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Economic Crisis and Convergence in the Eurozone Countries

Summary: Although a key condition for the creation of a monetary union is the existence of similar structural characteristics that reduce the existence and incidence of asymmetric shocks, in the case of the Eurozone, most, if not all, studies have emphasized the existence of sizeable divergences both in the macroeconomic performances and in the structural elements of the Eurozone countries. The objective of the paper is to analyse whether the economic and financial crisis that is affecting the Eurozone since the year 2008 has had any impact of the coherence of the Eurozone, that is, whether after 2008 the differences in the macroeconomic performance of the euro counties are declining (convergence) or increasing (divergence).

Key words: Economic crisis, Eurozone, Convergence, Sigma-convergence.

JEL: F15, F45, O52.

Even before the creation of the European Monetary Union, it was commonly argued that member states did not form an optimum currency area. By focusing on nominal convergence requirements there was no guarantee that the members that joined, at a first stage or later, the Eurozone achieved a sufficient real convergence that gave rise to a high synchronization of the national business cycles, thus avoiding the problem of the loss of autonomy in key areas of the macroeconomic policy, namely the monetary policy and the loss of the exchange rate tool. However, defenders of the process of monetary integration argued that real convergence and higher synchronization of national business cycles would be a (medium or long-term) consequence of the monetary unification (Francesco Paolo Mongelli 2013; Heather D. Gibson, Theodore Palivos, and George S. Tavlos 2014).

Therefore, this strategy of creation and subsequent enlargement of the European Monetary Union implied that the Eurozone was, in an (highly) optimistic view, at least in the first years of its creation, more prone to suffer asymmetric shocks: that is, countries could be at different phases of the business cycle (mainly explained by the existence of domestic shocks), or the intensity (duration) of the booms-busts could be

significantly different (due to the very domestic shocks or because common shocks could have different impact on the member states).

This problem is more serious if the heterogeneity is not corrected with the time, that is, if the asymmetric shocks are not temporary but permanent. In other words, if the desired process of real convergence among the monetary union member states does not take place or takes longer time than expected[1].

This is an even greater problem if the monetary union (or the individual member states) does not have tools to correct or absorb these shocks, regardless whether it means that common economic policies are not able to absorb the domestic shocks or that national economic policies lacks of the required flexibility to correct the deviations of the domestic business cycle. As the European Central Bank argues: "A greater degree of cyclical divergence within the euro area would complicate the conduct of the single monetary policy" (European Central Bank 2015, p. 31).

Recent literature offers mixed conclusions about the evolution of the heterogeneity of the Eurozone and the synchronization of the national business cycles. Focusing on Central and Eastern economies, Balázs Forgó and Anton Jevčák (2015), analyzing the ten Central and Eastern European (CEE) countries which entered the European in 2004 and 2007 show that between 2004 and 2014 most of those countries achieves a significant real and nominal convergence *vis à vis* the EA-12. The European Central Bank (2015) also argue that CEE countries have been catching up to the EU average over the last 15 years, however, during this period the convergence among the 12 countries that formed the Eurozone (EU-11 plus Greece) has been disappointing. Antonella Cavallo and Antonio Ribba (2015) conclude, analyzing eight euro countries, that there exists a significant macroeconomic heterogeneity in the Eurozone, where the business cycles of some countries like Greece, Ireland or Portugal are mainly dominated by local shocks. Filippo Ferroni and Benjamin Klaus (2015) show a decoupling of Spain of Germany and France. Istvan Benczes and Balazs Szent-Ivanyi (2015) argue that there was a convergence process in the European economies that, however, was reversed after the onset of the economic and financial crisis. Contrary to these views, Martin Gächter and Aleksandra Riedl (2014) argue that the introduction of the euro has led to a higher correlation of the business cycles of the member states, increasing the symmetry of national business cycles. Finally, Holly Snaith (2014) and Joshua Aizenman (2016), following the approach of the optimum currency areas, argue that the imposition of a "one size fits all" monetary policy is likely to increase the disparities between euro nations and regions, an argument also shared by António Mendonça (2014) and Carlos A. Carrasco and Patricia Peinado (2015).

In this sense, the objective of the paper is to analyse the coherence of the Eurozone, understood as the macroeconomic performance heterogeneity of the euro member states. With this aim, in the paper we will analyse a set of macroeconomic variables related to the nominal and real performance of euro countries. To be more precise, our analysis has a dynamic nature. We will analyse whether since the creation of the European Monetary Union the differences in the macroeconomic per-

[1] Obviously this problem increases if there is an enlargement process in monetary union, in which the new member states differ significantly of the incumbent ones.

formance of the members states have diminished, maintained, or, on the contrary, it has increased.

1. Data and Methodology

As mentioned in the Introduction, in the paper we have analysed the differences in the economic performance of the nineteen Eurozone member states. Namely, we have focused our attention on the evolution of fifteen variables, related to six categories of variables:

1. Economic activity:
   - real GDP *per capita*
   - real GDP growth rate
   - real GDP *per capita* growth rate
   - potential GDP growth rate
   - output gap
2. Labour market:
   - employment growth rate
   - unemployment rate
   - real wages growth rate
   - real unit labour costs (ULCs) growth rate
3. Income distribution:
   - adjusted wage share (% of GDP)
   - Gini coefficient
4. Inflation:
   - rate of inflation (CPI)
5. Balance of payments:
   - balance on current transactions (% of GDP)
6. Public finances:
   - public budget balance (% of GDP)
   - public debt (% of GDP)

The data of these variables have been obtained in Eurostat[2] and the AMECO[3] database. The period that we have analysed corresponds to the years 1995 to 2015, both included.

Given that our interest is focused on the national differences existing in the values registered in the fourteen countries, we have calculated, for the data available for each year, the standard deviation of each macroeconomic variable. We look at the evolution of the standard deviation to detect the possible existence of a trend. Thus, if we are able to detect a downward trend in the standard deviation dynamics, we will be able to talk of the existence of a convergence process in this variable, but if we detect an upward trend we will be able to talk of the existence of a divergence process in this variable.

[2] **Eurostat.** 2016. Eurostat Database. http://ec.europa.eu/eurostat/data/database (accessed March 02, 2016).

[3] **European Commission's Directorate General for Economic and Financial Affairs.** 2016. Macro-Economic Database AMECO. https://ec.europa.eu/info/business-economy-euro/indicators-statistics/economic-databases/macro-economic-database-ameco_en (accessed March 02, 2016).

In sum, we are developing an analysis of sigma-convergence, where the objective is to detect the existence of a trend in the evolution over the years of the standard deviation of the values recorded of a variable in a group of individuals, in this case, countries. Thus, for each variable we are making an OLS regression where the dependent variable is the standard deviation of the national values of the respective variable and the independent variable is a time trend:

$$StdDev_t = \beta_0 + \beta_1 trend + u_t. \quad (1)$$

If in Equation (1) the parameter β_1 is negative, therefore we can talk of the existence of a convergence process in this variable, and when β_1 is positive, therefore we can talk of the existence of a divergence process.

As far as the only independent variable (besides the constant term) is the time trend, Equation (1) implies the analysis of a process of unconditional convergence, where time is the only variable that explains the changes in the dependent variable. Therefore, we would be excluding of the analysis other elements that could affect the dispersion of the national performances. The inclusion of these additional explanatory variables could significantly change the results obtained at the analysis of the unconditional convergence. Once these variables are included in the model, the time trend initially detected in Equation (1) could become non-significant, but it could also happen that a time trend could become significant in the conditional convergence variables.

Therefore, to detect other potential determinants of the changes in the differences among individuals of the value of the analyzed variable, it is useful to make an analysis of conditional σ-convergence:

$$StdDev_t = \beta_0 + \beta_1 trend + X_t + u_t. \quad (2)$$

In Equation (2), X_t is a vector of variables that can influence the change in the standard variation of the variable in question. In our analysis we have included two different variables that can constitute a proxy of the economic situation of the countries. The first variable is called "recession", and it is a dummy that tries to show the situation of the Eurozone in the business cycle. Namely, the dummy recession takes the value 0 in the boom phase of the business cycle, and 1 during the recession phase. The existence of a recession (boom) has been determined by the value of the output gap of each country in all the years analysed, where a negative output gap is identified as a recession and a positive output gap as an expansion. The value and the sign of the output gap of the Eurozone for each country-year has been obtained as the unweighted average of the national output gaps.

The estimation of the output gaps is not an uncontroversial question. Nonetheless, we use this variable to identify the phases of booms and recessions not only because the generalization of its use, but also because the key role played in the management of the macroeconomic policy in the Eurozone, mainly in the field of the fiscal policy. Therefore, the mistakes in the estimation of the true output gap could significantly affect the results of the analysis. Indeed different sources and institutions give different figures for the output gap of euro countries. This is especially relevant in those cases where the absolute value of the estimated output gap is very low, im-

plying that the true sign of the estimated output gap, and, therefore, the position at the business cycle (recession or boom) may differ of the true one.

To avoid this problem we have used two sources of information: the output gap estimated by the European Commission, available at the AMECO database[4], and that estimated by the International Monetary Fund (IMF), available at the IMF World Economic Outlook Database[5] (October 2015). With this information, we have defined a dummy variable named recession taking the value 1 in 11 years: 1995 to 1997, 2003, 2009 to 2015.

The second variable tries to collect the impact of the Global Financial Crisis on the convergence-divergence process of the macroeconomic performance in the Eurozone. This variable is represented by a dummy called "Global Financial Crisis" that takes the value 1 during the years 2009 to 2015 (and 0 between 1995 and 2008).

By defining both dummies in this way, what the variable Global Financial Crisis is actually measuring is the differential impact of the current recession in relation to previous episodes of recessions. If the coefficient of Global Financial Crisis is not significant, this means that the current crisis is similar to previous recessions, but if the coefficient is significant, therefore, the current crisis is exerting on the corresponding variable an impact additional to that of previous recessions. In other words, the Great Global Financial Crisis would be different from other past crises. By proceeding this way, the total impact of the Global Financial Crisis on the evolution of the standard deviation of the analysed variables would be the sum of the coefficients of these two dummies, and this sum would show whether the corresponding variable would be converging or diverging.

Therefore, our analysis tries to know whether the process or convergence (divergence) in the macroeconomic performance in the Eurozone is influenced by the business cycle of the Eurozone and whether the extraordinary nature, depth and length of the current economic and financial crisis is generating an additional impact on the macroeconomic performance of the euro member states, and, consequently, on the coherence of the Eurozone.

The differences in the national performance in the analysed variables, and, therefore, in the convergence-divergence process of the Eurozone, however, can be affected by the existence of extreme cases. This implies that the value of a variable recorded in one country (or several countries) in a specific year can be significantly higher or lower than that recorded in the rest of countries, and, consequently, generating a bias that can influence the result of the analysis.

To avoid the bias generated by these extreme values, we have made two different analysis of the process of conditional σ-convergence. In the first analysis we have included all the available data. In the second analysis we have excluded those values (country-year) that can be considered as extreme values. To define a value as an extreme value, we have made a box-plot analysis, and here for each year the data considered as a far or close outlier will be defined as an extreme value, and, therefore, excluded from the analysis.

[4] See footnote 7.

[5] **International Monetary Fund (IMF).** 2015. IMF World Economic Outlook Database October 2015. http://www.imf.org/external/pubs/ft/weo/2015/02/weodata/index.aspx (accessed March 10, 2016).

To define a value as an outlier, we have calculated the first and third quartile, and then the interquartile range as the difference between the third and the first interquartile (IQR=Q3-Q1). Outliers are those values that are above the value defined as (Q3+1.5IQR) and those below (Q1-1.5IQR). Table 1 shows for each variable included in the analysis the values, that is, the pairs country-years, considered as outliers or extreme values.

A key conclusion that can be obtained from the data of Table 1 is that most outliers have been registered in the economies that joined the euro after 2001. The only exceptions to this pattern take place in the real GDP *per capita*, the balance on current transactions and the public debt. The gathering of outliers among the new member states of the Eurozone implies that, to a large extent, the differences in the economic performance of euro countries are explained by those countries. This conclusion is reinforced by the fact that, again with the exceptions of the real GDP *per capita* and the balance on current transactions, and the unemployment rate (in this case explained by the bad results of Spain), since 2009 most outliers correspond to countries that joined the Eurozone after its creation, helping to explain the higher divergences registered after the onset of the Global Financial Crisis.

Table 1 Outliers (Countries and Years)

Variables	Outliers
Real GDP *per capita*	Luxembourg (1995-2015)
Real GDP growth rate	Cyprus (2013), Estonia (1997, 2000, 2008-2009, 2011), Greece (2010-2011), Ireland (1995-2000, 2015), Latvia (2005-2006, 2009-2011), Lithuania (1999, 2003, 2009), Luxembourg (1999, 2010)
Real GDP *per capita* growth rate	Estonia (1996-1997, 2005-2006, 2008, 2011), Greece (2010-2011), Ireland (1996, 1999), Latvia (2001, 2004-2006, 2011), Lithuania (1998-1999, 2001, 2003, 2005, 2009, 2011), Luxembourg (1999), Slovakia (2008)
Potential GDP growth rate	Greece (2010-2012), Ireland (1995-2001), Latvia (2006-2007, 2010), Lithuania (1999, 2007), Slovakia (2009-2011)
Output gap	Estonia (1995-1996, 1999, 2005-2007, 2009), Greece (2011-2015), Latvia (2006, 2009-2011), Lithuania (1998, 2000-2002, 2009-2010), Luxembourg (2000), Slovakia (2000-2001), Spain (2011)
Employment growth rate	Cyprus (2013), Estonia (1995-1996, 1999, 2011), Greece (2011-2012), Ireland (1999, 2005), Latvia (2000, 2006, 2010), Lithuania (2000-2001), Luxembourg (2000-2001), Malta (2014), Slovenia (1996), Spain (2005, 2012)
Unemployment rate	Greece (2013-2015), Slovakia (2002-2006), Spain (1995-1997, 2008, 2013-2015)
Real wages growth rate	Cyprus (2014), Estonia (1995, 2000, 2004, 2006-2007, 2014), Greece (2002, 2010-2011, 2013, 2015), Latvia (1996, 1999, 2005-2007, 2009, 2014-2015), Lithuania (1996-1998, 2004, 2006-2007, 2009, 2015), Slovakia (1996-1997, 1999, 2007, 2010)
Real unit labour costs growth rate	Estonia (2007-2008, 2011, 2015), Greece (2002, 2005, 2013), Ireland (2002, 2007-2008, 2011), Latvia (1995-1996, 2002, 2005, 2007-2008, 2011, 2013-2015), Lithuania (1995-1996, 1998, 2000, 2006, 2010, 2015), Luxembourg (2001), Malta (2001)
Adjusted wage share	Slovakia (2008-2009)
Gini coefficient	No outliers

Rate of inflation	Cyprus (2014-2015), Estonia (1995-1996, 2005, 2007-2008, 2012), Finland (2004-2005), Greece (2010, 2012-2014), Ireland (2009-2010), Latvia (1995-1996, 2004-2010), Lithuania (1995-1996, 2007-2009), Slovenia (1999-2002), Slovakia (1999-2000, 2003-2004, 2012)
Balance on current transactions	Germany (2011-2012), Greece (2011), Luxembourg (1995, 2000, 2011), Malta (1995), Netherlands (2011-2013)
Public budget balance	Cyprus (2014), Finland (2000), Greece (2004, 2007-2008, 2013, 2015) Ireland (2010), Lithuania (1997), Luxembourg (1997-1999, 2001, 2014), Malta (1998, 2003), Slovakia (2000), Slovenia (2013), Spain (2012)
Public debt	Belgium (1997-2000), Greece (2000, 2010-2011, 2013, 2015), Italy (1999-2000)

Source: Our calculations based on AMECO.

2. Results

As mentioned in previous section, we have estimated by OLS the existence of a process of conditional σ-convergence for the fifteen variables related to the macroeconomic performance of the 19 euro countries during the years 1995 to 2015. In this section, we will present and analyze the results of this analysis.

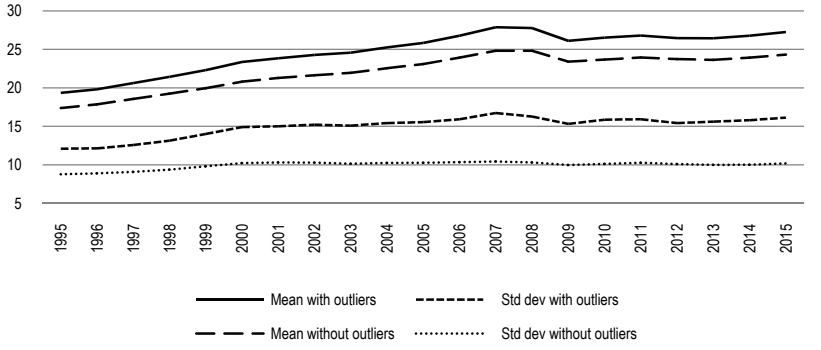
The first group of analysed variables is that corresponding to the economic activity, that is, real GDP *per capita*, real GDP growth rate, real GDP *per capita* growth rate, potential GDP growth rate, and output gap.

Figures 1 to 5 shows the evolution of the means and the standard deviation of the five variables. In each case, means and standard deviations have been calculated including all the data available (with outliers), and excluding those values identified as outliers (without outliers).

Figure 1 shows the evolution of the standard deviation of real GDP *per capita* with and without outliers. As expected (as will happen in all variables), the exclusion of the extreme values makes that the standard deviation of the economic growth in the Eurozone be less pronounced. Both with and without Luxembourg, Figure 1 shows that there is an upward trend in standard deviation meaning that divergence has increased in the Eurozone.

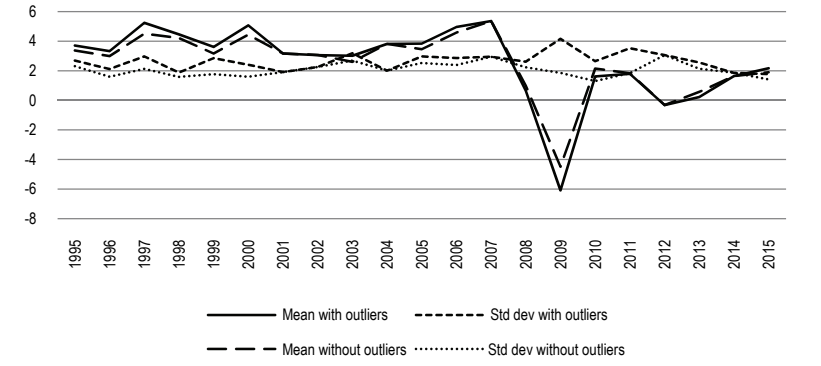
Figure 2 shows the evolution of the standard deviation and the mean of the rate of real GDP growth rate with and without outliers. A visual inspection of the figure does not allow to detecting any clear-cut trend, although it is easy to see the decline in the average GDP growth rate after the onset of the Global Financial Crisis. The fall in the average GDP growth rate is coming with a decline in the standard deviation of the GDP growth rates. In this sense, this likely convergence process in the economic growth could be explained by the poor economic performance resulting from the Global Financial Crisis.

The third variable related to the evolution of the GDP is the real GDP *per capita* growth rate (Figure 3). Since the beginning of the crisis the average rate of growth of GDP *per capita* has suffered a substantial decline, but it is difficult to ascertain whether such decline is the result or a time trend, of the impact of the recession, of the Global Financial Crisis or a combination of these elements. Similar conclusions can be obtained from the visual inspection of the evolution of the standard deviations and, therefore, it is difficult to reach a conclusion about the existence of a process of convergence or divergence in this variable.



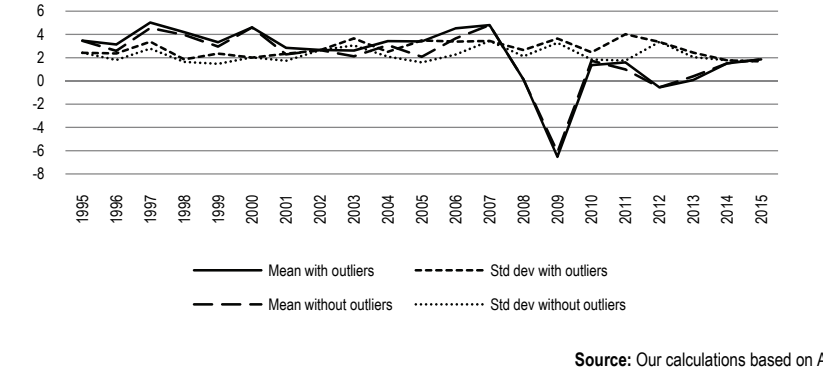
Source: Our calculations based on AMECO.

Figure 1 Mean and Standard Deviation of Real GDP per capita (Thousand Euros)



Source: Our calculations based on AMECO.

Figure 2 Mean and Standard Deviation of Real GDP Growth Rate (%)

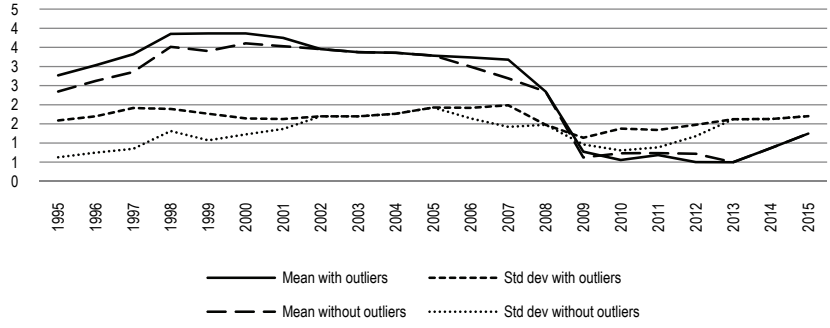


Source: Our calculations based on AMECO.

Figure 3 Mean and Standard Deviation of Real GDP per capita Growth Rate

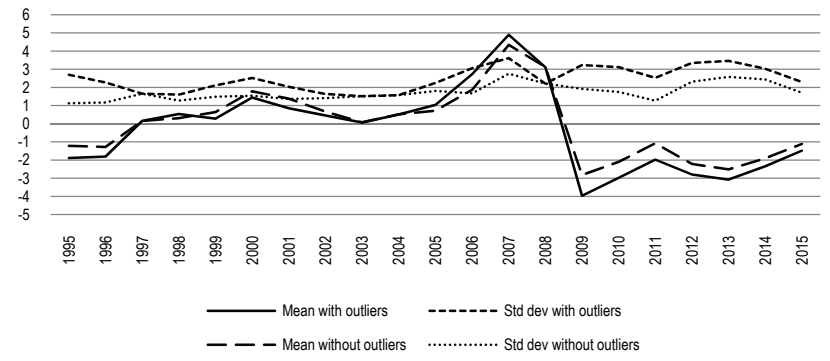
Figure 4 shows the evolution of the mean and the standard deviation of the potential output growth rate. Despite the existence of outliers, the differences in the data with and without outliers are very small. It is also remarkable the deep decline in the mean and the standard deviation that takes place since the beginning of the Global Financial Crisis.

In the case of the output gap, since the onset of the Global Financial Crisis the mean of the output gap has registered a dramatic change falling from a positive output gap (a boom) to a negative one, and therefore to a deep and long-lasting recession (see Figure 5). However, when we look at the dispersion among countries of the output gap, it is difficult to find signals of a trend.



Source: Our calculations based on AMECO.

Figure 4 Mean and Standard Deviation of Potential GDP Growth Rate (%)



Source: Our calculations based on AMECO.

Figure 5 Mean and Standard Deviation of Output Gap (%)

Table 2 OLS Regressions of the Standard Deviations of Real GDP per capita, Real GDP Growth Rate, Real GDP per capita Growth Rate, Potential GDP Growth Rate, and Output Gap

	Real GDP per capita		Real GPD growth rate		Real GDP per capita growth rate		Potential GDP growth rate		Output gap	
	With outliers	Without outliers#	With outliers	Without outliers	With outliers	Without outliers	With outli-ers#	Without outliers#	With outliers	Without outliers
C	13.020 (0.000)	9.501 (0.000)	2.427 (0.000)	1.459 (0.000)	2.147 (0.000)	1.660 (0.001)	1.638 (0.000)	0.835 (0.000)	1.939 (0.001)	1.038 (0.000)
Trend	0.274 (0.000)	0.081 (0.005)	0.006 (0.900)	0.083 (0.018)	0.065 (0.237)	0.055 (0.260)	0.016 (0.212)	0.081 (0.005)	0.030 (0.584)	0.084 (0.005)
Recession	-0.805 (0.022)	-0.513 (0.053)	0.317 (0.511)	0.497 (0.119)	0.629 (0.231)	0.705 (0.134)	0.042 (0.584)	-0.079 (0.562)	-0.224 (0.569)	0.097 (0.704)
Global Financial Crisis	-1.158 (0.053)	-0.282 (0.539)	-0.029 (0.970)	-1.446 (0.014)	-1.123 (0.222)	-1.054 (0.196)	-0.489 (0.010)	-0.893 (0.043)	0.788 (0.311)	-0.566 (0.214)
AR(1)									0.335 (0.193)	
Mean dependent variable	14.954	9.492	2.635	2.072	2.760	2.231	1.661	1.315	2.456	1.742
R^2	0.907	0.789	0.068	0.320	0.103	0.132	0.476	0.651	0.500	0.517
F-statistic	55.794 (0.000)	21.245 (0.000)	0.419 (0.741)	2.674 (0.080)	0.652 (0.592)	0.868 (0.476)	5.157 (0.010)	10.600 (0.000)	3.753 (0.026)	6.082 (0.005)
Wald *F*-statistic		16.442 (0.000)					5.463 (0.008)	6.561 (0.003)		
Durbin Watson statistic	1.145	0.963	1.627	1.887	1.394	2.291	1.043	0.842	1.682	1.845
Jarque-Bera test	1.403 (0.495)	0.886 (0.641)	0.151 (0.926)	5.198 (0.074)	0.142 (0.931)	2.829 (0.242)	1.484 (0.475)	1.156 (0.560)	0.825 (0.661)	0.062 (0.969)
White test	12.312 (0.055)	14.732 (0.022)					11.320 (0.079)	11.728 (0.068)		
Breusch-Pagan-Godfrey test	0.377 (0.944)	0.974 (0.807)	3.551 (0.314)	4.723 (0.193)	5.064 (0.167)	1.951 (0.582)	1.077 (0.782)	2.718 (0.437)	2.713 (0.438)	3.487 (0.322)
Breusch-Godfrey LM test	3.974 (0.137)	14.732 (0.022)	3.364 (0.186)	1.327 (0.514)	2.887 (0.236)	1.443 (0.485)	6.658 (0.035)	7.700 (0.068)	2.303 (0.316)	1.315 (0.517)

Note: *p*-values in parenthesis. # HAC standard errors and covariance.

Source: Authors' calculations.

As explained in the previous section, an OLS regression analysis has been applied to the evolution of the standard deviation of the fifteen variables analysed with the objective of detecting the possible existence of a process of convergence (divergence) in the economic performances of the euro countries. Moreover, in our analysis we will study the influence of recessions and the Global Financial Crisis on these convergence (divergence) processes.

Table 2 shows the results of these regression analyses corresponding to the five variables related to the economic activity, namely, real GDP *per capita*, real GDP growth rate, real GDP *per capita* growth rate, potential GDP growth rate, and output gap.

The regression analysis has detected the existence of a process of conditional divergence in the real GDP *per capita*. This divergence process is independent on the exclusion or inclusion of Luxembourg in the analysis of Luxembourg. The analysis shows that the diverging process is halted during recessions, periods in which differences in the real GDP *per capita* in the Eurozone countries decline. Moreover, the Global Financial Crisis has also led to an intense convergence in the real GDP *per capita* in the Eurozone, although when we exclude Luxembourg, the euro country with the highest GDP *per capita*, the impact of the Global Financial Crisis is no longer significant.

In the case of real GDP growth rate, the results of the regression analysis shows that there is a significant time trend leading to a divergence among euro countries when outliers are excluded.

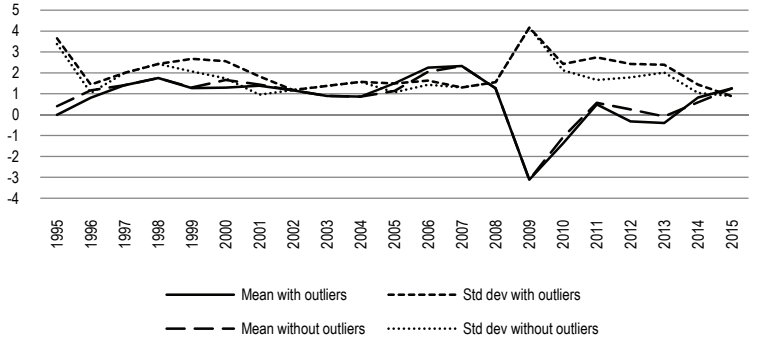
A similar result, though with the opposite sign, in the case of the Global Financial Crisis, which have a strong impact indicating a convergence process. The existence of a recession does not exert a significant effect on the dispersion of the national GDP growth rates. The existence of the Global Financial Crisis has led to an intense convergence process but only when the extreme values have been excluded.

In the case of the dispersion of the data of the real GDP *per capita* growth rate, the regression analysis shows that there is no significant time trend in the evolution of the standard deviation of the growth of real GDP *per capita*, and that neither the existence of a recession or the Global Financial Crisis have had any significant impact on the dispersion of the national values of this variable.

The empirical analysis has detected a significant diverging process in the potential GDP growth rates, but only when outliers are not included. Recessions do not exert a significant impact. However, the results confirm the large significant impact of the Global Financial Crisis, which has lead to a strong convergence process in the rate of growth of potential output in the Eurozone, a convergence that is more intense when outliers are excluded. This result shows the different nature and intensity of the Global Financial Crisis compared to other periods of normal recessions, and the huge impact of the crisis on long-term economic growth in the euro countries.

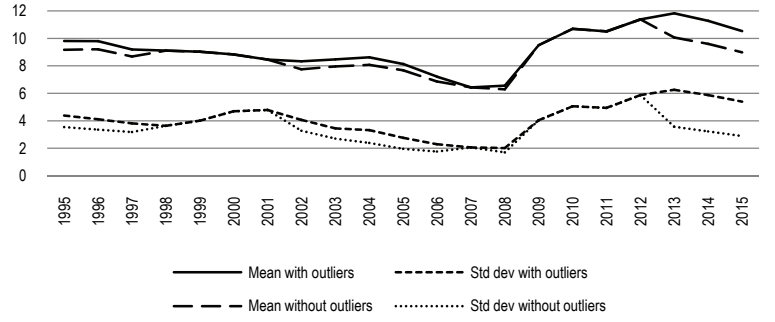
Lastly, in the case of the output gap, we have detected a significant time trend only when outliers are excluded of the analysis. The trend leads to a higher dispersion (divergence) in the position of the euro countries in their domestic business cycles. However, neither the existence of a recession or the outbreak of the Global Financial Crisis have had a significant impact on the dispersion of the euro output gaps.

The next four variables are related to the performance of the labour markets in the Eurozone: employment growth, unemployment rates, real wages growth, and real unit labour cost growth. Figures 6 to 9 shows the evolution, with and without outliers, of the mean and the standard deviations of these variables.



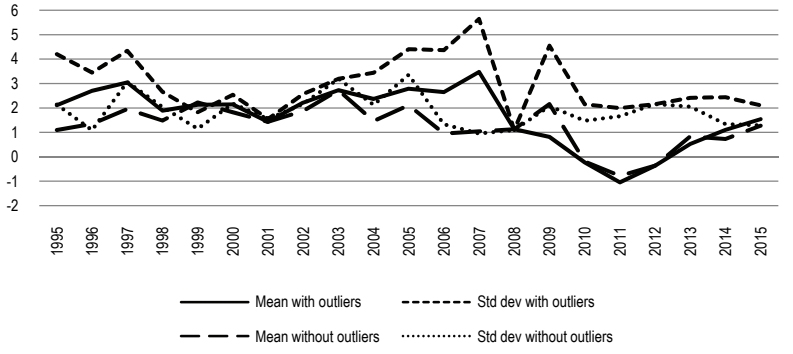
Source: Our calculations based on AMECO.

Figure 6 Mean and Standard Deviation of Total Employment Growth Rates



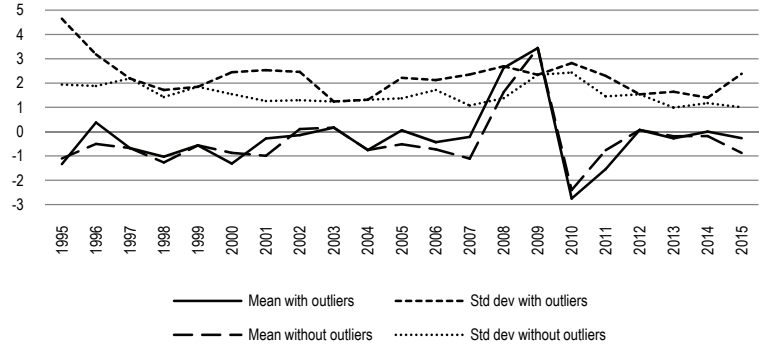
Source: Our calculations based on AMECO.

Figure 7 Mean and Standard Deviation of Unemployment Rate



Source: Our calculations based on AMECO.

Figure 8 Mean and Standard Deviation of Real Wages Growth Rates



Source: Our calculations based on AMECO.

Figure 9 Mean and Standard Deviation of the Rate of Growth of Real Unit Labour Costs

The first variable is the annual rate of growth of total employment. Figure 6 shows, in line with what happened in the case of the economic activity, the strong decline in the rate of growth of total employment in euro countries during the Global Financial Crisis. At the beginning of the Global Financial Crisis, the dispersion of the employment growth rates rose markedly, although it soon returned to values similar to those registered during the first decade. Therefore, it is difficult to conclude whether there is a process of convergence or divergence.

The next variable related to the labour market is the unemployment rate (see Figure 7). Unemployment rates in the Eurozone fell until the onset of the Global Financial Crisis, and began to rise since 2008. This pattern also takes place in the case of the standard deviation of unemployment rates in euro countries, which shows a sharp increase since 2008, breaking the declining trend registered since 1995.

The third variable is the rate of growth of real wages growth rates. Figure 8 shows that, although at the beginning of the Global Financial Crisis there was a large decline in the real wages growth in the Eurozone, it is difficult to find any time trend, and even to know whether the Global Financial Crisis has had an impact on the size and the dispersion of the real wages growth in euro countries. The final variable related to the labour market is the real unit labour costs growth rates. At a glance, it is difficult to find in Figure 9 any clear-cut trend in the evolution of the mean and the standard deviations of real ULCs.

Table 3 shows the results of these regression analyses corresponding to the four variables related to the labour market performance. In the case of employment growth, the regression analysis shows that once we control for the existence of a recession and the Global Financial Crisis, the existence of a time trend has been detected, both with and without outliers, leading to a convergence process in the employment creation. However, the Global Financial Crisis has exerted a huge impact on the dispersion of the employment creation in the Eurozone, leading to a strong divergence process among euro countries. This result implies that the negative impact of the Global Financial Crisis on employment has not been equally distributed, but, instead, has been concentrated in some countries. The dummy recession is not significant, proving the different nature of the current crisis compared to previous recessions.

The results of the OLS regression show the huge impact of the Global Financial Crisis on the dispersion of unemployment rates, mainly when outliers are excluded of the analysis. On their behalf, the time trend and the dummy recessions are only significant when outliers are excluded. Both variables have a negative sign, thus implying the existence of a convergence process that accelerates during recessions. It is remarkable the high absolute value of the time trend, and therefore the high speed of the convergence process that takes place when we do not include outliers in the analysis.

In this sense, it is also important to notice the different signs of the dummies recessions and Global Financial Crisis when outliers are excluded. This implies that during the recessions that happened before 2008 the unemployment rates converged among euro countries. However, the Global Financial Crisis makes that unemployment rates have diverged in the Eurozone. Moreover, since the absolute value of the

dummy Global Financial Crisis is higher than that of recessions, it can concluded that the Global Financial Crisis has significantly increased the dispersion of national unemployment rates, again showing the differential impact of the Global Financial Crisis on euro countries.

Table 3 OLS Regressions of the Standard Deviations of Employment Growth Rates, Unemployment Rates, Real Wages Growth Rate, and Real Unit Labour Costs Growth

	Employment growth		Unemployment rate		Real wages growth		Real unit labour costs growth	
	With outliers	Without outliers	With outliers	Without outliers	With outliers	Without outliers	With outliers	Without outliers
C	3.268 (0.000)	2.650 (0.000)	3.093 (0.172)	5.071 (0.000)	2.597 (0.005)	1.795 (0.001)	2.744 (0.000)	2.022 (0.000)
Trend	-0.181 (0.001)	-0.140 (0.018)	0.003 (0.978)	-0.255 (0.000)	0.051 (0.571)	-0.000 (0.997)	-0.071 (0.201)	-0.074 (0.011)
Recession	-0.654 (0.160)	-0.317 (0.539)	-0.156 (0.652)	-1.172 (0.000)	1.057 (0.228)	0.576 (0.266)	-0.268 (0.606)	-0.003 (0.989)
Global Financial Crisis	2.817 (0.002)	2.006 (0.036)	2.241 (0.000)	4.667 (0.038)	-1.988 (0.195)	-0.648 (0.468)	0.266 (0.768)	0.817 (0.079)
AR(1)			0.814 (0.000)					
Mean dependent variable	2.054	1.749	4.124	3.461	3.005	1.879	2.255	1.543
R^2	0.511	0.338	0.862	0.660	0.156	0.126	0.222	0.402
F-statistic	5.925 (0.005)	2.902 (0.065)	23.564 (0.000)	11.003 (0.000)	1.052 (0.395)	0.818 (0.501)	1.618 (0.222)	3.820 (0.029)
Wald *F*-statistic								
Durbin Watson statistic	1.612	1.566	1.294	1.517	2.308	1.928	1.082	1.366
Jarque-Bera test	0.203 (0.903)	3.403 (0.182)	2.648 (0.266)	3.316 (0.190)	1.076 (0.583)	0.264 (0.876)	0.445 (0.800)	1.900 (0.386)
White test								
Breusch-Pagan-Godfrey test	2.345 (0.503)	3.327 (0.343)	0.933 (0.817)	1.203 (0.752)	3.462 (0.325)	2.941 (0.400)	5.066 (0.167)	2.487 (0.477)
Breusch-Godfrey LM test	0.068 (0.966)	0.534 (0.765)	6.023 (0.049)	1.245 (0.536)	2.395 (0.301)	0.433 (0.805)	3.487 (0.174)	3.362 (0.186)

Note: *p*-values in parenthesis.

Source: Authors' calculations.

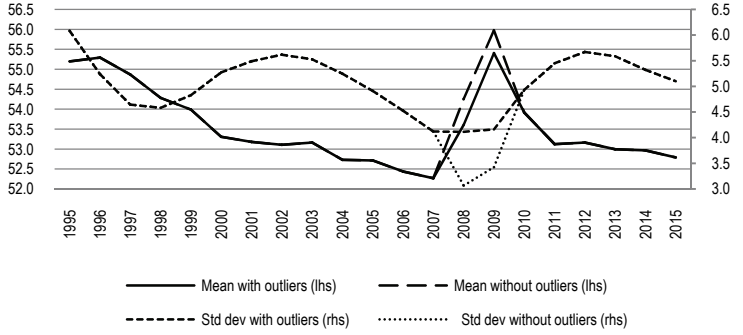
In the case of the real wages growth, the OLS regression shows that no variable is significant, thus implying that other elements explain the differences registered in the growth or real wages in the Eurozone.

In the analysis of the dispersion in the real unit labour costs growth, the OLS regressions have detected significant declining trend, in other words, a convergence process, but only when outliers are not included in the analysis. The existence of a recession does not have a significant impact on the evolution of the dispersion of the rate of growth of unit labour costs. Conversely, the Global Financial Crisis has had a significant effect, leading to larger divergence, but only when extreme values are excluded of the analysis.

The third category of analyzed variables is related to the income distribution in euro countries. We have analyzed two variables, one related to the income functional distribution (the adjusted wage share) and the other to the personal income distribution (the Gini coefficient).

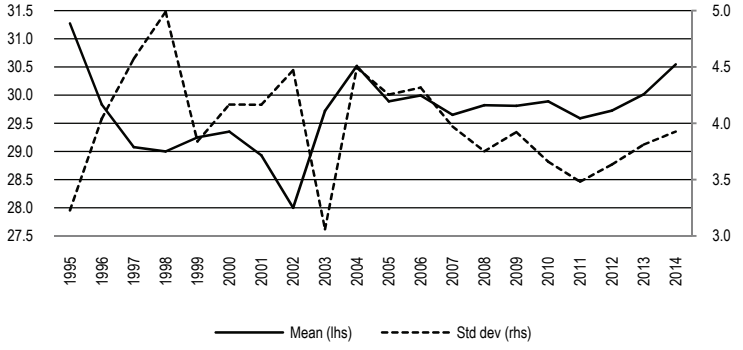
A glance to Figure 10 shows that there is declining trend in the evolution of the adjusted wage share that is temporarily inverted at the first years of the Global Financial Crisis. Conversely, the existence of a trend in the evolution of the standard

deviation, and consequently the existence of a process of convergence or divergence among euro countries, is not so evident.



Source: Our calculations based on AMECO.

Figure 10 Mean and Standard Deviation of the Adjusted Wage Share



Source: Our calculations based on Eurostat.

Figure 11 Mean and Standard Deviation of the Gini Coefficient

In the case of the dispersion in the personal income distribution, proxied by the Gini coefficient, as the Figure 11 shows, it is difficult to conclude whether there is or not a time trend or what would have been the effect of the recessions and the Global Financial Crisis.

The results of the OLS regressions show that in the case of the adjusted wage share the time trend is not significant, neither is the dummy variable that accounts for recessions in the Eurozone exerts a significant impact (see Table 4). On the contrary, the Global Financial Crisis would have had a significant effect, contributing to reduce the differences among countries, and, thus, leading to a convergence among euro countries. However, this convergence process vanishes when the outliers, in this case Slovakia in the years 2008 and 2009, are excluded of the analysis.

Table 4 OLS Regression of the Standard Deviation of Adjusted Wage Share and Gini Coefficient

	Adjusted wage share		Gini coefficient
	With outliers	Without outliers	
C	5.288 (0.000)	5.272 (0.000)	4.800 (0.000)
Trend	-0.007 (0.774)	-0.035 (0.513)	-0.069 (0.064)
Recession	-0.007 (0.921)	0.007 (0.974)	-0.883 (0.017)
Global Financial Crisis	-0.341 (0.057)	0.187 (0.703)	0.802 (0.186)
AR(1)	1.480 (0.000)	1.222 (0.000)	
AR(2)	-0.815 (0.000)	-0.662 (0.005)	
Mean dependent variable	5.006	4.912	3.907
R^2	0.930	0.765	0.452
F-statistic	34.671 (0.000)	8.453 (0.000)	4.679 (0.014)
Durbin Watson statistic	1.084	1.964	1.661
Jarque-Bera test	0.574 (0.750)	6.050 (0.048)	1.263 (0.531)
Breusch-Pagan-Godfrey test	0.469 (0.925)	0.483 (0.922)	1.426 (0.699)
Breusch-Godfrey LM test	2.277 (0.149)	1.129 (0.358)	4.316 (0.115)

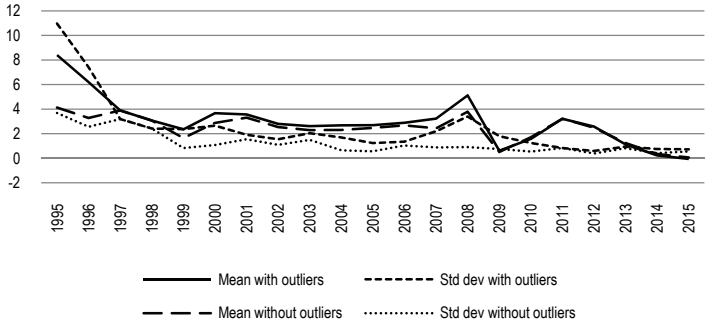
Note: *p*-values in parenthesis.

Source: Authors' calculations.

However, the results of the OLS regression show the existence of a significant time trend in the evolution of the standard deviation of the Gini coefficient that leads to a convergence process among euro countries (Table 4). This convergence accelerates during recessions, when the differences sharply decline. However, the Global Financial Crisis does not exert any significant different effect. This implies that, in terms of the national differences of the Gini coefficient, the Global Financial Crisis alone has not exerted a differential impact on personal income distribution in the Eurozone countries.

We have also analyzed the existence of a trend in the evolution of national rates of inflation, measured by the national consumer price indexes (CPI). Figure 12 shows the evolution of the standard deviation of national CPIs with and without outliers. Seemingly, there is a declining trend both in the average inflation rate and in the standard deviation of national inflation rates. This trend would be more evident when outliers are excluded, what reduces the inflation rates registered at the beginning of the analysed period.

The results of the OLS regression (see Table 5) confirm the existence of a convergence process but that only takes place once we exclude outliers of the analysis. The Global Financial Crisis would have had no significant impact on the dispersion of national inflation rates, but, on the contrary, the existence of recession in euro countries does have a significant impact, leading to an intense divergence process in the national inflation rates.



Source: Our calculations based on AMECO.

Figure 12 Mean and Standard Deviation of the Inflation Rates (CPI)

Table 5 OLS Regression of the Standard Deviation of Rate of Inflation

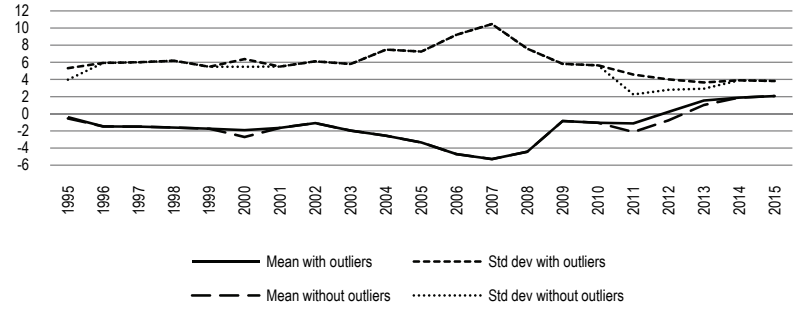
	With outliers*	Without outliers*
C	3.877 (0.002)	1.996 (0.000)
Trend	-0.225 (0.144)	-0.112 (0.017)
Recession	2.647 (0.136)	1.042 (0.032)
Global Financial Crisis	-1.712 (0.493)	-0.519 (0.472)
Mean dependent variable	2.438	1.246
R^2	0.612	0.813
F-statistic	8.957 (0.000)	24.763 (0.000)
Durbin Watson statistic	1.109	1.936
Jarque-Bera test	7.799 (0.020)	0.610 (0.736)
White	13.745 (0.032)	16.701 (0.010)
Breusch-Pagan-Godfrey test	16.186 (0.001)	2.723 (0.436)
Breusch-Godfrey LM test	2.663 (0.264)	1.134 (0.567)

Note: *p*-values in parenthesis. * white heterokedasticity-consistent standard errors and covariance.

Source: Authors' calculations.

In the category of the performance of the national balance of payments, we have analyzed the dispersion of the balance on current transactions (measured as a percentage of the GDP). Looking at the evolution of the mean and standard deviations of this balance (see Figure 13), we can see that since the year 2007 there has been an improvement in the balance on current transactions (moving from a deficit to a surplus) and an intense fall in the standard deviation.

The regression analysis has detected the existence of a conditional divergence process that is independent on the inclusion or exclusion of the extreme values (see Table 6). The existence of a recession in the Eurozone is not significant. However, the Global Financial Crisis has generated a high and significant impact, leading to a strong convergence process in the national balances on current transactions.



Source: Our calculations based on AMECO.

Figure 13 Standard Deviation of the Balance on Current Transactions

Table 6 OLS Regression of the Standard Deviation of the Balance on Current Transactions

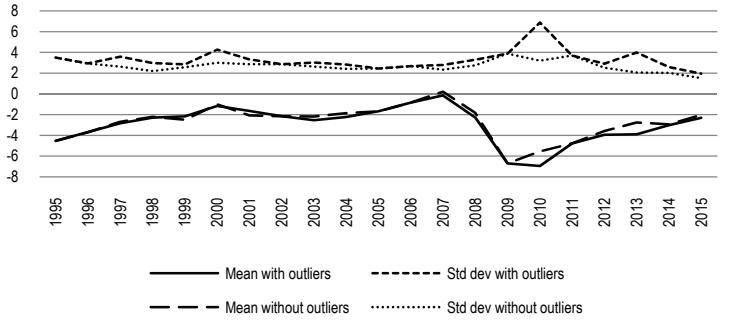
	With outliers	Without outliers
C	5.776 (0.000)	5.327 (0.000)
Trend	0.174 (0.065)	0.219 (0.048)
Recession	-0.494 (0.562)	-0.504 (0.611)
Global Financial Crisis	-3.756 (0.019)	-4.669 (0.014)
Mean dependent variable	6.011	5.702
R^2	0.600	0.616
F-statistic	8.518 (0.001)	9.100 (0.000)
Durbin Watson statistic	1.101	1.365
Jarque-Bera test	2.970 (0.226)	3.436 (0.179)
Breusch-Pagan-Godfrey test	1.651 (0.647)	1.342 (0.719)
Breusch-Godfrey LM test	4.462 (0.107)	1.929 (0.381)

Note: *p*-values in parenthesis.

Source: Authors' calculations.

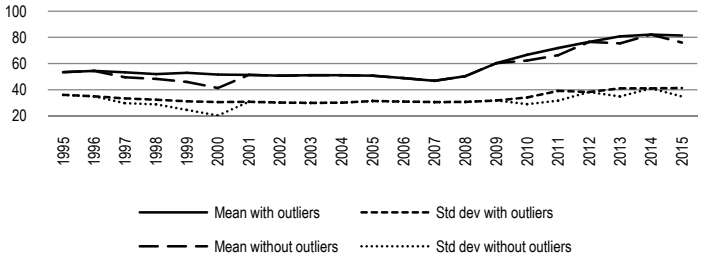
The final category analyzed is related to the performance of national public finances. We have focused our analysis on the evolution of the public budget balance and the public debt of the general governments, measuring both variables as percentage of the GDP.

Figure 14 reflects the deep deterioration of the public finances in the Eurozone that takes place between 2008 and 2010 and the subsequent improvement in the public budget balance. However, the impact on the deviation of national public budget balances is not clear at all. Thus at the beginning of the Global Financial Crisis there is higher dispersion of these balances, but this outcome is much smaller when we exclude the outliers in the year 2010. In this sense, as Table 1 shows, we have detected only one outlier in 2010: Ireland.



Source: Our calculations based on AMECO.

Figure 14 Mean and Standard Deviation of the Public Budget Balance



Source: Our calculations based on AMECO.

Figure 15 Mean and Standard Deviation of the Public Debt

In the case of the public debt, the Figure 15 shows the huge increase in the average size of public debt in euro countries. Regarding the standard deviation of public debt in the Eurozone, it would have increased since 2008, but it is impossible to ascertain is this rise is the consequence of a time trend, of the recession or the Global Financial Crisis.

As Table 7 shows, there would be a significant declining trend in the dispersion of the national public budget balances, thus leading to a convergence process. The results related to the impact of the existence of a recession and the Global Financial Crisis are mixed. The Global Financial Crisis would be significant, leading to a divergence process when all the countries-years are included, but when outliers are excluded of the analysis the Global Financial Crisis is not significant whilst the existence of a recession would have significant impact, with the Global Financial Crisis having no additional impact in the convergence process.

Table 7 shows the there would be no time trend in the dispersion of public debt in euro countries. The Global Financial Crisis alone would have had no significant impact in this process. However, the dummy recession is significant, with a positive sign, increasing the divergence among euro countries. This result implies,

that, without outliers, whenever there is a recession in Eurozone, the differences in the size of national public debt increase.

Table 7 OLS Regression of the Standard Deviation of the Public Budget Balance and Public Debt

	Public budget balance		Public debt	
	With outliers*	Without outliers#	With outliers#	Without outliers
C	3.981 (0.000)	3.268 (0.000)	30.544 (0.000)	25.378 (0.000)
Trend	-0.118 (0.083)	-0.081 (0.104)	0.043 (0.853)	0.435 (0.126)
Recession	-0.394 (0.395)	-0.115 (0.069)	2.939 (0.177)	6.087 (0.029)
Global Financial Crisis	2.126 (0.098)	0.929 (0.195)	3.902 (0.404)	-4.367 (0.342)
Mean dependent variable	3.300	2.707	33.813	31.462
R^2	0.219	0.229	0.663	0.438
F-statistic	1.596 (0.227)	1.679 (0.209)	11.165 (0.000)	4.412 (0.018)
Wald *F*-statistic	1.588 (0.228)	2.892 (0.065)	6.664 (0.003)	
Durbin Watson statistic	1.954	0.788	0.938	1.994
Jarque-Bera test	26.261 (0.000)	0.096 (0.953)	4.1198 (0.127)	0.561 (0.755)
Breusch-Pagan-Godfrey test	7.180 (0.066)	4.083 (0.252)	6.248 (0.100)	0.926 (0.819)
White test	4.453 (0.615)	11.648 (0.070)	12.929 (0.0442)	4.020 (0.673)
Breusch-Godfrey LM test	0.117 (0.946)	7.469 (0.065)	5.315 (0.070)	1.569 (0.456)

Note: *p*-values in parenthesis. # HAC standard errors and covariance. * white heterokedasticity-consistent standard errors and covariance.

Source: Authors' calculations.

3. Conclusions

The analyses carried out in the paper have given rise to different results, depending on the analyzed variable. In the cases of the real GDP *per capita* growth rate, the real wages growth, the adjusted wage share and the public debt, we have not found a significant time trend, and, therefore, we cannot talk of the existence of a convergence or divergence process taking place along the whole period analysed.

Only in the cases of employment creation, the Gini coefficient and the public budget balance there is clear and significant convergence process. On the contrary, in the cases of the real GDP *per capita* and the balance on current transactions we have detected a significant divergence process, thus exacerbating the differences existing before the creation of the European Monetary Union.

It is important to note that in the remaining six variables, the existence of a time trend, and, therefore, the existence of a convergence (in unemployment rates and of real ULCs growth rates) or a divergence process (in real GDP growth, potential GDP growth and unemployment rates) depends on the inclusion or exclusion of the extreme values.

As explained in Section 1, most outliers are countries that joined the Eurozone after its creation in 1999. These new member states have a level of development well below those registered in the economies that created the euro, explaining the marked macroeconomic disparities existing at the beginning of the period analyzed in the

study. The lack of a real convergence process would have lead to exacerbate the real divergences with the most advanced euro economies, and these higher divergences would, in turn, explain the greater impact of the Global Financial Crisis on these economies. In this sense, we cannot forget that most outliers detected since the year 1999 are found among the new euro countries. This result leads to pose the hypothesis, which deserves an additional study, that within the Eurozone there could be processes of convergence and/or divergence among different subsets of countries.

If we focus on the dummy variables related to the existence of a recession in the Eurozone and the current Global Financial Crisis, we find again mixed results. Thus, recessions lead to a clear convergence process in the real GDP *per capita* and the Gini coefficient. Results depend on the inclusion or exclusion of outliers in unemployment rates and public budget balances (in both cases leading to a convergence process) and in inflation rates (leading to a divergence process).

In the case of the Global Financial Crisis, it would have implied a convergence process in variables like the potential GDP growth and the balance on current transactions. But it would have led to a diverging process in employment growth and unemployment rates. In the other five variables the impact depend on the inclusion or not of outliers: in real GDP *per capita* and adjusted wage shares, the Global inancial Crisis would lead to a convergence process, but in the real GDP growth, the real ULCs growth and the public budget balance, it has led to a divergence process.

As mentioned, the significance of the dummy Global Financial Crisis implies that the crisis that, in our study, began in 2009 has generated on the euro economies an impact different of those of previous recessions. But, moreover, and we believe this is a proof of the different nature of the Global Financial Crisis, we want to emphasize that in many cases the sign of this effect is different to that of previous recessions. This implies that in some variables during a recession there is a convergence process but there has been a divergence process during the Global Financial Crisis, and *vice versa*. This different effect would happen in these variables: GDP growth rate, potential GDP growth rate, employment growth rate, unemployment rate, real unit labour costs growth rate, adjusted wage share, balance on current transactions, and public deficit.

In sum, our analysis has not been able to find a significant convergence in the macroeconomic performance of EMU countries. On the contrary, our result point out a higher divergence in the macroeconomic performance of Eurozone countries in key variables such as GDP *per capita*, GDP growth, rate of growth of potential GDP, output gap, unemployment rate and the balance on current transactions. Moreover, we have found that both recessions and the Global Financial Crisis generate a relevant and significant impact on the convergence-divergence process, implying that the results obtained in previous studies on the convergence in the Eurozone can be affected by the period analyzed and the situation of the business cycles in the whole Eurozone and in the member states.

Finally, we want to emphasize that the Global Financial Crisis has increased the divergence in many macroeconomic outcomes, generating the risk of a higher heterogeneity if the crisis becomes chronic-endemic or makes structural the bad performance (low growth-stagnation) recorded in many countries.

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