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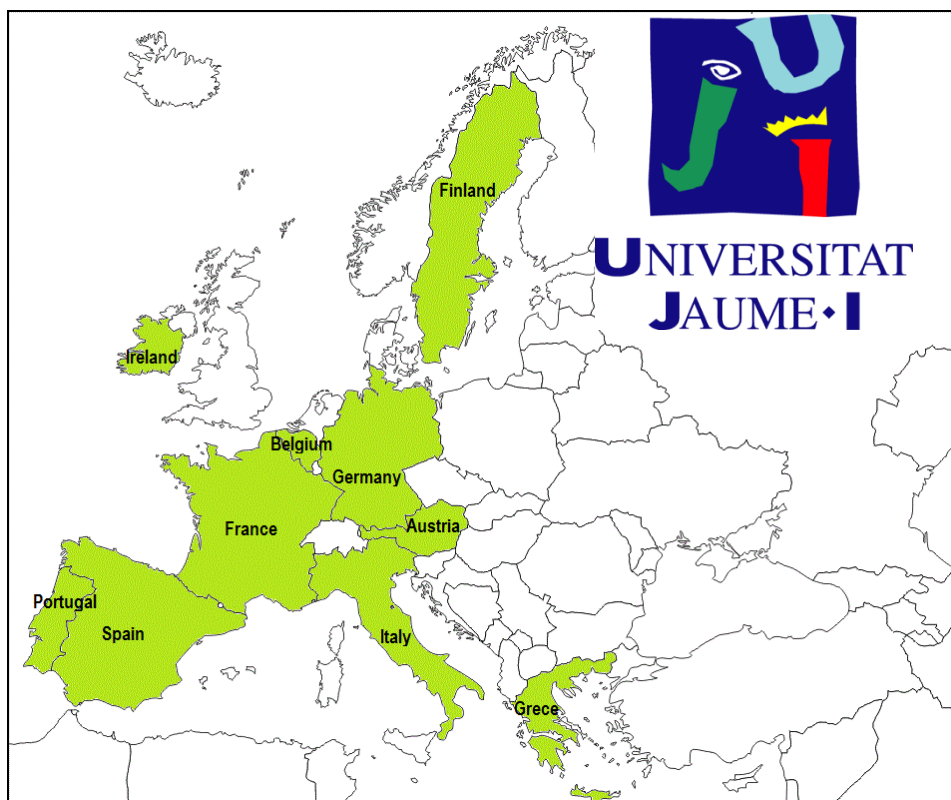
Real divergences and the Eurozone crisis

Degree final Project

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1. **ABSTRACT**

The first 15 years of European Monetary Union (EMU) have seen growing structural imbalances between member states without offsetting gains in productivity and economic growth.

Economic tensions within the Eurozone have been building since its inception, and have become acute during the current crisis. It has created a dualism in the euro zone, with northern countries recovering, albeit slowly, from the crisis, increasingly diverging from southern countries that are embroiled in sovereign-debt crises and with weak prospects of growth, even in the medium term. Divergence in competitiveness, in current accounts and in private sector debts has led to excessive public sector debt and deficits in peripheral Southern countries.

The Eurozone has imposed an asymmetric policy response to these divergences, with the burden of adjustment falling almost exclusively on the weaker economies of the South. These peripheral economies are required to seek a real depreciation with respect to the North through a combination of wage reductions and fiscal retrenchment.

But, will the internal devaluation contribute to a further increase of real divergences or to restore competitiveness in the peripheral countries? This is the primarily question of this proposal. It is aimed to analyze the euro crisis, focusing on its economic roots and the interactions between the crisis and the observed real divergences.

The results suggest that there are notable differences across countries and the whole nation in terms of capital intensity and total factor productivity. Furthermore, the economic reforms don't have been successful in driving long-run growth. So, countries need further reforms in order to reach convergence.

2. INTRODUCTION

In this paper I present my final degree project. I chose the topic "*Real divergences and the Eurozone crisis*", because I have studied the degree of economics and I would like finishing my studies with a research of the actual economic crisis. Being an specific research work, I will focus only in the related economic aspects.

I study the extent of macroeconomic convergence/divergence among euro area countries. I have to focus on raising the topic on design flaws, which have resulted in imbalances causing the economic current crisis which is affecting a big part of the Eurozone. My hypothesis is that the root of these imbalances is related to the specificities of the growth model in the periphery and core European countries.

The goal of the present paper is to assess whether the data supports the extent of macroeconomic convergence/divergence across 10 European countries over the 1991–2013 period. For this, I used the Net capital stock and in the Total factor productivity of some Eurozone economies. Concretely, I added in this research 10 countries: Belgium, Germany, Ireland, Greece, Spain, France, Italy, Austria, Portugal and Finland.

Accounting for these data features has proved to be very useful in convergence studies since it is crucial to distinguish long-run divergence from transitional dynamics to the steady state. Long-run convergence (or divergence) and catching-up are analyzed in this paper using capital intensity and total factor productivity as convergence indicators.

In this context, the objective of this paper is two-fold. First, we analyze the convergence behavior of capital intensity and total factor productivity (TFP) for 10 countries over the period 1991-2013. And second, we attempt to determine whether differences in competitiveness are accounted for by differences in capital intensity or technological progress. This distinction is important in terms of the sustainability of regional growth. To carry out this research, we focused on the concept of convergence based on unit root tests.

Summarizing, my analysis focuses on the differential performance across countries, and the rest of the paper is structured as follows:

In Section 2 I present the literature review. In Section 3 I have motivated the research. In Section 4, I explain the methodology I use for analysis (I have applied this procedure to a broad selection of Eurozone economies). Section 5 presents my findings with the analysis of results. In Section 6 I add possible further research. Section 7 will present the conclusion. Section 8 contains the Bibliography. And, finally, in Section 9 I attach annexes.

3. LITERATURE REVIEW

In this research, I am going to develop it chronologically. Since its beginning in 1999, the European Union is composed by countries with capitalist economies. It has experienced an expansionary period. So that, exists big growth at European countries.

Nowadays, Europeans are feeling period of crisis. This time is a result of disparities that exist across the countries and how this unbalanced growth path may influence national development and therefore the sustainability of this economic growth. So, it shows two clear differences in the composition of Eurozone countries: the central, whose economy is characterized by surplus, and the periphery with economic deficit.

Serving more details, during the good economic time, there was a capital accumulation, which generated instability. These boom years were characterized by an excessive credit in the peripheral zone. This debt was assumed for some countries, whose are paying little interest rates linked to short-term. This credit was used to benefit the countries to financing them for the construction and consumption, allowed them better rates of GDP and employment.

Nowadays the countries are experiencing difficulties due to the cut of the private capital which they were used to receive until 2009. After that, these countries are not able to pay a sustainable price for the financing.

Now I am going to pose a point of *Gros (2012)*. He did the question why did financial markets, which had provided to the periphery countries with ample financing over years when their current account deficits and the (approximate) size of their public debt were well known, almost out of the blue suddenly review their position. To answer the question, the author considered that, this is merely a change of the risk and growth perception, from before and after 2009.

In this moment, it is worth mentioning certain economic variables that are explained in the paper of *Estrada, Galí and López-Salido (2013)*. These variables are both nominal and real, which have developed in a different form in each country member.

- Unemployment is experiencing a generalized growth in the current period of economic recession, but does not affect equally to all members. For this reason we can say that the existence of the European Union has not been sufficient to prevent the dispersion of unemployment rates. What is more, a common monetary policy would be needed strong stabilization devices to redistribute risk between the Eurozone.
- The implementation of a common monetary policy has simplified the convergence to average inflation rates.
- Despite fluctuations, the evolution of relative prices shows a similar behavior, so we can talk about convergence in the Eurozone.
- Regarding evolution the current account, we know that there were big imbalances between countries in the Eurozone in the pre-crisis period, and which are declining in this period of recession. This is due to a cyclic pattern of medium-term dynamics of the economy (GDP improvement rate in recessions), and different measures imposed in different countries, seeking to improve price competitiveness (internal devaluation output deficit).

At the paper, authors mentioned that there are some concepts that explain imbalances to balance current account:

- | | |
|-----------------------------------|-----------------------------------|
| 1) Institutions | 7) Efficiency in the labor market |
| 2) Infrastructure | 8) Development financial market |
| 3) Macroeconomic Environment | 9) Technology |
| 4) Health and education | 10) Size Marketplace |
| 5) Training by highly educated | 11) Sophistication business |
| 6) Efficiency in the goods market | 12) Innovation |

These are interesting because countries used different policies of investment to different uses. These variances get levels on each country. For instance, invest on health and education at underdeveloped countries means a big positive change on their economic behavior. On the other hand, at developed countries the most important factor to growth is Technology. For this reason, in this project I am going to try to know if actual austerity government's policy is correct, or in the contrary could be better to base it on technological development.

Compiling, there are countries, as we call it peripherals, with deficits, and other we call central countries, with a totally opposite situation (surpluses). This situation occurs at the time when central countries decided stop financing the debt with their national savings. As the author Gros (2000) believes that this situation is because for a long period of prosperity, surplus savings were intermediated by the banking system, creating a strong bias toward movement of capital within the Eurozone. Besides this, the interest rates of the periphery countries felt more when the central countries invested there, because they had no risk. As a result, they achieved large current account deficits, deteriorating their international investment position. This situation explains the international funding. Although the total of the Eurozone has sufficient resources to finance countries needs with deficit.

These countries have imbalances in their current account, because they deteriorated their competitiveness on their unemployment labor costs. This statement is relative because it compares deficit countries with other countries more capable. However, we must not forget the housing bubbles which are causing a lot of damage during crisis time. This is due to their acceptance of a common monetary policy, sacrificing their right to devalue national currency.

Summarizing, the problem is that the central countries do not let to spend their savings to finance the debt of peripherals countries. The current account deficit appears for two reasons: lack of funding and low competitiveness.

Clarifying the issue of competitiveness, peripheral countries are relatively worse. Nowadays, divergences in competitiveness are a political debate topic, where the European Commission introduces changes in economic governance, with two indicators:

1. Unit labor costs
2. Relative consumer prices

We must bare in mind that making policies focused on competitiveness may not be the best, because it is difficult to determine the balance level of competitiveness. Furthermore, we cannot affect directly on the determination of labor costs because it is given in the working market. That is why the government has little to do.

Therefore, the imbalances in the current account are not explaining by relative price levels. We know that internal devaluation policies with reduction wage, are limited if they are not accompanied by a structural reforms improvement. At the moment the government seeks the nature and scale of policy responses to reduce imbalances, especially in periphery countries, as they are under pressure from financial markets.

Another point I consider important is the existence of an expansionary monetary policy for a long time, whose transmission mechanisms have different effects on each country. These have worked differently in each country, because each country has particular financial structures.

For this reason, it is possible that a fixed exchange rate cannot be good for different situations. At the center an expansionary policy would be effective with a lowering of the interest rate to increase inflation, while at the peripheral area it would be better a contractionary policy with a rise in the interest rate to decrease inflation.

As we know, corrections have been existed. For example, *Guillemette and Turner (2013)*, mentioned the reduction of the deficit to GDP from 7% to 4%. But society needs further adjustments, because the external debt has continued to rise.

Therefore, we could use the following drivers of the trade balance:

1. Depreciation of the common currency (euro) as a marginal help to countries that are worse off.
2. Structural Reforms to improve competitiveness, making it susceptible to price and wage demand.
3. Boost productivity in peripheral countries affecting taxes that go linked to labor.
4. Apply the adjustment mechanism of falling prices and wages, but without losing sight that this creates a depressed demand, as production falls and unemployment rises.

Now is being carried out an austerity process which is causing internal weakness. So it is generating undesirable consequences due to this, and given our concern for competitiveness, the European Central Bank is a system stabilizer whose main concern is the stability price. It injects liquidity in crash situations, because banks used to borrow at short term and lend at long. Moreover, the Private Sector exists as another stabilizer manager to reduce debt. As it is happening nowadays, the Private Sector can do an austerity fiscal policy in order to reduce spending and increasing taxes. But total production fall yet, as the debt still exists. Another alternative is the active sale, with an internal devaluation that lowers the relative prices. But what may seem like a solution, in turn, can generate future solvency problems.

Nonetheless, it is possible that the relative price adjustments should occur within and between countries in the euro area to support internal and external demands to full employment and low fiscal deficit and current account. That is, we must try to reduce the fiscal austerity of the peripheral countries in order to strengthen domestic demand weakened.

4. **MOTIVATION**

Having clear on what are we working, there is no doubt that countries are different. The question, however, is whether these differences are important enough to represent a stumbling-block for monetary unification.

A common currency has important benefits. For example, I consider important that Common currency decreases transactions costs, since it could stimulate economic integration in Europe. It also will improve the efficiency of the price mechanism, reducing uncertainty and, stress the greater price transparency let countries to increase competition, benefiting consumers. For this reason, the number of countries that benefit from monetary union is large. So it is an attractive position for most European countries.

However, countries differ because they have different preferences and they also differ because they have different fiscal systems. For this reason, countries have to use different combinations of debt and monetary financing of the government budget deficit. When these countries join a monetary union, they will change the way they finance their budget deficits. All this may make the introduction of a common currency costly:

The process is that less developed countries join a monetary union with more developed countries that have a low rate of inflation will also have to lower inflation. This then means that, for a given level spending, they will have to increase taxes. In general, countries with an underdeveloped tax system will find it more advantageous to raise revenue by inflation and the others will be a loss of welfare.

What is more, we know that there are asymmetric shocks, but I want to stress that these can be transmitted in asymmetric way because economies have different structures and institutions in labour, products and financial markets also differ. We conclude that, due to structural differences in the workings of labour markets, the same policy of the ECB has very different effects on outcomes in different countries.

The main problem is that governments can create budget deficits to absorb negative shocks without leading to problems of sustainability of these deficits.

As Peripheral European countries have experienced during the current crisis, however, government budget deficits can lead to problems. If the interest rate on the government debt exceeds the growth rate of the economy, a debt dynamic is set in motion which leads to an ever-increasing government debt relative to GDP. This becomes unsustainable, requiring corrective action. The important message is that, a budget deficit leads to an increase in government debt which will have to be serviced in the future reducing spending and/or increasing taxes.

For this reason, there are instruments that the ECB uses to pilot the economy towards targets, like open market operations, which are the most important instrument of the monetary policy of the ECB. The aim of these is increasing or reducing money market liquidity.

Now, I find interesting to focus my research on the origin of the divergences at the countries of the Eurozone. After that, I pretend to judge if the measures are being carrying out by governments are effective in order to stop divergences, or on the contrary, exist better alternatives to leave of the recession. As we have said, the best measure could not be the internal devaluation. Maybe better options exist to help deficit countries to make productive improvements in their competitiveness.

In order to understand the importance of this research, first of all, I'm going to explain Macroeconomic theory. With this idea I want to solve the next question: "What determines growth?"

Bob Solow and Trevor Swam, published two articles in the year 1956 introducing the Solow model, which I am presenting in this research. Bob Solow later developed many implications and applications of this model and was awarded the Nobel Prize in economics for this contributions. This model has shaped the way we approach not only economic growth but also the entire field of macroeconomics.

Before the advent of the Solow growth model, the most common approach to economic growth was built on the Harrod-Domar model, which emphasized potential aspects of economic growth. So, the Solow model demonstrated why do Harrod-Domar model was not an attractive place to start.

The Solow model is remarkable in its simplicity and for abstract representation of a complex economy. Therefore, the Solow model should be thought of as a starting point and a springboard for richer models.

As I will propose in my study, the role of capital accumulation and the technological progress are the protagonists:

$$Y = F(K, N)$$

Y → Aggregate output

K → Aggregate capital stock

(All the machines, plants and office buildings in the economy)

N → Aggregate employment

(The number of workers in the economy)

As we can see at the formula, capital accumulation does affect the level of output, but it cannot by itself sustain growth. A higher saving rate typically leads to lower consumption initially but to more consumption in the long run. This is because in the long run, the growth rate of an economy is determined by the rate of technological progress.

But, one thing occurs: *Even under constant returns to scale, there are decreasing returns to each factor, keeping the other factor constant:*

- *There are decreasing returns to capital: given labour, increases in capital lead to smaller and smaller increases in output.*
- *There are decreasing returns to labour: given capital, increases in capital lead to smaller and smaller increases in output.*

So, what determines how much output can be produced for given quantities of capital and labour? The state of technology.

Understand the base of this reasoning, the *Solow Model*, transform the first model at the “Output per worker and capital per worker”:

$$\frac{Y}{N} = F\left(\frac{K}{N}, 1\right)$$

With this new formula, if there is an economy with a high growth rate of output per worker over some period of time, it could be for two reasons:

- *It may reflect a high rate of technological progress under balanced growth.*
- *It may reflect instead the adjustment of capital per effective worker, to a higher level. Such adjustment leads to a period of higher growth, even the rate of technological progress has not increased.*

As we know, there are decreasing returns, because increases in capital per worker lead to smaller and smaller increases in output per worker as the level of capital per worker increases. For this reason, capital accumulation by itself cannot sustain growth. The economy will be unwilling or unable to save and invest enough to further increase capital.

At the time, sustained growth requires sustained technological progress.

In order to finally with the economic theory of Blanchard, there are two sources of convergence between countries:

- *Poorer countries are poorer because they have less capital to start with. Over time, they accumulate capital faster than others, generating convergence.*
- *Poorer countries are poorer because they are less technologically advanced than the others. Over the time, they become more sophisticated, either by importing technology from advanced countries or developing their own. As technological levels converge, so does output per worker. This one is the more important source of convergence because development is very important in our society. A country that saves more or spends more on education will achieve a higher level of output per worker in steady state.*

By all this, at the paper I am going to develop a research using real data of Eurozone economies. I am going to use a methodology whose results give me the opportunity to contrast my hypothesis. So that, if I am right on my thoughts, actual policy of depressed countries could not be the better. It is possible that a change in their behavior, doing other government policies based on more investments in the technological process, could be optimal.

5. METHODOLOGY

To get robust conclusions, this type of research of time series analysis has often been conducted by applying unit root tests. In order to explain the quantifiable method, I begin with the normal way of my data and identify the order of integrality to determine the number of times it will be necessary to differentiate the series to make it stationary on average. As I said, the detection method of the number of unit roots that I used, was augmented Dickey Test -Fuller (ADF abbreviated). This test tests the significance of the associated t-1 variable, which in the most general version would take the expression parameter:

$$\Delta y_t = a_0 + \gamma \cdot y_{t-1} + \sum_{i=1}^j \Delta y_{t-i} + a_2 \cdot t + E_t$$

Thus, if the gamma parameter is statistically different from zero, the series will be stationary on average. If we cannot reject the null hypothesis that the parameter equals zero hypotheses, then we can conclude that the series will have at least one unit root.

Summarizing,

$H_0 \rightarrow \gamma = 0 \rightarrow$ Accept divergence with Eurozone's average

$H_1 \rightarrow \gamma \neq 0 \rightarrow$ Accept convergence with Eurozone's average

Therefore, if we can reject the null hypothesis, then we consider that the series is stationary and the country converges to the European average. If we cannot reject it then we can think that the country in question has at least one unit root, diverging from the European average, in this case.

6. ANALYSIS OF RESULTS

In this paper we take the real unit labor cost as a relevant indicator of competitiveness and, as such, as a driver of real convergence. We examine our hypothesis of divergence in a selection of 10 Eurozone economies:

- | | |
|------------|-------------|
| 1. Belgium | 6. France |
| 2. Germany | 7. Italy |
| 3. Ireland | 8. Austria |
| 4. Greece | 9. Portugal |
| 5. Spain | 10. Finland |

Through the AMECO database, I have obtained data of the following variables:

- *Gross national income at 2005 market prices, deflator GDP (OVGN)*
- *Net capital stock at 2005 prices per person employed: total economy: Capital intensity (RKNDE)*
- *Total factor productivity: total economy (ZVGDF)*

I have used data series from 1991 to 2013 for each of selected countries. First of all, I need the variable Gross national income to weigh the other two variables concerning the indicator of competitiveness. This is important because I make the average of all the data of the period for each country. With these means, I make a total sum of mean assuming that this is 100%. Now I can ponder each country average:

| Belgium | Germany | Ireland | Greece | Spain | France | Italy | Austria | Portugal | Finland | |
|------------|----------|------------|------------|------------|------------|------------|------------|-----------|------------|---------|
| 286,820848 | 2187,617 | 111,432222 | 164,670904 | 792,618857 | 1617,56535 | 1337,79439 | 227,065009 | 139,86177 | 139,469704 | 7004,92 |
| 4,09% | 31,23% | 1,59% | 2,35% | 11,32% | 23,09% | 19,10% | 3,24% | 2,00% | 1,99% | 100% |

With this, I formed a panel for each variable. I have made some tables and graphs in Excel (see them at annex). This process allows me analyzing behavior of each country during this period time. It is worth to comment the transformation I had to do on the variable of total factor productivity to create a useful table. So I had to make changes in order to prices have first data as the base year. With this change, the results are of more clearly.

Convergence can be defined as the narrowing of international differences in the development of some economic variables. The concept of convergence in time series analysis refers to the notion that the output of a country relative to the European average of the reference is stationary.

This topic of convergence across European countries is receiving a great deal of attention from economists. Since economic convergence within the EMS member states is a precondition to economic and monetary integration.

Distinction must be made between nominal convergence, which is the convergence of the development of costs and prices and their underlying determinants, real convergence of working conditions and living standards and the convergence of economic institutions or structures. The latter is one of the fundamental objectives of a fully integrated Europe, but it is a long-term process.

For all this, I want to extract from the data whether each country converges to the European average sample. To do it, I constructed two tables more with a spread of initial variables and their average (see them at annex). From that differential, I made graphs to see intuitively the behavior of the studied variables: Capital intensity and Total Factor Productivity. In each of the graphs, we can see the evolution of the variable for each of the European countries in the sample over the period. In addition, we calculated the weighted average of the weight that each country in the whole. However, what interests us is whether or not each country converges to the European average. From the graphs, we can get an idea then contrast this with the unit root test to see whether or not convergence.

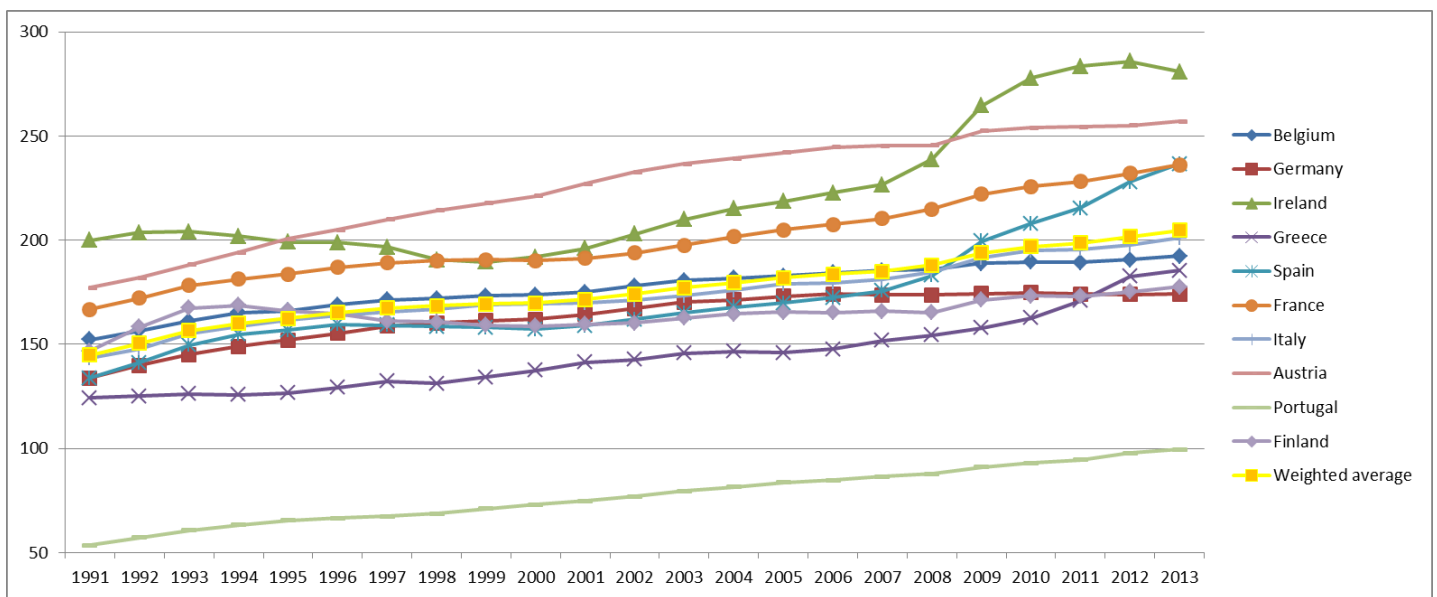
To see it more clearly, I attached two types of graphs for each variable: Net Capital Stock and Total factor productivity. Both show the same but in different ways:

- The first way is the evolution of the real data and the European average. With this, we can see that the country is above the European average in capital accumulation and / or the total factor productivity, which under, and which follows similar trend and evolution.
- The second method shows the differential, calculated with actual data minus the mean. Therefore, when it is close to 0, it has more convergence with the European average of Capital intensity and / or Total factor productivity.

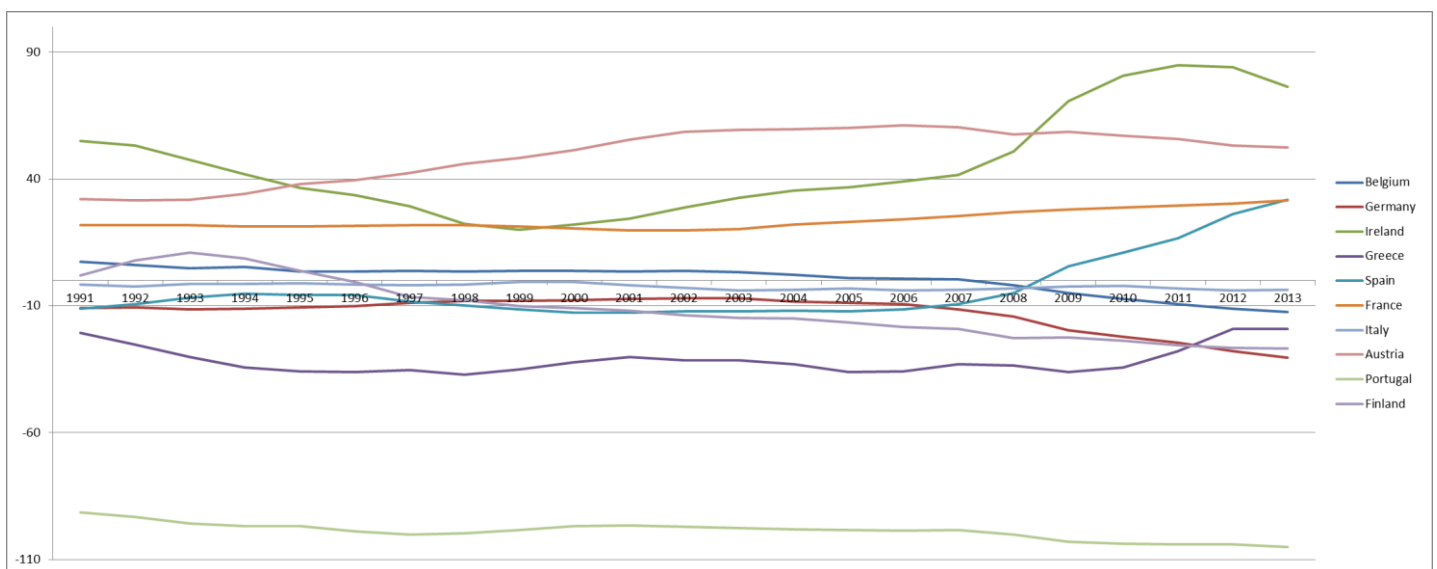
So, here I present graphs which show the evolution of countries respect to the sample mean for the time period studied.

I consider important to distinguish those countries which have big differences from the European average. Besides countries that are closer in terms of capital intensity and Total Factor Productivity. This allows us to see intuitively which countries could converge to the EU average and which others could diverge. This part of my research, only gives us a simple and visual outcome, then I check it with an econometric test of convergence

Net capital stock at prices per person employed: total economy: - Capital intensity



Own elaboration graph with data of database of AMECO.



Own elaboration graph with data of database of AMECO.

I am going to begin the comment with countries which their data is very different from the mean. With these countries, I can form two groups of four countries each.

- Countries far above the average
 - With mixed developments:
 - Ireland: shows a very different evolution, not constant, always staying above the European sample mean.
 - Austria: country with constantly evolving, always with higher intensity than the European average capital.
 - With possible future convergence between both:
 - France: country with constantly evolving, always with higher intensity than the European average capital.
 - Spain: country whose capital intensity, despite close to, has generally been lower than average until 2008, then it changes its trend positively, placing it in a more favorable area, above the average.

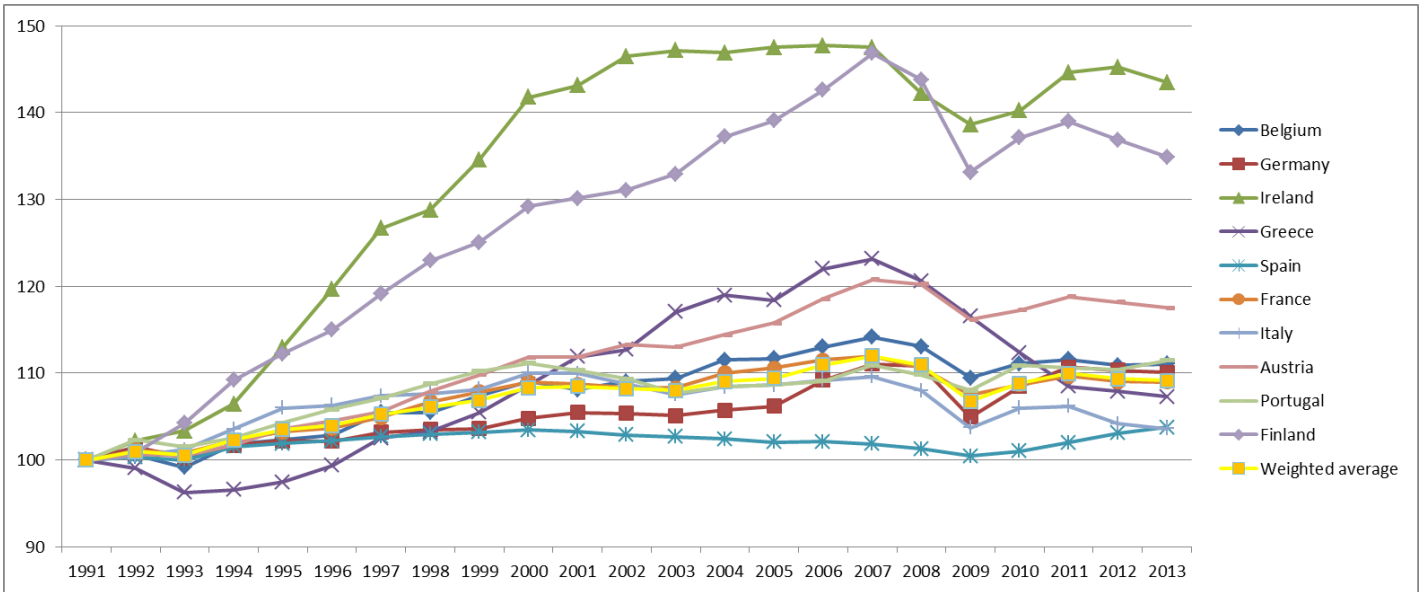
- Countries far below the average
 - With possible future convergence between them:
 - Greece: presents some fluctuations and a growing trend in recent years.
 - Finland: country with evolving with fluctuations, generally with lower intensity than the European average capital. It also has a decreasing trend.
 - Germany: country with evolving fluctuations, generally with lower intensity than the European average capital. It also has an increasing tendency.
 - With mixed developments:
 - Portugal: stands out as the country that is far from the European average. Presents a consistent trend, without many fluctuations.

Meanwhile, two countries whose capital intensity is closer to the average observed:

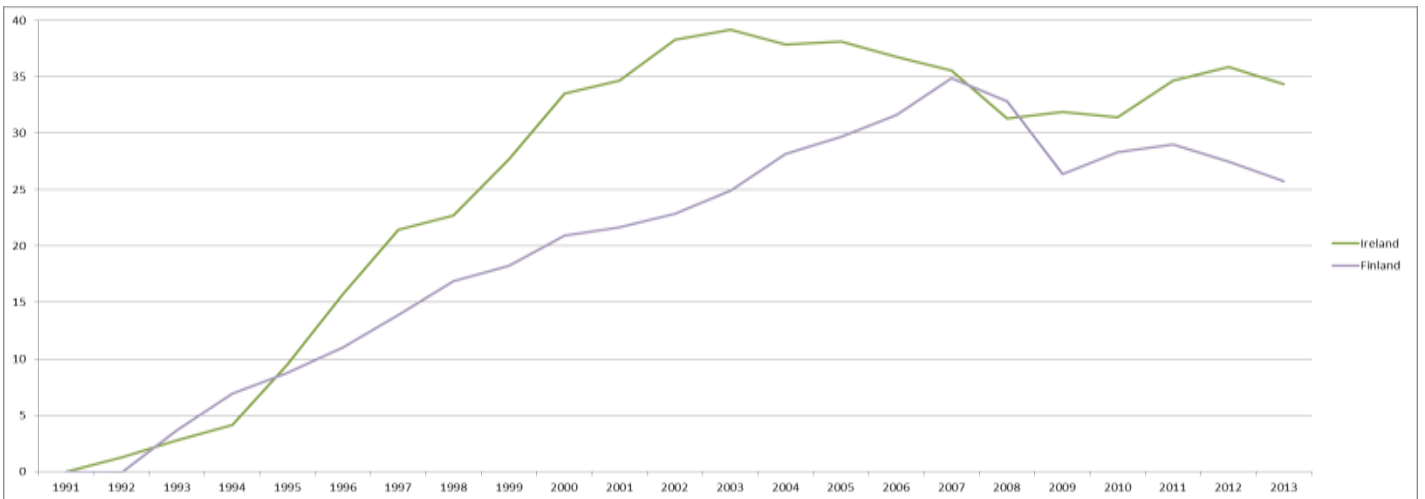
- Italy: the country that is closest to the European average. Presents a consistent trend, near the average for the entire period.
- Belgium: has similar capital intensity to the European average over time, one time above, one time below, but without much fluctuation.

So, I remark Italy as the country most likely to indicate that the econometric test convergence with the European average. Also, stressing Portugal, because it has very different capital intensity than the mean. This is negative, since it has very small capital intensity relative to other European members.

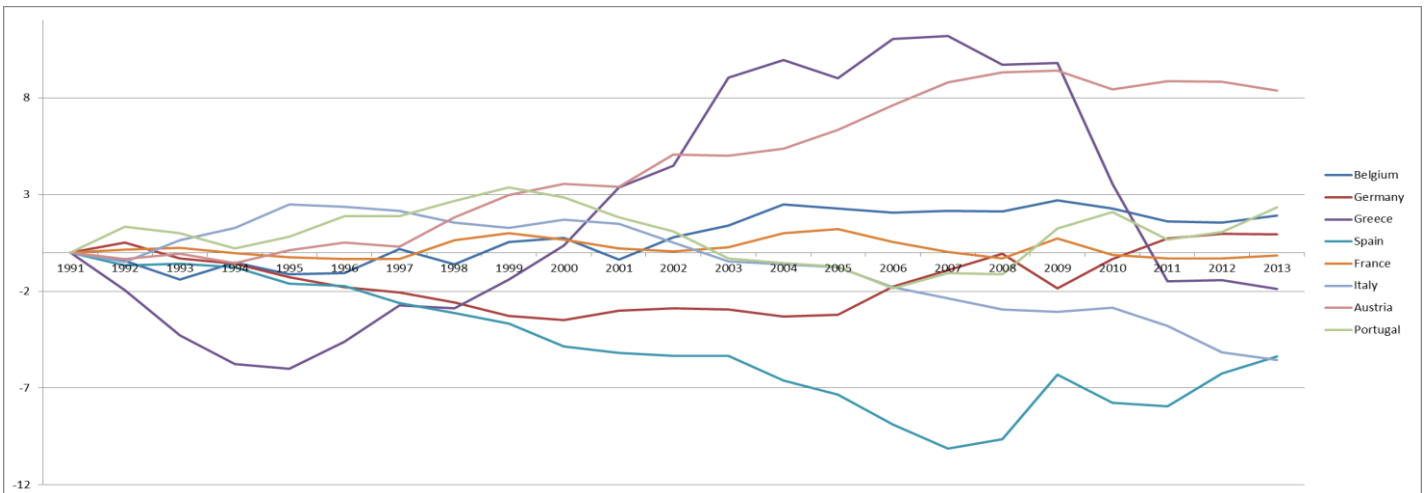
Total factor productivity: total economy



Own elaboration graph with data of database of AMECO.



Own elaboration graph with data of database of AMECO.



Own elaboration graph with data of database of AMECO.

Continuing with the same criteria of comment now I will differentiate countries according to their levels of total factor productivity. Regarding countries most differenced from the mean, I can form two groups:

- Countries far above the average
 - Remarkably far (I present it in a separate graph because they show very different to other European countries evolution. Their total factor productivity is much higher, which means better use of their resources)
 - Finland: presents growing trend of total factor productivity until 2007, then it changes its trend as negative. However, it remains well above the European average.
 - Ireland: country with evolving fluctuations, generally with an overall increased productivity and well above the European average factors.
 - Moderately above average
 - Austria: presents growing trend of total factor productivity, which lets itself walk away positively of the European average.
- Countries far below the average
 - Moderately below average showing some convergence between them.
 - Italy: evolves with fluctuations, generally close to the average until 2005, when total factor productivity changes its trend negatively.
 - Spain: country always with total productivity lowers than the European average. Besides decreasing trend until recent years. This is the worst country of the European members.
 - France: noted for its constant proximity to the European average.
- Country with mixed developments:
 - Greece: classified it regardless because it has introduced large variations in total factor productivity over the period. It started by below average, followed by a strong improvement until 2009, when it again changed its trend, plummeting. However, in recent years it is close to the average, what is more, it is being more or less stable.

Meanwhile, two countries whose capital intensity is closer to the average observed:

- With possible future convergence between them:
 - Belgium: country which evolves with small fluctuations, it usually has constant total productivity and it is close to the European average.
 - Portugal: its total factor productivity fluctuates above and below the average, and recently is placed above.
 - Germany: mainly their total factor productivity has been below average, until it changed its trend positively.

So, I remark France as the country most likely to indicate that the econometric test convergence with the European average. I also stress Greece to present large fluctuations relative to the average during all the period.

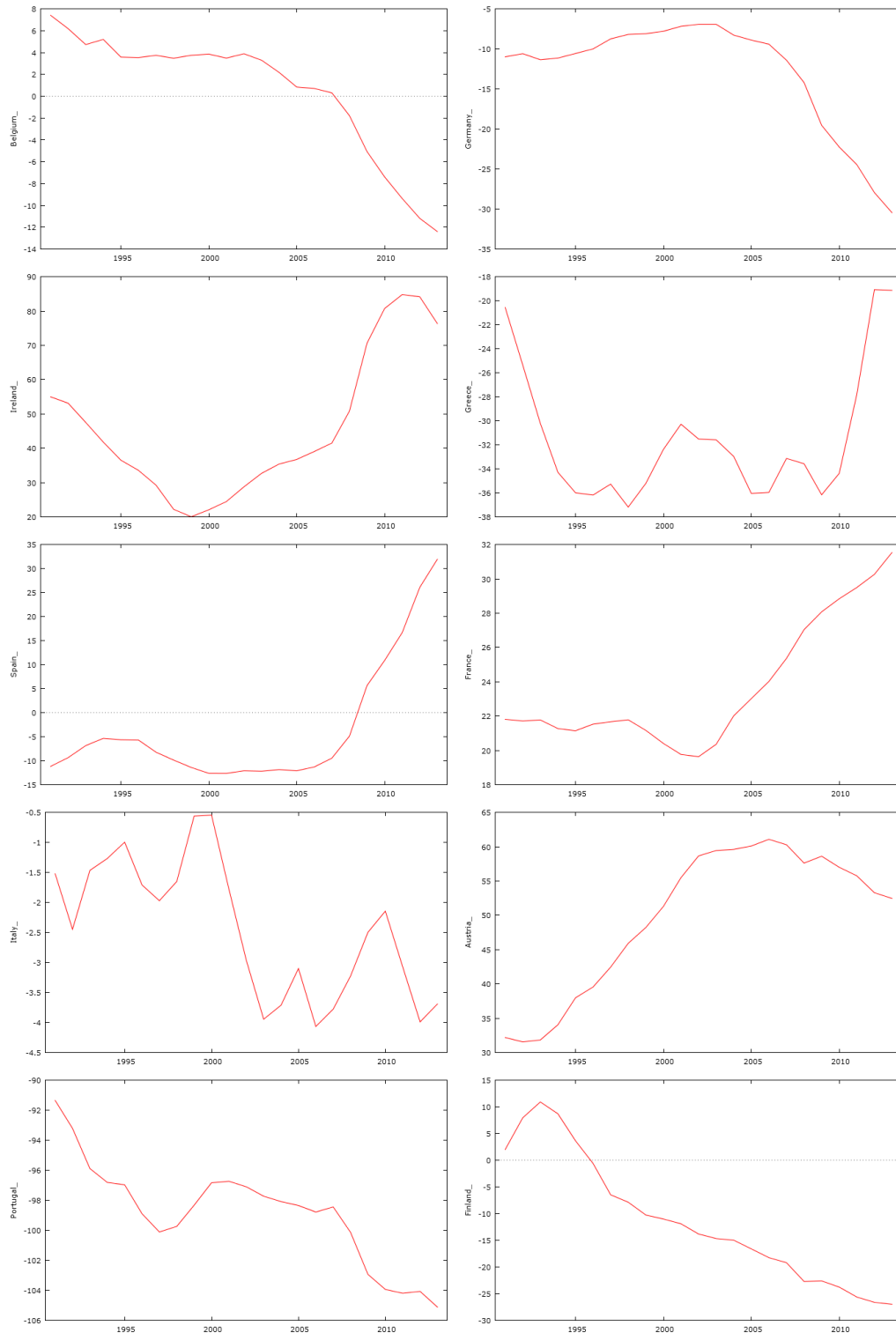
But a graphical analysis is not enough to get consistent conclusions. For this reason I used RATS, to support the convergence hypothesis across countries with unit root tests, as the augmented Dickey-Fuller.

To begin, I passed data from Excel to my sample. I can start using the data at the moment as I characterize these data as a time series that got its start in 1991.

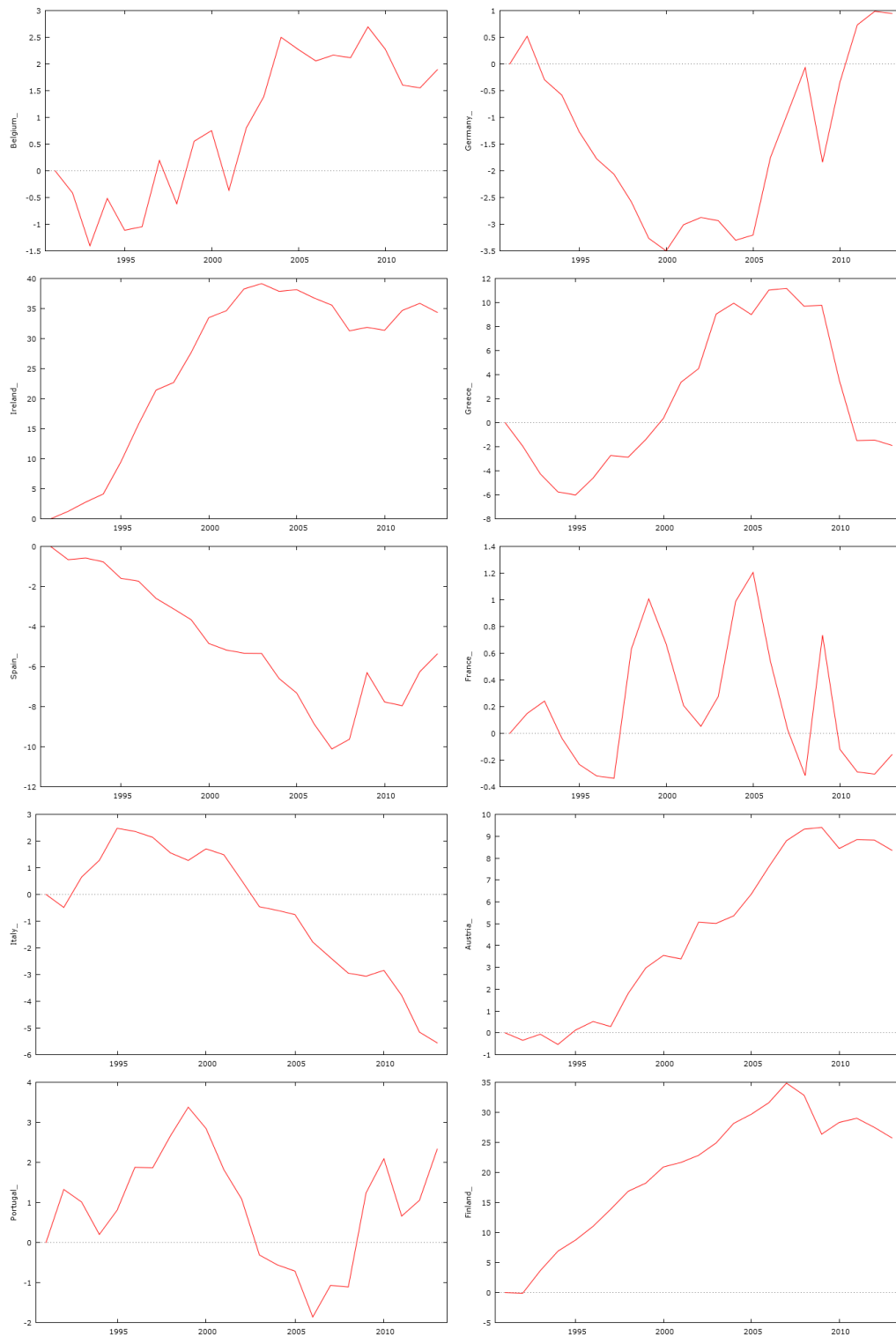
In order to do a do a good research, I need to know if data have trend. This is important because, empirically speaking, if the process is stationary, it will be without trend. Conversely, a non-stationary process it will be with a trend which implies divergence with European average sample. So I made graphs of development of each country during the period. I used Gretl to make graphs.

As we can see then, not all countries have a clear tendency during the studied period. So it is worth to do a complete test of unit roots in order to get robust results.

Net capital stock



Total factor productivity



Once the test has been understood, I proceed to present the results that I extracted from the data analyzed:

Net capital stock

| | Belgium | | | | Germany | | | | Ireland | | | |
|---|---------|---------|-----|--------|---------|--------|-----|--------|---------|---------|-----|--------|
| | BIC | | LM | | BIC | | LM | | BIC | | LM | |
| | lag | static | lag | static | lag | static | lag | static | lag | static | lag | static |
| t | 1 | -0,7369 | 0 | 0,0299 | 0 | 0,9270 | 0 | 0,927 | 4 | 2,1376 | 0 | -2,139 |
| Z | 1 | -2,501 | 0 | 0,0639 | 0 | 0,9302 | 0 | 0,9302 | 4 | -2,4592 | 0 | -2,856 |

| | Greece | | | | Spain | | | | France | | | |
|---|--------|----------|-----|---------|-------|--------|-----|--------|--------|---------|-----|---------|
| | BIC | | LM | | BIC | | LM | | BIC | | LM | |
| | lag | static | lag | static | lag | static | lag | static | lag | static | lag | static |
| t | 1 | -2,5861 | 0 | -1,9833 | 0 | 1,2333 | 0 | 1,2333 | 1 | -1,6865 | 0 | -1,6964 |
| Z | 1 | -14,3205 | 0 | -4,8388 | 0 | 1,9717 | 0 | 2,9717 | 1 | -4,236 | 0 | -2,0873 |

| | Italy | | | | Austria | | | | Portugal | | | | Finland | | | |
|---|-------|----------|-----|---------|---------|--------|-----|--------|----------|---------|-----|---------|---------|---------|-----|---------|
| | BIC | | LM | | BIC | | LM | | BIC | | LM | | BIC | | LM | |
| | lag | static | lag | static | lag | static | lag | static | lag | static | lag | static | lag | static | lag | static |
| t | 1 | -3,4514 | 0 | -2,1525 | 1 | 0,7813 | 0 | 0,7813 | 1 | -1,4722 | 0 | -1,6248 | 0 | -1,7482 | 0 | -1,7482 |
| Z | 1 | -22,3844 | 0 | -8,5378 | 1 | 1,2393 | 0 | 1,2393 | 1 | -5,8878 | 0 | -4,1662 | 0 | -5,9975 | 0 | -5,9975 |

**Rejection if the null hypothesis at 5% significance level*

Note: * Choosing the optimal lag length for the ADF regression between 0 and 5 lags by adding lags until a Lagrange Multiplier test fails to reject no residual serial correlation at level 0.050

| | 1% | 5% | 10% |
|---|-------|-------|-------|
| t | -4,38 | -3,6 | -3,24 |
| Z | -22,5 | -17,9 | -15,6 |

Total factor productivity

| | Belgium | | | | Germany | | | | Ireland | | | |
|---|---------|----------|-----|----------|---------|---------|-----|---------|---------|---------|-----|---------|
| | BIC | | LM | | BIC | | LM | | BIC | | LM | |
| | lag | static | lag | static | lag | static | lag | static | lag | static | lag | static |
| t | 0 | -2,9265 | 0 | -2,9265 | 0 | -1,1392 | 0 | -1,1392 | 0 | -0,6456 | 0 | -0,6456 |
| Z | 0 | -13,0877 | 0 | -13,0977 | 0 | -2,7877 | 0 | -2,7877 | 0 | -0,969 | 0 | -0,969 |

| | Greece | | | | Spain | | | | France | | | |
|---|--------|---------|-----|---------|-------|---------|-----|---------|--------|----------|-----|----------|
| | BIC | | LM | | BIC | | LM | | BIC | | LM | |
| | lag | static | lag | static | lag | static | lag | static | lag | static | lag | static |
| t | 0 | -0,3718 | 0 | -0,3718 | 0 | -0,3928 | 0 | -0,3928 | 0 | -2,4844 | 0 | -2,4844 |
| Z | 0 | -0,9505 | 0 | -0,9505 | 0 | -1,5719 | 0 | -1,5719 | 0 | -10,9495 | 0 | -10,9495 |

| | Italy | | | | Austria | | | | Portugal | | | | Finland | | | |
|---|-------|---------|-----|---------|---------|---------|-----|---------|----------|---------|-----|---------|---------|--------|-----|--------|
| | BIC | | LM | | BIC | | LM | | BIC | | LM | | BIC | | LM | |
| | lag | static | lag | static | lag | static | lag | static | lag | static | lag | static | lag | static | lag | static |
| t | 4 | -3,3165 | 0 | -1,7907 | 0 | -1,511 | 0 | -1,511 | 0 | -1,5942 | 0 | -1,5942 | 0 | 0,1987 | 0 | 0,1987 |
| Z | 4 | -8,07 | 0 | -3,6771 | 0 | -6,1189 | 0 | -6,1189 | 0 | -5,6652 | 0 | -5,6652 | 0 | 0,4003 | 0 | 0,4003 |

*Rejection if the null hypothesis at 5% significance level

Note: * Choosing the optimal lag length for the ADF regression between 0 and 5 lags by adding lags until a Lagrange Multiplier test fails to reject no residual serial correlation at level 0.050

| | 1% | 5% | 10% |
|---|-------|-------|-------|
| t | -4,38 | -3,6 | -3,24 |
| Z | -22,5 | -17,9 | -15,6 |

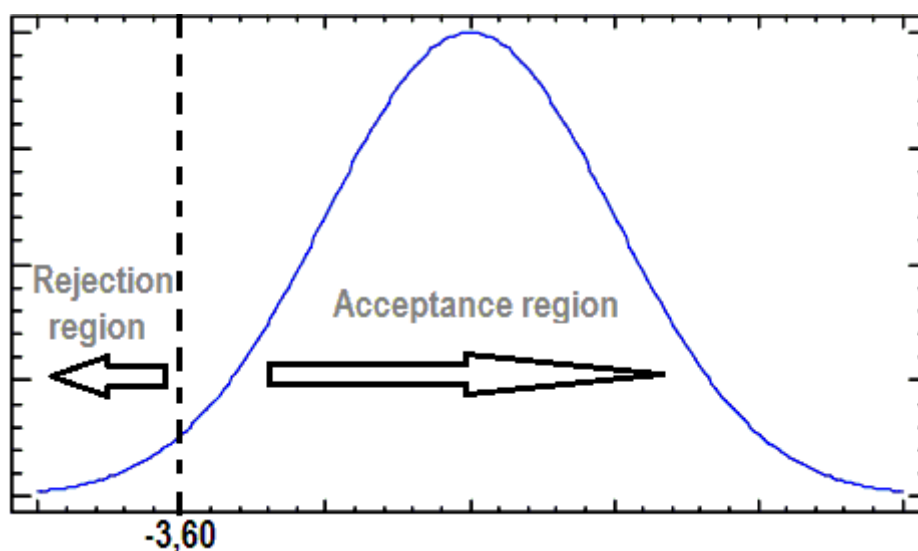
As I said, I used augmented Dickey Test-Fuller as a method of unit root test. There, I had to choose delays. So I did it with AIC/BIC and LM, two forms to establish delays. With this I am seeking more robust conclusions.

- First method, AIC / BIC, use t-static to make a basic unit root test. But as we saw with the graphs of each country before, some countries may have a tendency. For this reason, it is interesting to calculate Z-static to include tendency at the study.
- Second method, LM, calculates same statistics, but it has different way to choose delays.

Therefore, in order obtain robustly results, it is worth to both methods give us the same outputs. As we clearly could see on results' tables, generally, all of them are situated in the region of non-rejection of the null hypothesis of convergence. So countries do not converge with the European average, this is, they are diverging.

In reaching this conclusion, we interpret econometrics:

If the statistical value of t is greater than -3.60 , which is showing in above table significance, it would be in the rejection region. Therefore, when there are more small statics of countries, we could reject the null hypothesis of no convergence with different maximum error: 10%, 5% and 1% significance.



Therefore, with the variable Net Capital stock, we accept the null hypothesis of divergence in all countries, except on Italy. The results of the AIC / BIC method are the same: t -statistic = -3.4514 and $Z = -22.3844$. Although with LM method, which includes influence of tendency, gives inconsistent results, $t = -2.1525$ as $Z = -8.5378$. So, we can say that the result of convergence to the European average is not robust at both methods.

As can be seen from the analysis, most of the results are greater than the statistic associated with 0.05 significance level, so we cannot reject the null hypothesis and the series has at least a unit root. In case of Italy, the statistic t is less than 0.05 of significance and it is stationary. So we can conclude that Italy converges to the European average. However, we can see at the rest of countries, unit root tests might fail to reject the null hypothesis of the unit root, thereby wrongly implying absence of convergence.

Now it is important to note that studies with the unit root test refer to absolute convergence of the countries with the average. With that I have just obtained one converging country (Italy). This little evidence of convergence at European countries could be because I used a simple method of root test. This method has low power as unit root test, as it leaves out the possible structural changes. So, it is logical that there is not convergence between them. To sum up, there may be nominal convergence, but I could not affirm that there is real convergence. For this reason, the traditional neoclassical model of Solow fails.

7. FURTHER RESEARCH

I have obtained a basic result of convergence between countries. It would be appropriate to continue the study in order to obtain greater convergence. It would be possible relaxing some rigidities of the basic model of absolute convergence.

Therefore, given the existence of structural changes, it might be better not to stop the analysis here. The next thing that I would have to do to continue the research is to make conditional convergence econometric test. In this test I can limit the study, for example, doing groups of countries with similar economies.

8. CONCLUSION

As we know, in modern growth theory, when a country joins a monetary union, foregoing the use of monetary and Exchange rate policies to stabilize its national economy, the independent use of fiscal policy becomes more attractive, despite the political obstacles to fiscal flexibility.

In order to do a government's fiscal policy suitable, the growth rate of a government's debt, which is defined as the ratio of the budget deficit to the stock of debt outstanding, must not exceed the interest rate on that debt.

It is true that the existence of a current account deficit only becomes a problem when other countries are no longer willing to finance it. Without adjustments, debt accumulation will lead to destabilizing monetary tensions or a continuous impoverishment of the debtor country. This situation is exactly happening in Europe now, so it is necessary a reduction in current account imbalances with improvements in economics growth.

Capital accumulation plays a greater role in the growth process due to the embodied technological progress. Under this framework, capital accumulation and technical change can influence long-run growth. Bearing this in mind, we decided to turn our attention to the extent to which European countries are converging in terms of capital intensity and total factor productivity.

This paper contributes to the empirical literature significantly. The most innovative feature of our analysis is to contribute to looking for the cause of the deficit in the periphery countries. It is common to think that this cause of deficit is linked to excess debt, but is truer if we link this excess like a consequence. So, the policies that governments have to carry out by have to go by the supply side (innovation, development, productivity...). Therefore, what is wrong is the growth model, so we have to correct it.

To conclude this research, I am going to do a little summary:

First, I examined capital intensity and total factor productivity. This is interesting because the analysis of these two variables may provide richer information on convergence behavior and may help clarify the mechanisms that operate in European national growth dynamics. As stated before, I used the ADF unit root test to examine convergence behavior in Europe.

Although capital intensity and productivity have played an important role for countries, our results suggesting that the economic reforms don't have been successful in driving long-run growth. So, countries need further reforms in order to reach convergence. Specific economic policies aimed at enhancing a balanced national development are still needed.

I found that only one country has converged in terms of labor productivity and total factor productivity. The results suggest that there are notable differences across countries and the whole nation in terms of capital intensity and total factor productivity.

Clarifying, it seems that according to our results not all the countries have benefited from the economic reforms to the same degree. The results were generally to be expected, as countries have experienced rapid and continuous development throughout the period under consideration. It means, the results show notable improvements in total factor productivity across countries and relative to the European average, although there are still differences in some countries. So, further economic policies are needed to achieve convergence in capital intensity and narrow the gap that exists across countries.

My findings provide new insights into Europa's national growth and convergence behavior. So, this analysis may be useful for policymakers seeking to address national imbalances. For example, stepped-up integration of financial markets may improve capital allocation efficiency and it also can broaden risk-sharing among euro area countries, thus mitigating the negative impact of heterogeneity in the euro area. However, in the light of the most recent crisis, the effects of capital market integration, like the convergence of interest rates and lower financing costs, have not to be seen as absolutely positive.

Therefore, the main idea is that the policies that governments have to carry out by have to go by the supply side, in order to correct the growth model.

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10. ANNEXES

ANNEX 1

Gross national income at 2005 market prices, deflator GDP

(OVGN)

| | Belgium | Germany | Ireland | Greece | Spain | France | Italy | Austria | Portugal | Finland | |
|------|------------|----------|------------|------------|------------|------------|------------|------------|-----------|------------|---------|
| 1991 | 229,3834 | 1881,76 | 58,8558 | 130,4567 | 598,2625 | 1315,427 | 1162,525 | 176,8336 | 112,8072 | 102,0514 | |
| 1992 | 232,8372 | 1914,909 | 60,0511 | 131,5405 | 602,7192 | 1338,132 | 1169,935 | 181,1181 | 116,9113 | 97,3494 | |
| 1993 | 232,8667 | 1891,989 | 61,9406 | 128,6172 | 598,4654 | 1331,54 | 1162,379 | 182,1263 | 116,0822 | 95,9121 | |
| 1994 | 242,2426 | 1925,077 | 65,8069 | 131,5631 | 607,0361 | 1358,462 | 1185,709 | 186,2736 | 117,382 | 100,6624 | |
| 1995 | 247,4052 | 1952,081 | 71,0482 | 134,3399 | 629,5929 | 1385,66 | 1224,135 | 190,2135 | 120,505 | 105,7179 | |
| 1996 | 251,5739 | 1971,887 | 78,3346 | 137,0609 | 642,5056 | 1408,381 | 1241,091 | 196,7204 | 124,6953 | 110,2762 | |
| 1997 | 261,2486 | 2002,556 | 85,7413 | 142,09 | 667,6354 | 1444,055 | 1271,905 | 200,217 | 129,3931 | 118,1209 | |
| 1998 | 265,764 | 2033,613 | 92,7227 | 146,7989 | 696,9055 | 1494,425 | 1288,883 | 207,3999 | 135,8459 | 123,4215 | |
| 1999 | 275,6675 | 2069,981 | 99,9219 | 149,7578 | 730,3036 | 1555,027 | 1313,097 | 213,8149 | 141,0537 | 129,5665 | |
| 2000 | 286,7444 | 2136,415 | 110,7683 | 159,003 | 767,9489 | 1609,103 | 1357,437 | 221,8456 | 144,9748 | 137,2029 | |
| 2001 | 287,1329 | 2167,146 | 114,03 | 166,2764 | 789,9348 | 1637,611 | 1383,881 | 222,7586 | 147,1066 | 141,2207 | |
| 2002 | 290,3253 | 2162,67 | 117,9716 | 171,3644 | 812,1945 | 1641,646 | 1390,073 | 228,5791 | 149,6855 | 144,2501 | |
| 2003 | 293,1519 | 2165,458 | 126,1067 | 180,0011 | 840,2714 | 1661,726 | 1389,18 | 231,1964 | 149,2775 | 145,7951 | |
| 2004 | 301,5075 | 2228,2 | 131,6403 | 187,6395 | 866,1559 | 1709,32 | 1418,163 | 237,7092 | 151,4529 | 154,1237 | |
| 2005 | 305,423 | 2249,59 | 140,4425 | 190,2405 | 896,385 | 1744,922 | 1436,795 | 242,8631 | 151,9806 | 158,154 | |
| 2006 | 314,1888 | 2353,686 | 150,6145 | 199,0153 | 930,4989 | 1791,902 | 1472,396 | 251,5091 | 151,7784 | 165,9313 | |
| 2007 | 323,7208 | 2423,141 | 156,3293 | 204,8566 | 956,4263 | 1832,069 | 1491,839 | 260,4874 | 155,1204 | 173,2163 | |
| 2008 | 328,3071 | 2435,975 | 153,0032 | 203,5597 | 961,5881 | 1830,899 | 1459,316 | 266,8301 | 154,4653 | 174,394 | |
| 2009 | 312,6333 | 2341,023 | 137,7435 | 198,8752 | 932,3267 | 1774,754 | 1387,914 | 254,7553 | 149,1971 | 161,3569 | |
| 2010 | 327,5321 | 2427,457 | 137,4336 | 188,327 | 936,1056 | 1808,664 | 1411,685 | 261,972 | 153,1097 | 166,6077 | |
| 2011 | 330,6559 | 2510,362 | 135,5406 | 174,7766 | 929,5849 | 1847,061 | 1416,665 | 267,3744 | 150,8614 | 169,2409 | |
| 2012 | 328,0481 | 2530,775 | 136,6019 | 169,3463 | 922,2843 | 1839,862 | 1379,976 | 269,8692 | 147,3334 | 167,8855 | |
| 2013 | 328,5193 | 2539,44 | 140,292 | 161,9242 | 915,1022 | 1843,355 | 1354,292 | 270,0284 | 145,8014 | 165,3458 | |
| | 286,820848 | 2187,617 | 111,432222 | 164,670904 | 792,618857 | 1617,56535 | 1337,79439 | 227,065009 | 139,86177 | 139,469704 | 7004,92 |
| | 4,09% | 31,23% | 1,59% | 2,35% | 11,32% | 23,09% | 19,10% | 3,24% | 2,00% | 1,99% | 100% |

Own elaboration table with data of database of AMECO.

ANNEX 2

Net capital stock at 2005 prices per person employed: total economy: Capital intensity (RKNDE)

| | Belgium | Germany | Ireland | Greece | Spain | France | Italy | Austria | Portugal | Finland | Weighted average |
|------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|------------------|
| 1991 | 152,2749 | 133,8699 | 199,8612 | 124,304 | 133,678 | 166,6812 | 143,346 | 177,0626 | 53,51859 | 146,8637 | 144,8676588 |
| 1992 | 156,5937 | 139,8091 | 203,5407 | 125,0534 | 141,0564 | 172,1278 | 147,9635 | 181,9701 | 57,19758 | 158,3577 | 150,4112696 |
| 1993 | 161,19 | 145,1062 | 203,9949 | 126,2505 | 149,6122 | 178,2426 | 154,9981 | 188,3035 | 60,57779 | 167,3769 | 156,4650562 |
| 1994 | 165,2784 | 148,9365 | 201,8776 | 125,798 | 154,74 | 181,3585 | 158,8143 | 194,1379 | 63,27321 | 168,7798 | 160,0837589 |
| 1995 | 166,094 | 151,9298 | 199,0401 | 126,5239 | 156,878 | 183,6599 | 161,5145 | 200,4901 | 65,5413 | 166,1588 | 162,5119249 |
| 1996 | 168,8658 | 155,3246 | 198,8965 | 129,1522 | 159,6335 | 186,8618 | 163,6203 | 204,8868 | 66,43455 | 164,7275 | 165,3302958 |
| 1997 | 171,2358 | 158,7382 | 196,7333 | 132,2274 | 159,2646 | 189,164 | 165,5216 | 209,9437 | 67,38126 | 161,0239 | 167,4933459 |
| 1998 | 171,9291 | 160,2553 | 190,6722 | 131,2726 | 158,5827 | 190,2403 | 166,8026 | 214,3702 | 68,71556 | 160,587 | 168,4541079 |
| 1999 | 173,2007 | 161,3484 | 189,5055 | 134,2438 | 158,0624 | 190,6251 | 168,8939 | 217,6726 | 71,13138 | 159,1989 | 169,4558585 |
| 2000 | 173,7041 | 162,0441 | 191,9296 | 137,4678 | 157,2311 | 190,2562 | 169,303 | 221,1375 | 73,01826 | 158,8394 | 169,8497991 |
| 2001 | 175,0467 | 164,3713 | 196,0302 | 141,2762 | 158,9184 | 191,3225 | 169,7796 | 227,0405 | 74,82678 | 159,6543 | 171,5581607 |
| 2002 | 178,0433 | 167,2303 | 202,9316 | 142,64 | 162,0764 | 193,7934 | 171,1952 | 232,8046 | 77,05658 | 160,3376 | 174,158792 |
| 2003 | 180,5645 | 170,3358 | 209,9638 | 145,6871 | 165,0919 | 197,6252 | 173,3246 | 236,6982 | 79,53966 | 162,6069 | 177,269047 |
| 2004 | 181,799 | 171,3363 | 215,029 | 146,657 | 167,7845 | 201,6439 | 175,9141 | 239,2199 | 81,53711 | 164,6491 | 179,6249136 |
| 2005 | 182,784 | 173,0406 | 218,6991 | 145,9043 | 169,8612 | 204,9678 | 178,8471 | 242,0364 | 83,59962 | 165,348 | 181,9472501 |
| 2006 | 184,2955 | 174,1702 | 222,6481 | 147,6272 | 172,2959 | 207,6061 | 179,5219 | 244,6516 | 84,80504 | 165,3406 | 183,5875203 |
| 2007 | 185,3126 | 173,5969 | 226,5246 | 151,8802 | 175,5485 | 210,373 | 181,2349 | 245,2873 | 86,56827 | 165,8213 | 185,0112674 |
| 2008 | 186,1251 | 173,6993 | 238,7397 | 154,3378 | 183,0326 | 214,9471 | 184,6841 | 245,5088 | 87,77365 | 165,2008 | 187,909305 |
| 2009 | 188,8716 | 174,3954 | 264,5742 | 157,7842 | 199,5827 | 222,018 | 191,4455 | 252,547 | 91,00942 | 171,3495 | 193,943074 |
| 2010 | 189,6199 | 174,7525 | 277,73 | 162,6343 | 207,8755 | 225,8473 | 194,8653 | 254,0028 | 93,07502 | 173,2484 | 197,0104822 |
| 2011 | 189,2935 | 174,2105 | 283,4291 | 170,8537 | 215,3169 | 228,1522 | 195,5874 | 254,4079 | 94,4683 | 173,0432 | 198,6607555 |
| 2012 | 190,5654 | 173,8089 | 285,8821 | 182,6716 | 227,8242 | 232,0117 | 197,7637 | 255,039 | 97,68773 | 175,1419 | 201,7528563 |
| 2013 | 192,2581 | 174,1995 | 280,9658 | 185,5155 | 236,5859 | 236,1857 | 200,9635 | 257,1031 | 99,53692 | 177,6818 | 204,6535469 |

176,1743498

Own elaboration table with data of database of AMECO.

ANNEX 3

Total factor productivity: Total economy (ZVGDF)

| | Belgium | Germany | Ireland | Greece | Spain | France | Italy | Austria | Portugal | Finland | Weighted average |
|------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------------|
| 1991 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 1992 | 100,571085 | 101,503788 | 102,232157 | 99,0330415 | 100,323646 | 101,13357 | 100,499515 | 100,645479 | 102,308498 | 100,889825 | 100,9843024 |
| 1993 | 99,1411871 | 100,249567 | 103,33518 | 96,2856293 | 99,9647025 | 100,786672 | 101,195122 | 100,483506 | 101,557024 | 104,204032 | 100,5448834 |
| 1994 | 101,781369 | 101,713147 | 106,443091 | 96,5444566 | 101,52724 | 102,260686 | 103,575687 | 101,766685 | 102,498324 | 109,1889 | 102,2970425 |
| 1995 | 102,372662 | 102,213471 | 112,959438 | 97,4718435 | 101,893014 | 103,252792 | 105,962323 | 103,613106 | 104,293568 | 112,220868 | 103,4853099 |
| 1996 | 102,904125 | 102,175008 | 119,669665 | 99,3458576 | 102,219497 | 103,631981 | 106,311718 | 104,471133 | 105,829568 | 114,981051 | 103,9505259 |
| 1997 | 105,441958 | 103,181999 | 126,671744 | 102,520403 | 102,651388 | 104,910281 | 107,385574 | 105,535648 | 107,11218 | 119,113283 | 105,2464597 |
| 1998 | 105,474108 | 103,509004 | 128,782318 | 103,226809 | 102,971176 | 106,722823 | 107,647862 | 107,898684 | 108,754893 | 122,962587 | 106,0909427 |
| 1999 | 107,412667 | 103,59664 | 134,556502 | 105,4668 | 103,199379 | 107,867536 | 108,135933 | 109,832556 | 110,239274 | 125,083627 | 106,8601212 |
| 2000 | 109,03967 | 104,787553 | 141,771666 | 108,649269 | 103,440153 | 108,956018 | 109,995259 | 111,831789 | 111,132761 | 129,200312 | 108,286546 |
| 2001 | 108,122426 | 105,479379 | 143,12586 | 111,85534 | 103,315417 | 108,696957 | 109,976077 | 111,870546 | 110,307645 | 130,145168 | 108,4879489 |
| 2002 | 109,033851 | 105,356344 | 146,492771 | 112,727455 | 102,899481 | 108,282878 | 108,756534 | 113,293985 | 109,31733 | 131,075559 | 108,2302082 |
| 2003 | 109,39757 | 105,080513 | 147,159563 | 117,053133 | 102,672806 | 108,29053 | 107,555825 | 113,024751 | 107,702861 | 132,918477 | 108,0137931 |
| 2004 | 111,530341 | 105,730945 | 146,894609 | 118,974401 | 102,433493 | 110,019458 | 108,436968 | 114,386098 | 108,47453 | 137,199758 | 109,0304191 |
| 2005 | 111,65343 | 106,182106 | 147,524797 | 118,378868 | 102,063402 | 110,589686 | 108,63035 | 115,734279 | 108,670103 | 139,066584 | 109,3838878 |
| 2006 | 113,021218 | 109,212663 | 147,704367 | 122,002154 | 102,089492 | 111,503045 | 109,183223 | 118,568731 | 109,105234 | 142,576984 | 110,9642709 |
| 2007 | 114,12707 | 111,050947 | 147,525652 | 123,143106 | 101,849026 | 111,985761 | 109,594051 | 120,755823 | 110,89193 | 146,825296 | 111,9614926 |
| 2008 | 113,045218 | 110,861039 | 142,220696 | 120,622929 | 101,300181 | 110,61164 | 107,979248 | 120,247885 | 109,819 | 143,760628 | 110,9275411 |
| 2009 | 109,456205 | 104,922248 | 138,62687 | 116,53803 | 100,458418 | 107,496371 | 103,70138 | 116,166697 | 108,001869 | 133,124663 | 106,7607779 |
| 2010 | 111,079937 | 108,463237 | 140,190008 | 112,358471 | 101,03887 | 108,684408 | 105,962898 | 117,241841 | 110,895829 | 137,128779 | 108,8039951 |
| 2011 | 111,552575 | 110,680555 | 144,62435 | 108,468791 | 101,996783 | 109,660456 | 106,170161 | 118,793422 | 110,609273 | 138,961136 | 109,9493282 |
| 2012 | 110,893554 | 110,325607 | 145,209099 | 107,903234 | 103,084705 | 109,036025 | 104,186541 | 118,163482 | 110,394195 | 136,830896 | 109,3404515 |
| 2013 | 111,033428 | 110,083941 | 143,491775 | 107,250367 | 103,769871 | 108,97987 | 103,582037 | 117,493262 | 111,471572 | 134,879406 | 109,1380848 |

106,9016667

Own elaboration table with data of database of AMECO.

ANNEX 4

Differential of initial variables and their average:

Capital intensity

Net capital stock at 2005 prices per person employed: total economy :- Capital intensity (RKNDE)

| | Belgium | Germany | Ireland | Greece | Spain | France | Italy | Austria | Portugal | Finland |
|------|-------------|-------------|------------|-------------|-------------|------------|-------------|------------|-------------|-------------|
| 1991 | 7,40724121 | -10,9977588 | 54,9935412 | -20,5636588 | -11,1896588 | 21,8135412 | -1,52165879 | 32,1949412 | -91,3490688 | 1,99604121 |
| 1992 | 6,1824304 | -10,6021696 | 53,1294304 | -25,3578696 | -9,3548696 | 21,7165304 | -2,4477696 | 31,5588304 | -93,2136896 | 7,9464304 |
| 1993 | 4,72494379 | -11,3588562 | 47,5298438 | -30,2145562 | -6,85285621 | 21,7775438 | -1,46695621 | 31,8384438 | -95,8872662 | 10,9118438 |
| 1994 | 5,19464106 | -11,1472589 | 41,7938411 | -34,2857589 | -5,34375894 | 21,2747411 | -1,26945894 | 34,0541411 | -96,8105489 | 8,69604106 |
| 1995 | 3,58207513 | -10,5821249 | 36,5281751 | -35,9880249 | -5,63392487 | 21,1479751 | -0,99742487 | 37,9781751 | -96,9706249 | 3,64687513 |
| 1996 | 3,53550423 | -10,0056958 | 33,5662042 | -36,1780958 | -5,69679577 | 21,5315042 | -1,70999577 | 39,5565042 | -98,8957458 | -0,60279577 |
| 1997 | 3,74245412 | -8,75514588 | 29,2399541 | -35,2659459 | -8,22874588 | 21,6706541 | -1,97174588 | 42,4503541 | -100,112086 | -6,46944588 |
| 1998 | 3,47499215 | -8,19880785 | 22,2180921 | -37,1815079 | -9,87140785 | 21,7861921 | -1,65150785 | 45,9160921 | -99,7385479 | -7,86710785 |
| 1999 | 3,7448415 | -8,1074585 | 20,0496415 | -35,2120585 | -11,3934585 | 21,1692415 | -0,5619585 | 48,2167415 | -98,3244785 | -10,2569585 |
| 2000 | 3,85430089 | -7,80569911 | 22,0798009 | -32,3819991 | -12,6186991 | 20,4064009 | -0,54679911 | 51,2877009 | -96,8315391 | -11,0103991 |
| 2001 | 3,4885393 | -7,1868607 | 24,4720393 | -30,2819607 | -12,6397607 | 19,7643393 | -1,7785607 | 55,4823393 | -96,7313807 | -11,9038607 |
| 2002 | 3,88450798 | -6,92849202 | 28,772808 | -31,518792 | -12,082392 | 19,634608 | -2,96359202 | 58,645808 | -97,102212 | -13,821192 |
| 2003 | 3,29545301 | -6,93324699 | 32,694753 | -31,581947 | -12,177147 | 20,356153 | -3,94444699 | 59,429153 | -97,729387 | -14,662147 |
| 2004 | 2,17408642 | -8,28861358 | 35,4040864 | -32,9679136 | -11,8404136 | 22,0189864 | -3,71081358 | 59,5949864 | -98,0878036 | -14,9758136 |
| 2005 | 0,83674994 | -8,90665006 | 36,7518499 | -36,0429501 | -12,0860501 | 23,0205499 | -3,10015006 | 60,0891499 | -98,3476301 | -16,5992501 |
| 2006 | 0,70797973 | -9,41732027 | 39,0605797 | -35,9603203 | -11,2916203 | 24,0185797 | -4,06562027 | 61,0640797 | -98,7824803 | -18,2469203 |
| 2007 | 0,30133258 | -11,4143674 | 41,5133326 | -33,1310674 | -9,46276742 | 25,3617326 | -3,77636742 | 60,2760326 | -98,4429974 | -19,1899674 |
| 2008 | -1,78420504 | -14,210005 | 50,830395 | -33,571505 | -4,87670504 | 27,037795 | -3,22520504 | 57,599495 | -100,135655 | -22,708505 |
| 2009 | -5,07147402 | -19,547674 | 70,631126 | -36,158874 | 5,63962598 | 28,074926 | -2,49757402 | 58,603926 | -102,933654 | -22,593574 |
| 2010 | -7,39058224 | -22,2579822 | 80,7195178 | -34,3761822 | 10,8650178 | 28,8368178 | -2,14518224 | 56,9923178 | -103,935462 | -23,7620822 |
| 2011 | -9,36725552 | -24,4502555 | 84,7683445 | -27,8070555 | 16,6561445 | 29,4914445 | -3,07335552 | 55,7471445 | -104,192456 | -25,6175555 |
| 2012 | -11,1874563 | -27,9439563 | 84,1292437 | -19,0812563 | 26,0713437 | 30,2588437 | -3,98915627 | 53,2861437 | -104,065126 | -26,6109563 |
| 2013 | -12,3954469 | -30,4540469 | 76,3122531 | -19,1380469 | 31,9323531 | 31,5321531 | -3,69004685 | 52,4495531 | -105,116627 | -26,9717469 |

Own elaboration table with data of database of AMECO.

ANNEX 5

Differential of initial variables and their average:

Total factor productivity

Total factor productivity: total economy (ZVGDF)

| | Belgium | Germany | Ireland | Greece | Spain | France | Italy | Austria | Portugal | Finland |
|------|-------------|-------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 1991 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | -0,41321768 | 0,51948573 | 1,24785486 | -1,95126091 | -0,66065652 | 0,14926774 | -0,48478738 | -0,33882376 | 1,32419537 | -0,09447696 |
| 1993 | -1,40369638 | -0,29531683 | 2,7902967 | -4,2592541 | -0,58018094 | 0,24178878 | 0,65023857 | -0,06137744 | 1,0121405 | 3,65914849 |
| 1994 | -0,51567318 | -0,58389548 | 4,14604831 | -5,75258591 | -0,76980226 | -0,03635682 | 1,27864468 | -0,53035743 | 0,20128178 | 6,89185715 |
| 1995 | -1,11264752 | -1,27183848 | 9,47412802 | -6,01346645 | -1,59229582 | -0,23251801 | 2,47701328 | 0,12779598 | 0,80825833 | 8,735558 |
| 1996 | -1,04640063 | -1,77551763 | 15,7191396 | -4,60466833 | -1,73102912 | -0,31854483 | 2,36119239 | 0,520607 | 1,87904179 | 11,0305249 |
| 1997 | 0,1954983 | -2,06446041 | 21,4252846 | -2,7260569 | -2,59507126 | -0,33617879 | 2,13911443 | 0,28918849 | 1,86571988 | 13,8668229 |
| 1998 | -0,616835 | -2,58193842 | 22,6913756 | -2,86413391 | -3,11976698 | 0,63188059 | 1,55691918 | 1,80774171 | 2,66395032 | 16,871644 |
| 1999 | 0,5525454 | -3,26348143 | 27,6963812 | -1,39332119 | -3,66074253 | 1,00741439 | 1,27581185 | 2,97243475 | 3,3791524 | 18,2235057 |
| 2000 | 0,75312388 | -3,49899279 | 33,4851197 | 0,36272273 | -4,84639313 | 0,669472 | 1,70871335 | 3,54524323 | 2,84621492 | 20,9137656 |
| 2001 | -0,3655232 | -3,00857008 | 34,637911 | 3,36739132 | -5,17253228 | 0,20900826 | 1,48812777 | 3,38259676 | 1,8196956 | 21,6572186 |
| 2002 | 0,80364298 | -2,87386463 | 38,2625629 | 4,4972464 | -5,33072773 | 0,05267007 | 0,52632602 | 5,06377671 | 1,08712183 | 22,8453505 |
| 2003 | 1,3837766 | -2,93327985 | 39,1457703 | 9,0393398 | -5,34098708 | 0,27673687 | -0,45796807 | 5,01095834 | -0,31093231 | 24,9046842 |
| 2004 | 2,49992224 | -3,2994741 | 37,8641903 | 9,94398245 | -6,59692636 | 0,98903893 | -0,59345095 | 5,35567853 | -0,5558891 | 28,1693385 |
| 2005 | 2,26954214 | -3,20178144 | 38,1409093 | 8,99498028 | -7,32048567 | 1,20579847 | -0,75353758 | 6,35039111 | -0,71378491 | 29,6826959 |
| 2006 | 2,056947 | -1,75160804 | 36,7400964 | 11,0378831 | -8,87477917 | 0,53877444 | -1,7810483 | 7,60446012 | -1,85903688 | 31,6127131 |
| 2007 | 2,1655771 | -0,91054528 | 35,564159 | 11,1816133 | -10,1124664 | 0,02426803 | -2,36744126 | 8,79433002 | -1,0695624 | 34,8638036 |
| 2008 | 2,11767639 | -0,06650252 | 31,2931552 | 9,69538827 | -9,62735983 | -0,31590147 | -2,9482932 | 9,32034423 | -1,10854085 | 32,8330869 |
| 2009 | 2,69542758 | -1,83852995 | 31,8660921 | 9,77725182 | -6,30235937 | 0,73559346 | -3,05939769 | 9,40591927 | 1,24109127 | 26,3638854 |
| 2010 | 2,27594216 | -0,34075787 | 31,3860133 | 3,55447591 | -7,76512532 | -0,119587 | -2,84109704 | 8,43784569 | 2,09183351 | 28,3247841 |
| 2011 | 1,60324634 | 0,73122698 | 34,675022 | -1,48053732 | -7,95254496 | -0,28887217 | -3,77916751 | 8,84409337 | 0,65994446 | 29,0118082 |
| 2012 | 1,55310208 | 0,98515538 | 35,8686471 | -1,43721779 | -6,25574598 | -0,30442619 | -5,15391043 | 8,82303037 | 1,0537438 | 27,4904448 |
| 2013 | 1,89534366 | 0,9458561 | 34,3536906 | -1,88771831 | -5,36821344 | -0,15821491 | -5,55604737 | 8,35517701 | 2,33348746 | 25,7413207 |

Own elaboration table with data of database of AMECO.