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The Euro Area Ten Years after Its Creation: (Divergent) Competitiveness and the Optimum Currency Area Theory

Summary: As the euro is on its second decade, the European sovereign debt crisis and the ever more evident disparities in competitiveness among member states are prompting many to question whether monetary union is bringing more benefits than costs. The optimum currency area (OCA) theory provides a framework with several criteria for such analysis. In such context, we start by a descriptive analysis of the first twelve euro countries under six criteria, leading to a mixed conclusion on whether the EMU is closer or farther to fulfil them. Then we assess the impact of five OCA criteria on countries' relative competitiveness. Differences in the growth of unit labour costs, the dissimilarity of trade and the differences in output growth were found to be the most significant. This way, we identify some causes of the divergent competitiveness between some EMU countries that contributed to weaker economic growth in some of them.

Key words: Optimum currency area, Euro area, Economic and Monetary Union (EMU), Competitiveness.

JEL: E42, E63, F15, F33, F41.

In 1999, eleven European countries forsook their autonomous monetary policies and currencies in favour of the euro. Since the 1990s, the Economic and Monetary Union (EMU) project has been analysed under the light of the Optimum Currency Area (OCA) theory. This framework has been used to assess if the benefits of a country belonging to the monetary union outweigh its costs (Francesco Paolo Mongelli 2005). We revisit this issue more than ten years on as the euro area is going through its biggest test ever (Organization for Economic Cooperation and Development - OECD 2010): an uneven recovery after the global economic crisis and a sovereign debt crisis that brought about unprecedented political tension (International Monetary Fund - IMF 2010).

There has been much research on the EMU in the last decade and the OCA theory still guides many of the contributions on this field. Individual OCA properties (e.g. labour and capital markets integration; price flexibility) have been the subject of attention of a significant number of authors (e.g. Claude Lopez and David H. Papell 2007; Helge Berger and Volker Nitsch 2008; European Commission 2008a, Marcel Fratzscher and Livio Stracca 2009; Alessia Campolmi and Ester Faia 2011). Additionally, many have looked closely on meta-properties that aggregate several criteria,

especially the synchronization of business cycles (Mongelli 2005). There has been a special attention to evaluate whether this synchronization increased after the launch of the euro, i.e., if there has been an endogeneity of the OCA properties, as predicted by Jeffrey A. Frankel and Andrew K. Rose (1998).

A different aspect is covered by other researchers who have studied the rising imbalances between countries, especially in their current accounts, but also in output growth and unemployment rates, with the core euro area performing much better than some periphery countries (OECD 2010). These imbalances eventually contributed to the current euro area sovereign debt crisis (Michael Giorgiou Arghyrou and Giorgios Chortareas 2008; OECD 2010; Holger Zemanek, Ansgar Hubertus Belke, and Gunther Schnabl 2010).

Our approach is on a different level. At a first moment, using macroeconomic data, we describe the economic performance and competitiveness of the first twelve countries to join the EMU, and then their evolution under individual OCA properties, between 1999 and 2009. Following this, we assess the impact of some of these properties on the member states' relative competitiveness. For this purpose, we adapt Tamim Bayoumi and Barry Eichengreen's (1997) work, using OCA criteria to explain differences in the variation of EMU countries' competitiveness, using real effective exchange rates as a proxy.

The present paper is structured as follows. In Section 1, we review the relevant literature on the OCA theory. In Section 2, we take a brief overview over economic growth and competitiveness in the EMU. In Section 3, we try to analyse the performance of the EMU in what concern several OCA properties. In Section 4, we proceed by estimating the impact of five OCA criteria on countries' relative competitiveness. Finally, we conclude, by summarizing our most relevant findings as well as their limitations and presenting some possible paths of future research.

1. A Review of the Literature on the OCA Theory

Robert Mundell (1961) introduced the concept of OCA to refer to a geographic area that would benefit from a single monetary policy under a common currency or definitely pegged exchange rates. This was an answer to Milton Friedman (1953), who argued that only flexible exchange rates allowed for corrective movements necessary to achieve external equilibrium.

To define an OCA, Mundell (1961) considered mobility of factors, especially labour, as the main criterion. Geographic mobility allowed for a compensation of shocks suffered in a part of the area, with workers moving from depressed regions to the others, thus eliminating the need for different monetary policies. Inter-industrial mobility should also be considered, as workers had to be able to take jobs in different industries (Ronald McKinnon 1963; Peter Kenen 1969). Moreover, financial integration would also help mitigate asymmetrical shocks by directing savings from surplus regions to affected ones (James C. Ingram 1962).

Several factors were considered in the following years. McKinnon (1963) considered that the more a country is integrated in international trade, the more benefits it would enjoy from belonging to a currency area. In this situation, depreciation would have a lesser effect in rebalancing a country's external deficit. Kenen (1969)

argued that monetary unions would better suit countries with diversified economies, as demand or supply shocks that affected one sector could be more easily compensated by the others. Otherwise, Marcus J. Fleming (1971) considered that a monetary union required, above all, a similarity of inflation rates, to maintain balanced current-accounts in the different member states. Otherwise, differences of competitiveness would progressively arise, with countries with higher inflation running persistent deficits.

Differently, and abandoning macroeconomic variables, Mintz (1970, in George S. Tavlas 1993) considered that political factors would be more decisive than economic ones. Likewise, Gottfried Haberler (1974, p. 394) doubted that a European single currency “would succeed without far-reaching political integration.”

Since the late 1960s, many economists criticized the single criteria approach of the first decade of the OCA theory. Some criteria were difficult to measure (Peter Robson 1998) and interdependent (Yoshihide Ishiyama 1975). This led to the situation that one could define very different regions as OCA if different criteria were chosen (Tavlas 1994). As an alternative, some authors proposed that, rather than focusing in one or another criterion, countries should consider their own cost-benefit analysis (Fleming 1971).

Moreover, not only the single-criterion based approach but also some of the assumptions of the OCA theory were questioned in this period. It was, then, assumed that the long-run Phillips curve is negatively sloped, i.e., an expansionary monetary policy or exchange rate devaluation would lead to a decrease in unemployment. However, monetarists argued that workers reacted to higher inflation by demanding higher wage increases. This reduced the effectiveness of monetary policy to change employment levels (Tavlas 1993). Thus, the argument “against currency unions was considerably weakened” (Jurgen Matthes 2009, p. 115).

Criticisms of the assumptions present in the OCA theory and the slowdown in the European monetary integration in the 1970s diminished the importance of the field of monetary unions, reducing the interest in its research until the end of the following decade. But this “intellectual purgatory” finished by the late 1980s as the project of a single European currency gained new impetus and previous contributions were reviewed (Harris Dellas and Tavlas 2009).

The need to have similar inflation rates prior to joining a currency union was questioned. Some authors defended that, if one of the countries joining a currency union has a credible record of inflation targeting and maintains that commitment afterwards, other countries joining the union will end up with similar inflation rates, regardless their previous record (Francesco Giavazzi and Marco Pagano 1988; and Charles Goodhart 1989). This advantage was called reputational benefits (Tavlas 1994). Notwithstanding, this optimistic perspective was challenged by some authors (Enrique Alberola and Tymo Tyrväinen 1998; Alberto Alesina, Robert Barro, and Silvana Tenreyro 2002). The usefulness of autonomous exchange rates was put into doubt, since studies stressed that exchange rates adjustments happened with considerable lags from the underlying shocks (Tavlas 1993).

In the early 1990s, the criticism of the single-criterion based approach led many to adopt meta-properties, i.e., a joint analysis of how all OCA criteria affected

the way countries in monetary unions reacted to shocks (Mongelli 2005). There were several possible meta-properties, namely: similarities of economic shocks and policy responses; synchronicity of business cycles; synchronicity of monetary transmission mechanisms (Matthes 2009). Meta-properties helped surpass the intrinsic contradictions of the early contributions (Mongelli 2005) and were also more easily measured than some individual criteria (Matthes 2009). Nevertheless, their results could still be contradictory (Tavlas 1994).

In the 1990s, much attention was given to the future European single currency (Tavlas 1994). Asymmetrical shocks in Europe were more evident than among US states (Bayoumi and Eichengreen 1993a). However, there was evidence of smaller and more correlated shocks between central European countries (Bayoumi and Eichengreen 1993b). Bayoumi and Eichengreen (1997) operationalized the OCA theory, creating an OCA Index. They concluded, that Germany, Austria, Belgium and the Netherlands were the most suitable candidates to monetary unification. Also, the pairs of Portugal and Spain and of Italy and Greece would benefit from monetary integration with each other.

This debate also led to the development of alternative approaches, especially the endogeneity paradigm of Frankel and Rose (1998). These authors argued that *ex-ante* criteria were not essential to the feasibility of an OCA, since most of them would evolve positively by effect of countries' monetary integration. They tested their hypothesis, concluding that international trade promoted business cycles correlation (Frankel and Rose 1998). Accordingly, countries that did not satisfy OCA criteria before joining a currency union might satisfy them later.

During the first decade of the euro, much of the focus was on the meta-property of business cycles synchronization, though a consensus has not been found. Whereas some authors concluded that evidence of endogeneity could be found (Romain Duval, Jorgen Elmeskov, and Lukas Vogel 2007; João Silvestre and Antonio Mendonça 2007; Stefano Schiavo 2008), others found no such evidence (European Commission 2008a; Matthes 2009; Thomas D. Willett, Orawan Permpoon, and Clas Wihlborg 2010; Klaus Weyerstrass et al. 2011).

Studies on individual OCA are also numerous. Considering the diversity and the interest of most of these studies for the proceeding of the paper, we try to summarise their main findings in Table 1.

2. An Overview of Economic Growth and Competitiveness in the EMU

The first step on our assessment is a descriptive comparison of economic performance in the twelve countries. For this purpose, in Table 2 we take a look at GDP growth (Kappler 2011). As a simple measure of dispersion in this variable, as in following ones, we will use the standard deviation.

We conclude that, despite some volatility, there has been a tendency for a reduction in the dispersion of GDP growth rates. Nevertheless, in the last two years, there was an increase in the dispersion, probably as a result of the global economic crisis (IMF 2011b).

Table 1 Studies on OCA Properties and the EMU

Properties	Authors (year)	Main findings
Labour mobility	Otmar Issing (2000)	Labour markets were rigid in the run up to EMU.
	Alesina, Ardagna, and Vincenzo Galasso (2010)	There was a tendency to create a two-tier labour market.
	OECD (2007)	Geographic mobility was very low.
	European Commission (2008a); Campolmi and Faia (2011)	Rigidity caused higher unemployment and inflation.
	Alfonso Arpaia and Karl Pichelmann (2007); OECD (2010); Zemanek (2010)	Rigidity contributed to the loss of competitiveness in the euro area periphery.
	Eckhard Hein and Achim Truger (2005); Olivier Blanchard (2007)	Rigidity was responsible for weaker output growth and, thus, higher unemployment.
Financial integration	European Commission (2008a)	Strong integration and increased intra-EMU FDI
	Fratzcher and Stracca (2009)	Integration led to diminished weight of domestic shocks but also to shared of national risks.
	Jean-Pierre Danthine, Francesco Giavazzi, and Ernst-Ludwig von Thadden (2001)	Convergence of interest rates on public debt (now reduced).
Trade integration	Mongelli (2008)	Private debt markets and intra-EMU FDI increased.
	European Commission (2008a)	Increase in intra-EMU trade.
	Lionel Fontagné, Thierry Mayer, and Gianmarco Ottaviano (2009)	Intra-EMU trade brought about reduced price volatility and discrimination.
	Berger and Nitsch (2008)	Once the historic tendency is removed, there are no signs of increased intra-EMU trade.
	Marcus Kappler (2011)	The positive relation between trade and business cycle synchronization is more evident in the long run than in the short run.
Inflation rates and price flexibility	Mongelli (2008)	Dispersion of inflation rates fell to historic levels.
	Lopez and Papell (2007); Su Zhou, Mohsen Bhamani-Oskooee, and Ali M. Kutun (2008)	Convergence of inflation rates began before monetary unification, casting doubts on the role of the single currency in the process.
	Naiwei Chen and Arvind Mahajan (2010)	There are more signs of PPP between currency blocks than inside them.
Fiscal integration	OECD (2000)	Fiscal discipline diminished after EMU creation.
	Zemanek (2010)	Fiscal indiscipline helped bringing about the sovereign debt crisis.

Table 2 GDP Growth Rate in EMU Countries (%) (1999-2009)

Country / Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Austria	3.3	3.7	0.5	1.6	0.8	2.5	2.5	3.6	3.7	2.2	-3.9
Belgium	3.5	3.7	0.8	1.4	0.8	3.2	1.7	2.7	2.9	1.0	-2.8
Finland	3.9	5.3	2.3	1.8	2.0	4.1	2.9	4.4	5.3	0.9	-8.2
France	3.3	3.9	1.9	1.0	1.1	2.5	1.9	2.2	2.4	0.2	-2.6
Germany	2.0	3.2	1.2	0.0	-0.2	1.2	0.8	3.4	2.7	1.0	-4.7
Greece	3.4	4.5	4.2	3.4	5.9	4.4	2.3	4.5	4.3	1.3	-2.3
Ireland	10.9	9.7	5.7	6.5	4.4	4.6	6.0	5.3	5.6	-3.5	-7.6
Italy	1.5	3.7	1.8	0.5	0.0	1.5	0.7	2.0	1.5	-1.3	-5.0
Luxembourg	8.4	8.4	2.5	4.1	1.5	4.4	5.4	5.0	6.6	1.4	-3.7
Netherlands	4.7	3.9	1.9	0.1	0.3	2.2	2.0	3.4	3.9	1.9	-3.9
Portugal	4.1	3.9	2.0	0.7	-0.9	1.6	0.8	1.4	2.4	0.0	-2.5
Spain	4.7	5.0	3.6	2.7	3.1	3.3	3.6	4.0	3.6	0.9	-3.7
Stand. dev.	2.535	1.954	1.42	1.831	1.915	1.169	1.641	1.175	1.438	1.492	1.829

Source: Eurostat (1999-2009).

A possible explanation for different output growths is a variation in countries' competitive position (Blanchard 2007). As a proxy for competitiveness we use the ECB's real effective exchange rates (REER) for each country, obtained by deflating the nominal exchange rate of the euro with the GDP deflator. REER allow for a comparison between EMU countries and their main competitors, including other member states. They take into account the possible intra-EMU differences in inflation as well as variations in nominal exchange rates between the euro and their main trading partners' currencies (the list of countries is available at <http://sdw.ecb.europa.eu/browseExplanation.do?node=6374972>). A rise in the index means a loss of competitiveness. In Table 3 we present the REER indices.

Table 3 EMU Countries REER Indices (GDP Deflators Deflated) (1Q1999=100) (1999-2009)

Country / Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Austria	98.7	96.0	95.5	95.1	97.6	98.1	97.3	97.6	97.7	97.6	97.9
Belgium	98.0	94.2	94.2	95.1	99.5	101.2	101.1	101.4	102.6	104.1	104.8
Finland	98.1	93.9	95.7	96.0	98.3	98.4	96.3	95.2	96.4	97.1	98.2
France	97.8	93.2	93.0	94.2	98.5	99.4	98.8	99.1	100.3	102.2	101.9
Germany	97.5	89.7	88.5	88.8	93.3	93.7	91.4	89.5	89.9	89.7	90.5
Greece	98.4	94.9	95.4	97.5	103.6	105.9	105.7	106.6	108.2	111.0	111.5
Ireland	98.6	95.7	99.4	104.0	113.3	115.7	115.8	117.6	118.7	119.1	113.9
Italy	98.5	94.3	95.2	97.5	103.5	105.6	104.7	104.3	105.4	107.2	108.9
Luxembourg	100.8	98.6	96.7	97.4	104.8	105.8	108.0	112.7	114.8	117.8	116.0
Netherlands	98.5	96.1	99.4	102.7	108.7	109.1	108.9	108.5	109.3	111.1	109.9
Portugal	99.4	98.0	99.2	100.9	104.4	105.3	105.0	105.3	106.3	107.2	106.9
Spain	99.4	97.9	100.0	102.9	108.9	112.2	114.3	116.7	118.7	120.6	120.6

Source: European Central Bank (1999-2009).

It is visible that there was significant divergence in REER among EMU countries. It is important to note that three economies (Germany, Austria and Finland) have improved their position. Of the remaining, Spain and Ireland have suffered a particularly steep loss of competitiveness. Also, whereas Ireland and Luxembourg started regaining some competitiveness, Spain, Greece and Italy have either stagnated or kept on losing ground.

This loss of competitiveness is partially to blame for the persistent current account deficits in some EMU countries (Zemanek 2010), as we can see in Table 4.

We can see that large and persistent deficits were run in Greece and Portugal, but also in Spain and Italy. Differently, Finland and Luxembourg had surpluses in their current accounts in every year, and so did Germany and Austria from 2002. These deficits, initially considered benign (Blanchard and Giavazzi 2002), became ever more worrying as they often combined with sagging economic growth (except for Spain). We now know they eventually helped bringing about the current sovereign debt crisis (Argyrou and Chortareas 2008; OECD 2010; Zemanek, Belke, and Schnabl 2010).

Table 4 EMU Countries Current Account as a Share of GDP (%) (1999-2009)

Country / Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Austria	-1.7	-0.5	-0.8	2.6	1.6	1.8	2.2	2.9	3.5	4.6	2.9
Belgium	5.1	4.0	3.4	4.3	3.5	3.2	2.1	2.0	1.7	-1.8	0.3
Finland	6.2	8.1	8.6	8.9	5.2	6.3	3.6	4.6	4.2	2.9	2.7
France	3.1	1.4	1.8	1.2	0.8	0.5	-0.5	-0.5	-1.0	-2.0	-2.0
Germany	-1.3	-1.8	0.0	2.0	1.9	4.6	5.0	6.2	7.5	6.2	5.6
Greece	n/a	-7.8	-7.2	-6.5	-6.6	-5.8	-7.5	-11.3	-14.3	-14.7	-11.0
Ireland	0.6	0.1	-0.6	-1.0	0.0	-0.6	-3.5	-3.6	-5.3	-5.6	-3.0
Italy	0.7	-0.5	-0.1	-0.8	-1.3	-0.9	-1.7	-2.6	-2.4	-2.9	-2.1
Luxembourg	8.7	13.5	8.8	10.2	8.3	12.0	11.2	9.9	9.6	4.9	7.0
Netherlands	3.8	1.9	2.4	2.5	5.5	7.6	7.4	9.3	6.7	4.4	4.9
Portugal	-8.2	-10.4	-10.4	-8.3	-6.5	-8.3	-10.4	-10.7	-10.1	-12.6	-10.2
Spain	-2.9	-4.0	-4.0	-3.3	-3.5	-5.2	-7.4	-9.0	-10.0	-9.6	-5.1

Source: OECD (1999-2009).

These very different economic trajectories reduce the effectiveness of a single monetary policy (Friedman 1953). It might also lead to the need for clearly distinct policies for some countries, which turns out to be impossible within a monetary union.

3. The EMU under OCA Properties

In order to understand the previously presented reality, we analyse the evolution of the EMU in regard to OCA properties. At this time, the analysis is still of a descriptive type. We divide our focus on six OCA properties, using appropriate indicators. We exclude political factors since they are harder to quantify and the EMU's framework was stable in the studied period. Table 5 summarises those properties and indicators.

Table 5 Selected OCA Properties and Respective Indicators

OCA properties	Indicators	Authors (year)
Labour market integration and wages flexibility	Unemployment rate	Mundell (1961)
	Long-term unemployment rate	OECD (1999)
	Share of EMU citizens living in foreign EMU countries	OECD (1999)
	Nominal wages	Arpaia and Pichelmann (2007)
	Productivity and unit labour costs	Arpaia and Pichelmann (2007)
Financial and capital markets integration	Government bond yields	Danthine, Giavazzi, and von Thadden (2001)
	FDI	Mongelli (2008)
Economic openness	Openness to trade ratio	Bayoumi and Eichengreen (1997)
Diversification of production	Structure of external trade	Bayoumi and Eichengreen (1997)
Similarity and flexibility of inflation rates and price levels	Inflation rates	Fleming (1971)
	Purchasing power parity	Kees Koedijk, Ben Tims, and Mathijs A. van Dijk (2004)
Fiscal integration	Budget balance and stock of debt as share of the GDP	OECD (1999)
	EU revenues as a share of the GNI	Mongelli (2005)

3.1 Labour Market Integration and Wages Flexibility

The first mentioned OCA property was labour market flexibility (Mundell 1961). In an integrated market, workers would move away from high-unemployment, thus the dispersion of unemployment rates would decrease. Thus, we assess whether this compensation effect has been present in the EMU by measuring the dispersion of unemployment rates. In Figure 1 we present unemployment rates. For purpose of analysis, we also included data for the first 15 countries that joined EU, which includes the 12 studied countries, Denmark, the UK and Sweden.

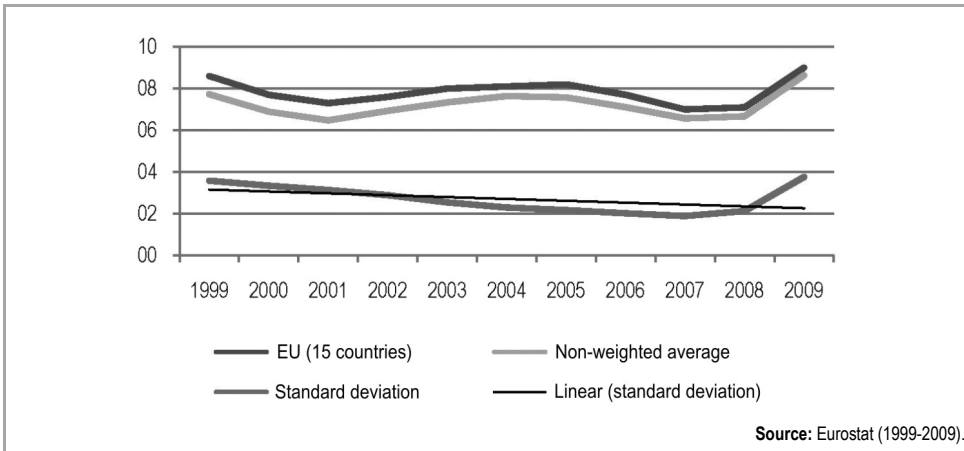


Figure 1 EMU Countries Unemployment Rates (%) (1999-2009)

The standard deviation of the unemployment rates has consistently decreased until 2007. Such an evolution points towards labour market integration. This tendency was interrupted in the last two studied years, which we assume to be a consequence of the global crisis (IMF 2011b).

To assess inter-sectorial mobility we use long-term unemployment rates (12 months or more). A high rate can be a sign of workers' difficulty to find a job in a different sector after an asymmetrical shock (OECD 1999). We present the selected data in Figure 2.

Data shows a tendency of reduction in long term unemployment rates. Simultaneously, the dispersion of this variable has also been decreasing consistently, except for 2009, which we can see as a sign of increased inter-sectorial mobility. This conclusion is reinforced by a fall in the dispersion of this variable, which can be read as a sign that the labour force has gained inter-sectorial mobility either inside their countries or by moving to other member states. It would also be interesting to take a look at geographic mobility. Unfortunately, data regarding intra-EU migration movements is generally patchy, as EU citizens enjoy total freedom of movement inside the Union (OECD 2007). Nevertheless the literature stresses that geographic mobility in the EU is very low, though it is increasing (OECD 2007).

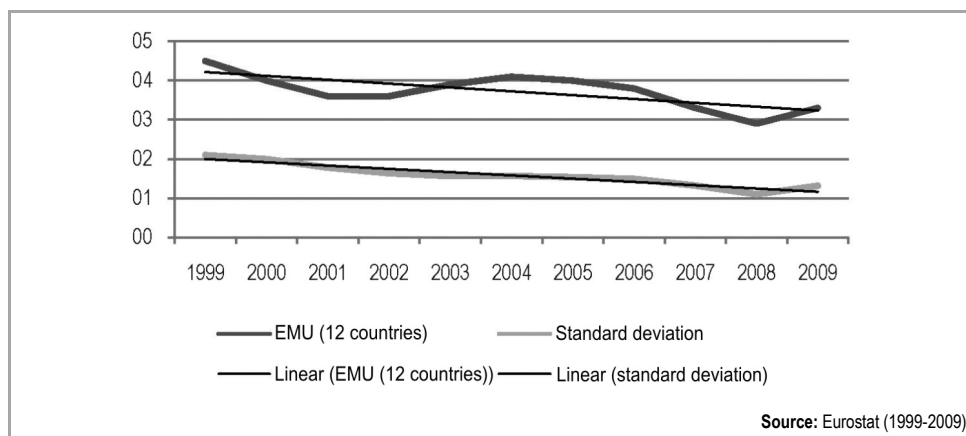


Figure 2 EMU Countries Long Term Unemployment Rates (%) (1999-2009)

A different perspective of the labour market is given by the evolution of wages. In monetary union, nominal wages flexibility is of paramount importance to compensate for asymmetrical shocks, since there are no nominal exchange rates to restore the previous equilibrium. In Table 6 we present the initial average value and accumulated growth in nominal wages, productivity and unit labour costs (ULC).

Table 6 Accumulated Growth in Wages, Productivity and ULC in the EMU (1999=100) (1999-2009)

Country	1999 average nominal wages	Nominal wages	Productivity	ULC
Austria	32075,64	124.43	115.05	111.44
Belgium	36931,69	130.60	105.58	123.70
Finland	29843,00	139.06	110.91	125.19
France (values for 2008)	33039,36	128.96	113.19	118.46
Germany	30690,25	111.37	112.89	105.99
Greece	16478,56	173.93	129.43	137.88
Ireland	28085,62	164.63	132.57	132.77
Italy	27076,15	126.59	100.68	131.44
Luxembourg	39464,91	135.83	100.62	134.99
Netherlands	28978,06	137.64	112.66	127.28
Portugal	14095,74	142.29	109.98	129.39
Spain	21981,78	141.96	110.05	134.58

Source: OECD (1999-2009).

Data reveals a tendency for bigger nominal wage growth in the countries that had smaller nominal wages when they joined the EMU. This is not surprising as in an integrated market wages are expected to converge. However there are several cases that deserve a closer look. Italy had the third smaller increase albeit having the fourth smaller starting nominal wages. Greece and Ireland had especially big nominal wages increases in the studied period.

As we have seen, unless nominal wage increases are combined with a growth in productivity, they will result in loss of competitiveness as well as an increase in

inflation (Campolmi and Faia 2011). However, only Germany kept nominal wage increases in line with productivity growth, with the consequent small increase in ULC. Even though other countries managed to achieve significant productivity growth, namely Ireland and Greece, these gains were more than outpaced by increases in nominal wages, resulting in a loss of competitiveness. The situation was even direr in Spain and Portugal, where steep nominal wages increases were combined with lacklustre productivity growth. These results are broadly consistent with the variations in REER and the current accounts balances detailed in the previous chapter.

Therefore, it is arguable that many EMU countries did not have the wage flexibility required to maintain their competitive positions in the first decade of currency union. The same assessment has been frequently made on the literature (e.g. OECD 2010).

3.2 Financial and Capital Markets Integration

Seminal contributions also underlined the importance of the integration of financial markets, to compensate for asymmetric shocks (Ingram 1962). We begin by taking a look at the government bonds market. The convergence of interest rates on public debt, once the effect of fundamental risk, also known as credit risk, is removed, is a sign of increased integration in financial markets (Danthine, Giavazzi, and von Thadden 2001). In Figure 3 we present the non-weighted standard deviation of the interest rates on ten years government bonds, both with and without Luxembourg, for this country is especially small and we have no data for it from 2007.

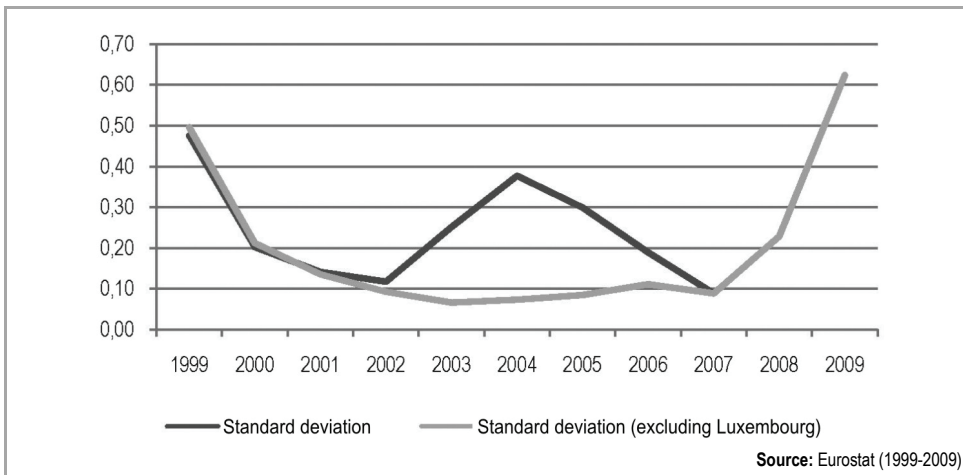


Figure 3 Interest Rates on EMU Governments Ten Years Bonds (%) (1999-2009)

Interest rates tended to converge, especially when we exclude Luxembourg from the analysis. This tendency was reversed in the last two years, much as a consequence of the steep increase in Greece and Ireland's interest rates. This is, however, a

result of differentiated perceived risk in the titles and not a financial disintegration (IMF 2011a). The private sector debt market also grew during this period (Mongelli 2008), pointing towards increased integration.

A different proxy is Foreign Direct Investment (FDI) between EMU countries (Mongelli 2008). Unfortunately, we could not find complete information in this regard. Still, intra-EMU FDI as a share of the GDP increased from one fifth to one third (European Commission 2008a) and total intra-EMU FDI grew more than 240% (Mongelli 2008).

3.3 Economic Openness

The more a country is integrated in international trade, the more benefits it can enjoy from belonging to a currency area (McKinnon 1963). A simple yet accurate measure of this integration is the openness ratio, which is calculated by dividing the total imports and exports of a country by its GDP (Bayoumi and Eichengreen 1997). In Table 7 we present the openness ratio of each EMU country.

Table 7 EMU Countries Openness Ratio (Constant Prices) (%) (1999-2009)

Country / Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Austria	84.3	91.1	96.0	96.1	98.1	105.2	109.8	112.9	117.5	115.0	101.3
Belgium	142.2	153.6	153.3	154.0	154.0	159.0	164.5	167.9	170.6	172.8	157.5
Finland	70.3	78.1	77.5	78.6	77.3	80.1	84.8	89.5	91.5	96.5	84.7
France	51.4	56.2	56.5	56.8	56.2	57.9	59.4	61.1	62.2	62.1	56.4
Germany	61.3	66.4	68.1	69.1	71.9	77.4	82.3	89.6	92.9	94.6	87.4
Greece	57.6	63.2	61.1	56.7	55.1	57.8	57.0	58.6	59.8	59.6	51.2
Ireland	165.8	183.1	186.9	182.6	174.3	179.9	180.7	181.4	183.4	186.3	189.6
Italy	49.7	53.2	53.4	52.4	52.2	53.7	54.2	56.4	57.9	56.2	49.3
Luxembourg	271.0	279.0	286.2	279.0	293.6	313.3	310.0	332.2	338.7	346.6	330.8
Netherlands	124.0	134.6	135.0	135.7	137.5	143.7	148.8	155.5	158.9	160.8	153.3
Portugal	67.1	69.0	68.6	68.7	70.3	73.4	73.9	79.4	82.5	83.8	76.3
Spain	58.2	61.2	61.6	61.7	62.9	65.2	66.3	69.3	71.9	69.0	60.8

Source: OECD (1999-2009).

If we ignore the exceptional year of 2009, when the world crisis caused a contraction in global trade (IMF 2010), all the countries had a tendency to have an increase in their openness ratio, or at least to maintain it. It is interesting to note that while some countries greatly increased their openness ratio, namely Luxembourg, the Netherlands, Germany and Belgium, others had only slight or negligible increases, like Greece and Italy. This results in unequal benefits from the single currency and possibly points out to shifts in competitiveness.

A different set of benefits from a single currency are related to the elimination of exchange rates risk and transaction costs inside the euro area (Michael Emerson et al. 1992). Accordingly, in Table 8 present the Intra-EMU openness ratio, i.e., considering only intra-EMU trade.

Table 8 Countries' Intra-EMU Openness Ratio (Current Prices) (%) (1999-2009)

Country / Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Austria	38.1	41.5	42.1	41.7	42.2	44.5	44.7	48.2	48.9	48.0	40.9
Belgium	76.3	84.8	85.4	88.7	88.7	92.4	97.8	103.8	105.9	105.5	88.3
Finland	21.5	24.1	22.1	21.3	22.0	21.9	22.5	24.6	24.6	23.2	18.1
France	23.3	25.6	25.2	23.9	23.6	24.1	24.2	24.8	25.2	25.0	21.5
Germany	22.6	25.5	25.8	25.1	25.7	27.2	28.2	30.0	31.0	31.2	26.3
Greece	15.9	17.0	16.8	15.9	15.5	15.4	14.3	14.8	15.4	15.0	12.4
Ireland	42.6	44.4	44.3	40.1	35.8	36.0	36.9	34.6	32.3	31.1	33.1
Italy	18.3	20.1	19.7	18.7	18.8	18.9	19.0	20.1	20.9	20.5	16.9
Luxembourg	65.1	86.3	87.7	77.1	82.9	88.5	79.2	76.3	73.6	77.0	60.1
Netherlands	55.5	61.6	58.2	54.6	54.1	57.5	60.1	64.2	65.2	66.3	56.6
Portugal	35.8	40.4	42.6	38.8	38.5	38.6	36.4	36.6	36.4	36.8	32.6
Spain	25.8	27.8	26.3	25.1	25.2	25.2	24.8	24.9	25.1	23.4	19.1

Source: Eurostat (1999-2009).

This data shows some relevant tendencies. On the one hand, most of the countries' intra-EMU trade did not rise as share of the GDP. When excluding the year of 2009, for the reasons discussed above, we see that the openness ratio increased significantly in Belgium, Luxembourg, the Netherlands, Austria and Germany. On the other hand, it decreased steeply in Ireland but also in Spain and Greece. A plausible explanation for these findings is the already described loss of competitiveness in these countries, vis-à-vis their EMU partners.

3.4 Diversification of Production

Countries with diversified production benefit more from monetary unification, as shocks that affect one part of the market are more easily compensated by the remaining ones (Kenen 1969). Accordingly, we analyse the exports of EMU countries by sector, as a measure of diversification of production (Bayoumi and Eichengreen 1997). In Table 9 we present the share of each sector in the total exports of the EMU from 1999 to 2009. Products are divided according to the SITC.

Table 9 Share of Each Sector in Total Exports in the EMU (%) (1999-2009)

Sector / Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Food, drinks and tobacco	6.83	6.31	6.35	6.42	6.56	6.25	6.15	5.98	6.06	6.34	7.04
Raw materials	2.14	2.14	1.99	2.04	2.05	2.16	2.16	2.33	2.36	2.35	2.16
Mineral fuels, lubricants and related materials	1.79	2.56	2.33	2.37	2.62	2.67	3.76	4.23	4.06	5.16	3.98
Chemicals and related products	10.79	11.00	11.33	12.25	12.42	12.61	12.87	12.81	12.96	12.83	14.13
Other manufactured goods	22.74	22.38	21.92	21.72	21.48	21.58	21.21	21.66	21.56	20.85	19.93
Machinery and transport equipment	35.12	35.57	35.60	34.27	33.96	33.83	32.72	31.93	31.68	30.41	28.56
Services	20.62	20.05	20.48	20.94	20.91	20.90	21.12	21.06	21.32	22.06	24.19
Standard deviation	12.36	12.32	12.36	11.95	11.77	11.75	11.26	11.01	10.96	10.44	10.32

Source: Eurostat (1999-2009) and European Commission (1999-2009).

There are signs of increased diversification, using the standard deviation as a measure. It is clear that services have become more important in the external trade of the EMU and that machinery and transport equipment, despite having lost some

weight, remain the most significant sector in the total exports. Nevertheless, since data is aggregated in only eight sectors, possible intra-sectorial changes are not revealed.

With a different aim in mind we now take a look at the comparative diversification between EMU countries. For each country we have calculated each sector's share in total exports and then we have calculated the difference between these shares and the EMU's shares. In Table 10 we present the sum of these differences, in absolute value, for each country.

Table 10 Sum of the Absolute Value of the Differences in Export Shares by Sector between EMU Countries and the EMU (pp) (1999-2009)

Country / Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Austria	24.2	22.9	22.1	19.6	20.3	16.7	19.2	20.4	19.2	20.9	21.3
Belgium	28.4	28.3	26.9	32.3	31.8	33.2	34.6	35.3	35.1	33.5	33.3
Finland	28.9	34.2	28.5	27.5	30.1	28.3	26.4	28.8	26.4	25.8	27.5
France	12.8	12.2	12.1	10.8	11.1	11.0	9.2	9.7	8.1	8.6	9.9
Germany	23.4	23.3	23.9	25.1	25.8	24.9	25.0	24.0	24.3	25.2	24.8
Greece	92.6	91.7	92.6	91.2	88.8	94.4	91.1	88.0	88.0	88.2	84.0
Ireland	33.5	36.7	41.9	50.9	60.0	63.7	66.0	70.4	75.9	79.3	79.3
Italy	22.7	23.3	24.4	23.9	23.1	22.8	21.9	21.4	21.0	22.3	23.0
Luxembourg	102.3	105.6	96.8	96.7	95.9	98.8	98.5	99.9	110.3	109.3	107.6
Netherlands	24.9	24.1	24.6	25.3	24.1	22.1	24.9	27.0	26.5	30.4	27.7
Portugal	35.8	35.4	36.3	35.2	33.7	33.9	32.3	30.8	32.2	32.0	36.2
Spain	30.5	29.2	31.1	30.6	29.8	29.0	29.2	29.0	28.2	27.4	28.1

Source: Eurostat (1999-2009) and European Commission (1999-2009).

Data gives us a picture of very different economies. Especially, Luxembourg, Greece and Ireland's structure of exports were very different from the EMU's. Therefore, in regard to trade, these three countries are the most vulnerable to asymmetric shocks in relation to the remaining EMU. When analysing tendencies we can see that most of countries' structures haven't changed significantly with the exception of Ireland. From this data it is not possible to infer an increasing homogeneity in countries' economic structure.

3.5 Similarity and Flexibility of Inflation Rates and Price Levels

Fleming (1971) considered similar inflation rates essential to form an OCA. Accordingly, we compare inflation rates in the twelve countries. In Table 11 we present the percentage change on the previous year of the Harmonised Index of Consumer Prices (HICP) for the EMU countries. Additionally, for each country, we have calculated the sum of the differences between its inflation rates and the EMU's.

In the first years of the euro inflation rates diverged and from 2002 to 2007 they steadily converged. Then, they diverged again. The ECB's objective of keeping EMU's inflation rate below but close to 2% (European Commission 2008a) was achieved only in 1999 and 2009, though inflation was generally close to the benchmark. However, differences can be noted. Especially Greece, Ireland and Spain had high inflation rates. These countries also had, as we have previously analysed, some

of the bigger increases in wages with the consequent loss of competitiveness. This can, in most cases, be explained by the Balassa-Samuelson effect (Mongelli 2008) and by labour markets' rigidity (Campolmi and Faia 2011).

Table 11 Annual Change of the HICP in the EMU Countries (%) (1999 - 2009)

Country / Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Avg.	Sum of diff.
Austria	0.5	2.0	2.3	1.7	1.3	2.0	2.1	1.7	2.2	3.2	0.4	1.8	-2.9
Belgium	1.1	2.7	2.4	1.6	1.5	1.9	2.5	2.3	1.8	4.5	0.0	2.0	0.1
Finland	1.3	2.9	2.7	2.0	1.3	0.1	0.8	1.3	1.6	3.9	1.6	1.8	-2.6
France	0.6	1.8	1.8	1.9	2.2	2.3	1.9	1.9	1.6	3.2	0.1	1.8	-2.9
Germany	0.6	1.4	1.9	1.4	1.0	1.8	1.9	1.8	2.3	2.8	0.2	1.6	-5.1
Greece	2.1	2.9	3.7	3.9	3.4	3.0	3.5	3.3	3.0	4.2	1.3	3.1	12.2
Ireland	2.5	5.3	4.0	4.7	4.0	2.3	2.2	2.7	2.9	3.1	-1.7	2.9	9.7
Italy	1.7	2.6	2.3	2.6	2.8	2.3	2.2	2.2	2.0	3.5	0.8	2.3	2.8
Lux.	1.0	3.8	2.4	2.1	2.5	3.2	3.8	3.0	2.7	4.1	0.0	2.6	6.3
Nether.	2.0	2.3	5.1	3.9	2.2	1.4	1.5	1.7	1.6	2.2	1.0	2.3	2.7
Portugal	2.2	2.8	4.4	3.7	3.3	2.5	2.1	3.0	2.4	2.7	-0.9	2.6	6.0
Spain	2.2	3.5	2.8	3.6	3.1	3.1	3.4	3.6	2.8	4.1	-0.2	2.9	9.8
EMU (12 countries)	1.1	2.1	2.4	2.3	2.1	2.1	2.2	2.2	2.1	3.3	0.3		
Standard deviation	0.72	1.02	1.06	1.14	0.96	0.84	0.86	0.74	0.52	0.72	0.93		

Source: Eurostat (1999-2009).

A complementary explanation for different inflation rates would be that some countries had lower price levels in 1999 and, according to the PPP theory, their price levels increased faster as they converged (Koedijk, Tims, and van Dijk 2004). In Table 12, we present PPP levels, defined as the amount of currency units a given quantity of goods and services costs in each country.

Table 12 PPPs in the EMU Countries (EU27=1) (1999-2009)

Country / Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
EU27	1	1	1	1	1	1	1	1	1	1	1
Austria	1.060	1.035	1.068	1.048	1.047	1.038	1.059	1.051	1.068	1.092	1.121
Belgium	1.065	1.025	1.031	1.012	1.039	1.064	1.074	1.084	1.092	1.120	1.149
Finland	1.159	1.144	1.178	1.174	1.196	1.157	1.167	1.166	1.158	1.178	1.208
France	1.110	1.080	1.070	1.059	1.110	1.116	1.103	1.109	1.100	1.137	1.165
Germany	1.127	1.112	1.113	1.102	1.086	1.064	1.035	1.028	1.023	1.042	1.069
Greece	0.787	0.780	0.781	0.772	0.815	0.825	0.853	0.858	0.885	0.898	0.943
Ireland	1.075	1.106	1.156	1.175	1.200	1.194	1.206	1.208	1.180	1.217	1.198
Italy	0.946	0.940	0.941	0.989	1.010	1.036	1.035	1.023	1.006	1.009	1.033
Luxembourg	1.088	1.081	1.104	1.093	1.114	1.095	1.138	1.123	1.138	1.160	1.197
Netherlands	1.048	1.026	1.055	1.055	1.097	1.079	1.070	1.066	1.056	1.084	1.125
Portugal	0.805	0.805	0.822	0.829	0.835	0.850	0.817	0.813	0.812	0.831	0.840
Spain	0.847	0.844	0.862	0.858	0.891	0.901	0.913	0.903	0.897	0.922	0.944
Standard deviation	0.130	0.126	0.132	0.131	0.128	0.117	0.121	0.121	0.116	0.121	0.119

Source: Eurostat (1999-2009).

Indeed, the PPPs between countries tended to converge. However, firm conclusions cannot be taken from so small a period. Other studies pointed out that this tendency had begun before 1999 (Lopez and Papell 2007; Zhou, Bhamani-Oskooee, and Kutan 2008). Moreover, the initial low price levels in Greece, Portugal and Spain are consistent with the higher inflation rates in these countries. On the other hand, Ireland and Luxembourg's price levels do not justify higher inflation rates.

3.6 Fiscal Integration

Budgetary discipline is the only fiscal integration approach in the EMU (Eichengreen and Charles Wyplosz 1998). Accordingly, we start by taking a look at budget balances, in Table 13, having in mind the deficit limit of 3%.

Table 13 EMU Countries Budget Balances as a Share of National GDP (%)

Country / Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Average
EU27	-2.3	-1.7	0.0	-0.7	-1.5	-4.5	-1.7	-1.6	-0.9	-0.9	-4.1	-1.8
Austria	-0.6	0.0	0.4	-0.1	-0.1	-0.3	-2.7	0.1	-0.3	-1.3	-5.9	-1.0
Belgium	1.6	6.8	5.0	4.0	2.4	2.3	2.7	4.0	5.2	4.2	-2.6	3.2
Finland	-1.8	-1.5	-1.5	-3.1	-4.1	-3.6	-2.9	-2.3	-2.7	-3.3	-7.5	-3.1
France	-1.5	1.3	-2.8	-3.7	-4.0	-3.8	-3.3	-1.6	0.3	0.1	-3.0	-2.0
Germany	:	-3.7	-4.5	-4.8	-5.6	-7.5	-5.2	-5.7	-6.4	-9.8	-15.4	-6.9
Greece	2.7	4.7	0.9	-0.4	0.4	1.4	1.6	2.9	0.1	-7.3	-14.3	-0.7
Ireland	-1.7	-0.8	-3.1	-2.9	-3.5	-3.5	-4.3	-3.4	-1.5	-2.7	-5.4	-3.0
Italy	3.4	6.0	6.1	2.1	0.5	-1.1	0.0	1.4	3.7	3.0	-0.9	2.2
Luxembourg	0.4	2.0	-0.2	-2.1	-3.1	-1.7	-0.3	0.5	0.2	0.6	-5.5	-0.8
Netherlands	-2.7	-2.9	-4.3	-2.9	-3.0	-3.4	-5.9	-4.1	-3.1	-3.5	-10.1	-4.2
Portugal	-1.4	-1.0	-0.6	-0.5	-0.2	-0.3	1.0	2.0	1.9	-4.2	-11.1	-1.3
Spain	-0.4	0.8	-0.4	-1.3	-1.8	-2.2	-1.8	-0.7	-0.3	-2.1	-7.2	
Average	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Average

Source: Eurostat (1999-2009).

We can see that the deficit limit agreed on the MT was violated every year since 2000. Nevertheless, the years 2008 and 2009 must be analysed in the light of the economic crisis (IMF 2010). It is clear that some countries were persistent transgressors, especially Greece, but also Portugal, Italy and France. Moreover, even when ignoring 2008 and 2009, only five countries (Belgium, Finland, Ireland, Luxembourg and Spain) never breached the limit. Greece was especially rule-breaking, however its true fiscal position was revealed only later as statistical data was reviewed during the sovereign debt crisis (OECD 2010).

When we consider the economic growth in years of excessive deficits, from 1999 to 2007, we see that all violations, bar Germany in 2003, occurred in years with positive or null growth. Even admitting that yearly variations might hide negative performance between quarters, we can conclude that budgetary discipline was not systematically present in the EMU from 1999 to 2009. This situation led to an accumulation of public which is shown in Table 14. We pay special attention to the debt limit of 60% of the GDP (Eichengreen and Wyplosz 1998).

Table 14 EMU Government Consolidated Gross Debt as a Share of National GDP (%) (1999-2009)

Country / Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Austria	67.3	66.5	67.3	66.7	65.8	65.2	64.6	62.8	60.7	63.8	69.6
Belgium	113.7	107.9	106.6	103.5	98.5	94.2	92.1	88.1	84.2	89.6	96.2
Finland	45.7	43.8	42.5	41.5	44.5	44.4	41.7	39.7	35.2	34.1	43.8
France	58.9	57.3	56.9	58.8	62.9	64.9	66.4	63.7	63.9	67.7	78.3
Germany	60.9	59.7	58.8	60.4	63.9	65.8	68.0	67.6	64.9	66.3	73.5
Greece	94.0	103.4	103.7	101.7	97.4	98.6	100.0	106.1	105.4	110.7	127.1
Ireland	48.5	37.8	35.5	32.1	30.9	29.6	27.4	24.8	25.0	44.4	65.6
Italy	113.7	109.2	108.8	105.7	104.4	103.9	105.9	106.6	103.6	106.3	116.1
Luxembourg	6.4	6.2	6.3	6.3	6.1	6.3	6.1	6.7	6.7	13.6	14.6
Netherlands	61.1	53.8	50.7	50.5	52.0	52.4	51.8	47.4	45.3	58.2	60.8
Portugal	49.6	48.5	51.2	53.8	55.9	57.6	62.8	63.9	68.3	71.6	83.0
Spain	62.3	59.3	55.5	52.5	48.7	46.2	43.0	39.6	36.1	39.8	53.3
Number of violations	7	4	4	5	6	6	7	7	7	7	9

Source: Eurostat (1999-2009).

Data shows us that, already in 1999, seven countries exceeded the debt limit, and that violations were frequent. As a consequence, apprehension concerning the high levels of public debt in some countries triggered the sovereign debt crisis in 2010 (Zemanek 2010) and, as of August 2011, three member states asked for external help to meet their refinancing needs: Greece, Ireland and Portugal (European Commission 2011).

Table 15 Summary of the Assessment of OCA Properties

OCA properties	Indicators	Main findings
Labour market integration and wages flexibility	Unemployment rate	Signs of geographic mobility as these rates converged until 2007.
	Long-term unemployment rate	Decrease and convergence, pointing towards inter-sectorial and geographic mobility.
	Share of EMU citizens living in foreign EMU countries	Scarce data available. Reviewed studies indicate that the share is small.
	Nominal wages	Generally, countries with smaller nominal wages in 1999 had bigger increases. These increases in wages surpassed the growth in productivity, resulting in different patterns of growth of ULC in the euro area.
	Productivity and unit labour costs	
Financial and capital markets integration	Government bond yields	Significant convergence until the sovereign debt crisis.
	FDI	Scarce data available. Reviewed studies indicate that intra-EMU FDI increased substantially.
Economic openness	Openness to trade ratio	Core euro area countries increased their intra-EMU trade, possibly as a result of gains in competitiveness. Differently, some periphery countries traded less inside the EMU.
Diversification of production	Structure of external trade	No signs of homogenisation of structures in the EMU.
Similarity and flexibility of inflation rates and price levels	Inflation rates	Inflation rates were lower than in previous decades. There were periods of convergence and of divergence between EMU countries.
	Purchasing power parity	There was a tendency for converge in price levels.
Fiscal integration	Budget balance and stock of debt as share of the GDP	There were several cases of fiscal indiscipline, thus the envisioned fiscal cushion did not materialize.
	EU revenues as a share of the GNI	EU revenues did not increase between 1999 and 2009.

The EU budget can be used to transfer resources from richer to poorer regions, thus being an imperfect proxy for fiscal integration in the EMU (Mongelli 2005). These own resources have a maximum limit, agreed by EU governments, which for the period between 2007 and 2013 was reduced from 1.24% to 1.23% of the EU GNI. Indeed, EU's revenues as a share of the GNI have steadily decreased from 1999 to 2006, and have then started increasing slightly, remaining well below the limit of 1.23% (European Commission 2008b, 2010). Therefore, we confirm that the EU budget was not reinforced in order to support the possible needs for fiscal integration in the context of the EMU.

In this chapter we have analysed the EMU under the perspective of six OCA properties, using several indications. Our findings were not always conclusive and all the indicators did not point towards the same conclusions. In Table 15 we summarise our results.

4. Explaining Changes in Competitiveness as a Result of OCA Properties

After analysing the evolution of the selected OCA properties in the first ten years of the EMU, we assess their quantitative impact on the euro area's competitiveness. For this purpose we use REER as a proxy. Accordingly, we adapt the model put forward by Bayoumi and Eichengreen (1997), which simultaneously considers several OCA properties and their impact in exchange rates. The original model aimed at explaining bilateral nominal exchange rate variation as a function of three OCA properties: asymmetric disturbances to output, trade linkages and the usefulness of money for transactions.

We introduce some changes in the model. Inevitably, we consider real exchange-rates instead of nominal ones. Bayoumi and Eichengreen considered that both exchange-rates would yield similar results. On the other hand, we introduce a new variable: the growth of unit labour costs. Since the labour market was the first dimension considered in the OCA theory (Mundell 1961), we believe that its performance can be useful to understand differences in EMU countries' competitive position. Since inflation rates are implicit in real exchange rates it would not make sense to include them in this analysis. Finally, whereas Bayoumi and Eichengreen used averages from periods of ten years for each variable, we use annual data, due to the fact that our studied period comprises only eleven years. Therefore, we propose the following equation:

$$REER_{ij} = a + \beta_1 OUTPUT_{ij} + \beta_2 DISSIM_{ij} + \beta_3 TRADE_{ij} + \beta_4 LOG(SIZE)_{ij} + \beta_5 ULC_{ij}$$

Where, considering each year:

$REER_{ij}$ is the difference, in absolute value, between variations in the real effective exchange-rates of countries i and j (source: ECB);

$OUTPUT_{ij}$ is the difference, in absolute value, between the real GDP growth rates of countries i and j ;

$DISSIM_{ij}$ is the sum of the differences, in absolute value, of the share of each group of products or services in the countries' total exports, between countries i and j ;

$TRADE_{ij}$ is the mean of the bilateral exports to GDP ratio between countries i and j ;

$\text{LOG}(\text{SIZE})_{ij}$ is the logarithm of the mean of the sum of the countries' GDP;

ULC_{ij} is the difference, in absolute value, between the ULC growth rates of countries i and j , in each year. ULC is measured as the average cost of labour per unit of output.

Based on the OCA theory, we can anticipate the signs of the proposed variables (Table 16):

Table 16 Expected Signs of the Variables Coefficients

Variable	Expected sign	Authors
OUTPUT	+	Friedman (1953)
DISSIM	+	Mundell (1961)
TRADE	- / +	Frankel and Rose (1998) / Kenen (1969) and Paul Krugman (1993)
LOG(SIZE)	-	McKinnon (1963)
ULC	+	Mundell (1961)

In a flexible system, differences in economic performance result in exchange rates movements (Friedman 1953). Thus, we expect OUTPUT to have a positive coefficient. The more different countries are, the more asymmetric shocks they tend to suffer and therefore their exchange rates are expected to vary more, giving DISSIM a positive coefficient. If more trade results in the specialization of economies, more asymmetric shocks are to be expected, thus bigger variations in exchange rates (Krugman 1993) and TRADE will have a positive coefficient. On the other hand, if increased trade promotes more homogeneous economies their economic cycles are expected to become more harmonised (Frankel and Rose 1998) and TRADE will have a negative coefficient. The bigger the size of the pair of countries is, the bigger is the pool of non-tradable goods and services available, which protects their economies from fluctuations in relative prices (McKinnon 1963). Therefore we expect their REER to vary less, resulting in a negative coefficient of LOG(SIZE). In monetary unions, countries with rigid labour markets might see their competitiveness erode with time, as bigger increases in labour costs will, *ceteris paribus*, result in a decrease in competitiveness (OECD 1999). Hence, we expect ULC to have a positive coefficient.

For the estimation of our equation, a first precautionary step was to calculate the correlation between our proposed variables, especially between DISSIM and TRADE. The obtained correlogram did not show signs of correlations that could endanger the statistical inference, thus we proceeded to the estimation of the proposed model, using the method of ordinary least squares. Results are presented on Table 17.

From this results we conclude that the variable LOG(SIZE) is not statistically significant and TRADE is only significant at a 12% confidence level. On the other hand, OUTPUT, DISSIM and ULC have the predicted signs, thus reinforcing the validity of the previously reviewed OCA theory. Comparable results were obtained by Bayoumi and Eichengreen (1997). TRADE, however, has a positive coefficient, which points toward the specialization paradigm. Bayoumi and Eichengreen (1997) had concluded otherwise.

Table 17 Main Findings of Models Estimation

Variable	Proposed model		Without ULC		6 dummies (cross-weighted)	
	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
C	1.250223	0.1293	1.286116	0.1237	0.370191	0.5729
OUTPUT	0.059581	0.0438	0.069347	0.0207	0.055443	0.0354
DISSIM	0.005113	0.0034	0.006842	0.0001	0.005189	0.0005
TRADE	0.034965	0.116	0.018267	0.4167	0.022173	0.2172
LOG(SIZE)	-0.042224	0.4916	-0.024893	0.6883	0.020851	0.6681
ULC	0.183257	0.0000	-	-	0.155067	0.0000
YEAR=1999	-	-	-	-	-0.355975	0.0055
YEAR=2000	-	-	-	-	0.382194	0.0025
YEAR=2001	-	-	-	-	0.588734	0.0000
YEAR=2003	-	-	-	-	0.734882	0.0000
YEAR=2007	-	-	-	-	-0.745287	0.0000
YEAR=2008	-	-	-	-	-0.296758	0.0189
Adjusted R-squared	0.083613		0.035566		0.223335	

Source: Authors' estimations.

If we want to follow more closely Bayoumi and Eichengreen (1997), a pertinent adaptation of our model would be to discard the variable ULC. In this case, as seen from Table 17, LOG(SIZE) and TRADE would be even less statistically significant and the adjusted R^2 would be less than half the one obtained with the complete model. OUTPUT and DISSIM would maintain their significance and coefficient signs.

A different approach would lead us to remove the idiosyncratic effects of each pair of countries and of years that affected equally the twelve countries. These adaptations allow us to concentrate on the importance of the proposed variables. Since REER is calculated using several countries as a reference, most of them with a currency that floats against the euro, nominal variations in exchange rates will affect all EMU countries. We estimated the significance of dummy variables for each year, with the goal of identifying the years with significant impact on REER. In the presented results we include the six significant dummies. The results of such estimation (Table 17 – see “6 dummies”) show that whereas OUTPUT, DISSIM and ULC keep their coefficients and significance relatively unchanged, TRADE becomes definitely non-significant. More interesting, however, is that the six selected years are not only significant but have a strong effect on REER. The dollar, in particular, weakened from 2002 to 2007 (OECD 2010), which is probably a cause of the significance of the years 2003 and 2007.

In our view, the statistical significance of those three variables confirms the validity of the model. Also, our results confirm that the OCA theory still provides useful information for the debate on the EMU. Apart from output growth and the structure of trade, the evidence from our model reinforces the conclusions of previous works that put big increases in unit labour costs in some countries as a central cause of the widening gap in competitiveness among EMU countries (e.g. European Commission 2008a; OECD 2010; Zemanek 2010).

It must be noted that the global fit of the model (measured by the adjusted R^2), is small. It improves with the introduction of dummies for some years, resulting in the inclusion of the effect of the exchange rate. Also, the diminished significance of the variable TRADE does not mean that trade is not part of the explanation. In fact,

the trade related variable DISSIM was found to be significant. The proposed model is admittedly simple. The inclusion of different properties or proxies and the use of different estimation procedures would probably shed additional light on this subject. We consider our contribution to be a first step that deserves to be further explored.

5. Final Remarks

As we have taken a look at different economic aspects, identified as crucial for a successful monetary union by the OCA theory, possible causes of the EMU current travails have emerged. This is especially true in labour markets: whereas unemployment rates converged between EMU countries, wage policies give us a different message. Peripheral countries' low initial nominal wages grew faster than core countries', yet their productivity growth was, in many cases, sluggish, resulting in loss of competitiveness (Arpaia and Pichelmann 2007; OECD 2010).

Other OCA properties give us interesting information. Both financial and capital markets have shown signs of increased integration. However, the increase in intra-EMU trade appears to have been more the result of a previous tendency than a consequence of monetary unification (Berger and Nitsch 2008). Moreover, as economies have become more diversified no signs of homogenisation, as predicted by Frankel and Rose (1998), were identified.

Although inflation rate within the area has been close to 2% (European Commission 2008a), inflation rates in peripheral countries were usually higher. This situation and the concurrent strong wages growth eroded their competitiveness (Zemanek 2010). Fiscal integration seen as the compliance of budgetary rules was a disappointment. Some countries violated the budget deficit limit every year since 2000, piling up an excessive stock of debt.

We measured the impact of the most important OCA properties on the relative competitiveness of EMU countries. We concluded that different growth in labour costs was an important factor, hence putting our work in a growing group of contributions pointing in the same way. Differences in output growth and in trade patterns of each pair of countries were also deemed significant variables. The impact of the intensity of trade in our model pointed to the specialization paradigm predicted by Krugman (1993). This raises questions about the impact of trade on the stability of the EMU. However, the significance of the selected variable is small, forcing us to look at this conclusion with reinforced caution.

This work leaves several questions to be answered. Firstly, in each property, some countries moved more closely than others: assessing whether a smaller set of countries form a more perfect union would possibly yield new information. Another interesting study would be to assess the impact of political factors on the performance of the EMU, which would certainly contribute to the ongoing debate about changes to the European institutional framework. Possible paths for the EMU to cope with the challenges that the sovereign debt crisis is bringing about are, in itself, a rich field of future research. As the seminal contribution of Kenen (1969) made clear, having different domains for monetary and fiscal policies may be the recipe for disaster.

As times passes, more data from the EMU will be retrieved and more interesting studies can be made. Namely, Bayoumi and Eichengreen (1997) approach of using averages of periods of ten years can be replicated. Finally, every single OCA property deserved a more detailed study. Nevertheless, the several shortcomings we identified are enough for us to agree with the proposition that monetary union is no excuse for countries to avoid doing structural reforms, especially in labour and product markets (Issing 2000; OECD 2010). Indeed, the loss of autonomous monetary policy would make them indispensable (European Commission 2008a).

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