338

Table 16.4 Y cycle-capital expenditures

i	lag	lead
0	0.1771	0.1771
1	0.4008	-0.0356
2	0.4344	-0.0069
3	0.3118	0.1598
4	0.1736	0.2645
5	-0.0166	0.0006

Table 16.5 Y cycle-direct taxes

i	lag	lead
0	0.2407	0.2407
1	0.2305	0.1597
2	0.201	0.0984
3	0.1417	0.1099
4	0.0759	0.2807
5	0.1352	0.0943

Table 16.6 Y cycle-indirect taxes

i	lag	lead
0	0.2644	0.2644
1	0.3233	0.1057
2	0.2847	-0.0077
3	0.1902	-0.0032
4	0.0734	0.2042
5	0.0901	0.073

Netherlands

Table 17.1 Y cycle-social benefits

i	lag	lead
0	-0.0713	-0.0713
1	-0.0622	-0.0037
2	-0.0657	0.1426
3	-0.1087	0.3107
4	-0.1389	0.483
5	-0.1777	0.22

Table 17.2 Y cycle-social transfers

i	lag	lead
0	0.0267	0.0267
1	0.0283	0.0503
2	-0.0527	0.124
3	-0.1686	0.243
4	-0.1915	0.4243
5	-0.2039	0.2451

Table 17.3 Y cycle- Y cycle EMU

i	lag	lead
0	0.8815	0.8815
1	0.4054	0.3404
2	-0.2354	-0.2009
3	-0.4808	-0.3554
4	-0.318	-0.0987
5	-0.095	0.2483

Table 17.4 Y cycle-capital expenditures

i	lag	lead
0	-0.0335	-0.0335
1	-0.2547	0.0715
2	-0.365	0.157
3	-0.2858	0.1314
4	-0.1303	0.0823
5	0.0958	-0.0456

Table 17.5 Y cycle-direct taxes

i	lag	lead
0	0.1332	0.1332
1	0.1318	0.0627
2	-0.0069	0.0465
3	-0.1588	0.1567
4	-0.271	0.3909
5	-0.229	0.2737

Table 17.6 Y cycle-indirect taxes

i	lag	lead
0	0.1864	0.1864
1	0.2103	0.0937
2	0.1056	0.0835
3	-0.061	0.1695
4	-0.1958	0.3368
5	-0.2683	0.2064

Portugal

Table 18.1 Y cycle-social benefits

i	lag	lead
0	0.0648	0.0648
1	-0.0302	0.3132
2	-0.1477	0.4716
3	-0.2471	0.4864
4	-0.3101	0.5017
5	-0.3485	0.3508

Table 18.2 Y cycle-social transfers

i	lag	lead
0	0.0947	0.0947
1	-0.048	0.3407
2	-0.2082	0.5004
3	-0.2932	0.5117
4	-0.3373	0.4866
5	-0.3924	0.3436

Table 18.3 Y cycle- Y cycle EMU

i	lag	lead
0	0.6469	0.6469
1	0.4888	0.3063
2	0.2535	-0.0946
3	-0.1107	-0.2001
4	-0.5673	-0.0657
5	-0.436	0.1281

Table 18.4 Y cycle-capital expenditures

i	lag	lead
0	0.001	0.001
1	-0.0241	-0.0903
2	-0.3593	0.3694
3	0.1431	0.3346
4	0.2132	-0.021
5	-0.0841	-0.068

Table 18.5 Y cycle-direct taxes

i	lag	lead
0	0.3293	0.3293
1	0.1601	0.4116
2	-0.0559	0.3823
3	-0.2678	0.3142
4	-0.4427	0.3174
5	-0.3918	0.2529

Table 18.6 Y cycle-indirect taxes

i	lag	lead
0	0.2947	0.2947
1	0.2294	0.3437
2	0.1132	0.3572
3	-0.0789	0.3653
4	-0.3188	0.4045
5	-0.3921	0.3046

Spain

Table 19.1 Y cycle-social benefits

i	lag	lead
0	0.2213	0.2213
1	0.1028	0.4257
2	0.0343	0.6141
3	-0.0359	0.7248
4	-0.1042	0.7216
5	-0.1742	0.4968

Table 19.2 Y cycle-social transfers

i	lag	lead
0	0.3641	0.3641
1	0.2616	0.5022
2	0.1851	0.6086
3	0.0586	0.6451
4	-0.0574	0.5995
5	-0.1589	0.3861

Table 19.3 Y cycle- Y cycle EMU

i	lag	lead
0	0.8453	0.8453
1	0.6651	0.5069
2	0.236	0.0839
3	-0.1322	-0.1842
4	-0.3422	-0.22
5	-0.2479	-0.1659

Table 19.4 Y cycle-capital expenditures

i	lag	lead
0	0.6755	0.6755
1	0.4736	0.7745
2	0.2689	0.6616
3	0.1101	0.4178
4	-0.0145	0.197
5	-0.2267	0.023

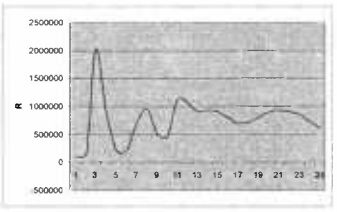
Table 19.5 Y cycle-direct taxes

i	lag	lead
0	0.6782	0.6782
1	0.5992	0.6099
2	0.3707	0.4982
3	0.0998	0.418
4	-0.1251	0.3567
5	-0.2409	0.2028

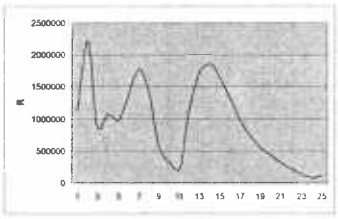
Table 19.6 Y cycle-indirect taxes

i	lag	lead
0	0.5507	0.5507
1	0.5973	0.4237
2	0.5191	0.3685
3	0.3064	0.3712
4	0.0369	0.3613
5	-0.1579	0.212

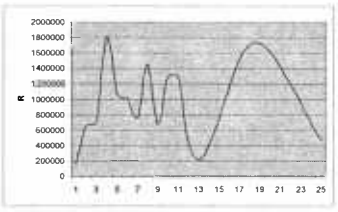
Figures 1.1 – 1.17: GDP Spectral analysis



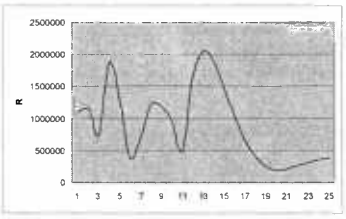
Austria (2.1)



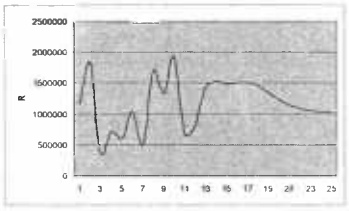
Finland (2.5)



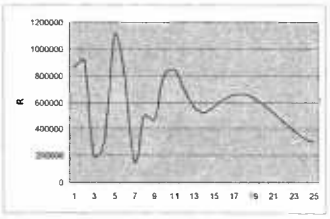
Luxembourg (2.9)



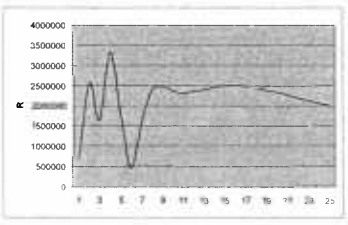
Belgium (2.2)



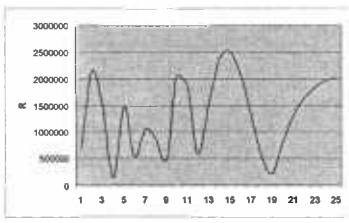
France (2.6)



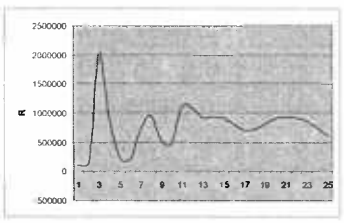
Netherlands (2.10)



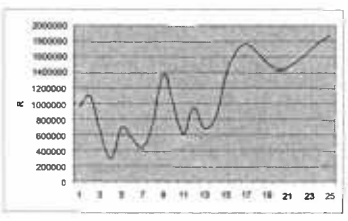
Germany (2.3)



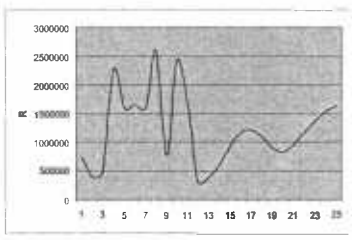
Ireland (2.7)



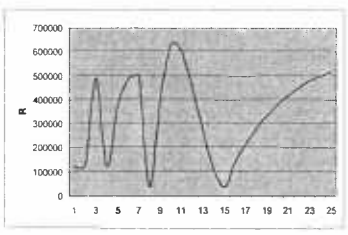
Portugal (2.11)



Greece (2.4)



Italy (2.8)



Spain (2.12)

Tables 20-21: Panel Data Regression Results

Table 20: Models 1-4 EGLS Results

Independent variables	Model 1	Model 2		Model 3		Model 4	
	HP detrended GDP	HP detrended GDP (lagged)		BK detrended GDP		BK detrended GDP (lagged)	
Social Transfers	-0.561037 (-6.245366)	-0.64383 (-2.22239)	----------	-0.3016258 (-1.871818)	-0.306815 (-2.101210)	-0.3037178 (-1.876248)	-0.378472 (-2.332318)
Social Benefits	-0.934069 (-4.715383)	-0.46749 (-3.66094)	-0.576289 (-5.63898)	-0.236295 (-2.680611)	-0.240018 (-2.752821)	-0.199175 (-2.380806)	-0.197130 (-2.698570)
Direct Taxes	0.623109 (3.977626)	-0.09404 (-0.46661)	----------	0.476475 (3.513460)	0.514804 (7.095156)	-0.024730 (-0.424463)	----------
Indirect Taxes	0.649065 (3.756092)	1.123423 (4.768558)	0.863697 (6.296178)	0.057740 (0.361090)	----------	0.487872 (3.368862)	0.465952 (3.968522)
Capital Expenditures	0.597642 (4.358361)	0.039606 (0.085089)	----------	0.439276 (4.513837)	0.434364 (4.524736)	-0.092976 (-0.337709)	----------
EMU Formation	-2.220660 (-2.103449)	-0.10992 (-0.145987)	----------	-0.809830 (-0.857600)	----------	-0.164460 (-0.8321034)	----------
GDP cycle lagged	0.512840 (8.395954)	0.38049 (3.641695)	0.405341 (6.058973)	0.193013 (2.124619)	0.197606 (2.213321)	0.064234 (2.124619)	----------
Aggregate EMU GDP cycle	0.0232994 (8.160039)	-0.00066 (-0.202394)	----------	0.044903 (8.229951)	0.046729 (8.165424)	-0.092976 (-0.254835)	----------
Openness	-0.086055 (-2.392905)	-0.00164 (-0.12959)	----------	-0.059625 (-2.035600)	-0.072049 (-2.716478)	-0.001201 (-0.126817)	----------
Elections	2.468243 (2.590806)	-0.52995 (0.870901)	----------	2.117393 (2.470527)	2.24097 (2.458673)	0.568147 (1.079791)	----------
Constant	-7.046409 (-0.930138)	-16.3606 (-2.25958)	-10.87556 (-2.78987)	-3.162752 (-0.536884)	-0.577904 (-0.118686)	-5.299180 (-1.51842)	-5.496486 (-1.932783)
Model summary							
R2	0.859553	0.510021	0.471484	0.668458	0.693916	0.162378	0.140009
Durbin-Watson stat	1.459976	1.755331	1.698345	1.682430	1.679816	1.925736	1.885936
F-stat	46.04678	7.831568	12.04323	15.16954	19.09116	1.458534	1.918741
Countries included	12	12	12	12	12	12	12
Total panel observations	180	180	180	180	180	180	180

In parenthesis are depicted the t-stat values. Models 1, 2: dependent variable is the cyclical component extracted with the Hodrick Prescott filter. Models 3, 4: dependent variable is the cyclical component extracted with the Baxter King filter. Models 1, 3: dependent variables are in the same year with the independent variable see equation (9). Models 2,4: dependent variables are lagged by one year, see equation (10). The second column in models 2, 3, 4 solves the equations without the variables that are found to be insignificant in the first step.

Table 21: Models 5-8 EGLS Results

Independent variables	Model 5		Model 6		Model 7		Model 8	
	HP detrended GDP		HP detrended GDP (lagged)		BK detrended GDP		BK detrended GDP (lagged)	
Social Transfers/GDP	-474.2121 (-3.087964)	-484.8098 (-3.32982)	-85.38342 (-0.683882)	----------	-132.6077 (-1.234676)	----------	-35.38880 (-1.493543)	----------
Social Benefits/GDP	-106.5309 (-2.246547)	----------	-82.26859 (-2.251969)	-86.39277 (-2.748935)	-34.49073 (-0.913916)	----------	-40.08061 (-0.479184)	----------
Direct Taxes/GDP	106.0178 (1.401236)	----------	-44.81280 (-0.904203)	----------	63.66989 (0.984703)	----------	23.19399 (0.843348)	----------
Indirect Taxes/GDP	268.6528 (2.199681)	284.4668 (2.414957)	278.9736 (3.459903)	251.1525 (3.753898)	29.98953 (0.341355)	----------	107.2016 (2.289046)	65.02412 (2.148405)
Capital Expenditures/GDP	193.6432 (2.711544)	179.4793 (2.532986)	-150.2150 (-1.373805)	----------	163.3050 (3.533212)	130.4544 (3.483906)	-50.29477 (-0.910887)	----------
EMU Formation	3.251393 (2.335643)	3.13445 (2.311132)	2.303676 (1.875401)	1.651216 (2.189894)	2.692357 (2.398356)	----------	0.789753 (1.142384)	----------
GDP cycle lagged	0.575916 (6.476096)	0.568051 (6.242598)	0.562024 (5.345531)	0.522860 (6.602615)	0.213948 (1.834229)	----------	0.077125 (0.845654)	----------
Aggregate EMU GDP cycle	0.047246 (7.519521)	0.047776 (7.882583)	-0.003961 (-0.757786)	----------	0.056865 (8.512077)	0.057391 (8.897600)	0.000326 (-0.72683)	----------
Openness	-0.122010 (-2.636374)	-0.137075 (-2.841592)	-0.052723 (-1.912643)	-0.046778 (-1.991207)	-0.080840 (-2.125410)	-0.101851 (-2.619860)	-0.014706 (-0.988996)	----------
Elections	2.256209 (1.821280)	----------	0.801897 (0.834618)	----------	1.937981 (1.949435)	----------	1.271826 (1.856899)	----------
Constant	-6.698699 (-0.385162)	7.224515 (0.499135)	-7.507581 (-0.634901)	-16.53644 (-2.189414)	2.153827 (0.164437)	6.964984 (1.936714)	-3.162752 (-0.536884)	-8.591508 (-2.204164)
Model summary								
R2	0678738	0.666143	0.441983	0.436126	0.555945	0.489509	0.112228	0.039244
Durbin-Watson stat	1.430354	1.430580	1.739660	1.723407	1.633244	1.471875	1.936189	1.680717
F-stat	15.89570	16.80251	5.959313	7.879484	9.419590	10.48394	0.951121	0.568456
Countries included	12	12	12	12	12	12	12	12
Total panel observations	180	180	180	180	180	180	180	180

In parenthesis are depicted the t-stat values. Models 5, 6: dependent variable is the cyclical component extracted with the Hodrick Prescott filter. Models 7, 8: dependent variable is the cyclical component extracted with the Baxter King filter. Models 5, 7: dependent variables are in the same year with the independent variable see equation (11). Models 6, 8: dependent variables are lagged by one year, see equation (12). The second column in models 5, 6, 7, 8 solves the equations without the variables that are found to be insignificant in the first step.

Table 22: Models 1-2 GLM Results

Independent variables	Model 1		Model 2	
	HP detrended GDP		BK detrended GDP	
Social Transfers	0.118651 (1.416735)	----------	0.061994 (0.971190)	----------
Social Benefits	-0.307433 (-3.929470)	-0.277551 (-2.654144)	-0.120414 (-2.389645)	-0.082216 (-2.654144)
Direct Taxes	0.126478 (1.643162)	----------	0.110554 (1.968349)	----------
Indirect Taxes	0.183969 (2.35562)	0.258815 (4.040386)	278.9736 (3.459903)	0.085888 (1.773238)
Capital Expenditures	0.594329 (5.340676)	0.569803 (5.506267)	0.397075 (4.786860)	0.394662 (4.846501)
EMU Formation	-1.335410 (-0.500560)	----------	0.058781 (0.029360)	----------
GDP cycle lagged	0.475844 (9.510196)	0.447302 (9.968892)	0.141238 (2,138515)	0.14224 (2.234429)
Aggregate EMU GDP cycle	0.062229 (7.210416)	0.058241 (7.784543)	0.079033 (9.047079)	0.079872 (9.399848)
Openness	-0.007262 (-0.337708)	----------	-0.006355 (-0.378271)	----------
Elections	0.204701 (0.079439)	----------	0.078066 (0.038626)	----------
Constant	-0.576517 (-0.165694)	-1.609641 (-1.146765)	-0.752827 (-0.634901)	-1.456635 (-1.168820)
Model summary				
Mean dependent var	0.654473	-0.896692	0.586936	0.586936
Akaike criterion	8.339665	8.268230	7.851964	7.812081
LR statistic	280.5982	316.5836	132.7713	134.1659
Pearson statistic	230.5920	220.9521	142.3846	139.8920
Iterations for convergence	1	1	1	1
Countries included	12	12	12	12
Total panel observations	180	180	180	180

In parenthesis are depicted the t-stat values. Model 1: dependent variable is the cyclical component extracted with the Hodrick Prescott filter. Model 2: dependent variable is the cyclical component extracted with the Baxter King filter.

Table 23: Covariance Matrix

	Social Benefits	Social Transfers	openness	Indirect Taxes	Elections	Direct Taxes	Capital Expenditures	Aggregate EMU GDP cycle
Social Benefits	0.00807	-0.006386	-7.95E-05	-0.002761	0.00798	4.25E-05	-2.94E-03	1.83E-05
Social Transfers	-0.006386	0.03924	-0.00043	-0.011223	-0.008048	0.002391	1.97E-03	-7.13E-05
openness	-7.95E-05	-0.00043	0.001293	0.00146	0.000537	-0.001164	-4.28E-04	-5.81E-05
Indirect Taxes	-0.002761	-0.011223	0.00146	0.029861	-0.011251	-0.022496	-1.03E-03	-5.73E-05
Elections	0.00798	-0.008048	0.000537	-0.011251	0.907624	0.003747	-1.10E-03	5.89E-05
Direct Taxes	4.25E-05	0.002391	-0.001164	-0.022496	0.003747	0.02454	2.49E-03	-3.04E-06
Capital Expenditures	-2.94E-03	1.97E-03	-4.28E-04	-1.03E-03	-1.10E-03	2.49E-03	1.88E-02	-1.35E-05
Aggregate EMU GDP cycle	1.83E-05	-7.13E-05	-5.81E-05	-5.73E-05	5.89E-05	-3.04E-06	-1.35E-05	1.63E-05

Tables 24-31: Cross Section Effects Models 1-8

Table 24: Model 1

Austria	6.977634
Belgium	8.471261
Finland	1.749258
France	-24.7836
Germany	50.59211
Greece	5.32347
Ireland	10.45805
Italy	-81.3145
Luxembourg	29.11809
Netherlands	13.55221
Portugal	7.098014
Spain	-27.2421

Table 25: Model 2

Austria	6.765126
Belgium	5.482232
Finland	8.599129
France	-34.8668
Germany	12.20775
Greece	9.259616
Ireland	5.256501
Italy	-13.8761
Luxembourg	10.12843
Netherlands	-6.38664
Portugal	5.42583
Spain	-7.99506

Table 26: Model 3

Austria	2.353427
Belgium	1.250398
Finland	-1.5254
France	1.639993
Germany	14.29167
Greece	2.40055
Ireland	6.850372
Italy	-39.7588
Luxembourg	18.05228
Netherlands	4.504865
Portugal	3.390669
Spain	-13.45

Table 27: Model 4

Austria	2.64351
Belgium	4.235114
Finland	2.08611
France	-19.5217
Germany	22.28569
Greece	2.236365
Ireland	1.69063
Italy	-20.1571
Luxembourg	5.033876
Netherlands	4.417831
Portugal	2.272483
Spain	-7.22284

Table 28: Model 5

Austria	-1.68496
Belgium	18.82316
Finland	-13.5123
France	-6.55167
Germany	10.22037
Greece	-21.4081
Ireland	-3.95189
Italy	-16.5925
Luxembourg	24.1492
Netherlands	26.54327
Portugal	-10.569
Spain	-5.46555

Table 29: Model 6

Austria	-1.15231
Belgium	3.259396
Finland	-0.1425
France	-7.94783
Germany	-5.75865
Greece	2.129314
Ireland	0.025524
Italy	1.726161
Luxembourg	8.872923
Netherlands	1.068856
Portugal	-3.79115
Spain	1.710261

Table 30: Model 7

Austria	-1.82744
Belgium	1.885528
Finland	-0.76123
France	-1.65584
Germany	-0.61121
Greece	-2.90958
Ireland	3.398443
Italy	-3.79324
Luxembourg	8.214627
Netherlands	1.662015
Portugal	-1.46734
Spain	-2.13474

Table 31: Model 8

Austria	-0.30871
Belgium	-3.45075
Finland	1.477553
France	2.007748
Germany	-1.67347
Greece	0.610095
Ireland	2.28601
Italy	0.416482
Luxembourg	0.321236
Netherlands	-1.32026
Portugal	0.185711
Spain	-0.55165