



**Maastricht
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Internal devaluation in the Eurozone

A historical and quantitative analysis

Thesis presented by
Lionel Legrand

Supervisor
Vincent Bodart (UCL/UNamur)

Supervisor and Reader
Erik de Regt (Maastricht University)

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I. Introduction

After a decade of economic and political turmoil, countries of the Economic and Monetary Union of the European Union (the EMU, hereinafter) seem to return to the path of stability, serenity and credibility. Before looking to the future of the Euro area, one can rightly advocate for shedding light on decisions taken in the past. Ten years after the Global Financial Crisis and the subsequent sovereign debt crisis, a retrospective analysis of the measures applied this last decade is essential. Why did the Eurozone take years to recover while the US took only months? Why did some of the Eurozone's countries face sovereign debt crises while some others did not? Why has the Eurozone been facing such economic disparities? Why has unemployment remained dramatically high in some countries?

Part of these answers lies in the architecture of the EMU itself. This has already been studied quite extensively – both theoretically and empirically. But the existing literature does not provide an exhaustive portrait of the EMU's situation before and after the GFC. On one hand, empirical analyses do not put the EMU in a historical perspective nor contrast it with other monetary constructions. On the other hand, theoretical and reflexive studies do not try to empirically assess the causal relationships. We aim at closing the gap between empirical and reflexive inquiries.

Members of fixed exchange rate regimes such as the EMU face the trilemma of international finance: a country cannot enjoy at the same time fixed exchange rate, free capital mobility and a sovereign monetary policy. They de facto give up the latter to enjoy the two formers. In the absence of national monetary policy, members of these monetary constructions cannot use the tool of external devaluation to adjust to external shocks. Unable to adapt through exchange rates – since they are fixed – the only adjustment variable the members of fixed exchange rate regimes have is the real and effective exchange rate.

In a nutshell, fixed exchange rate regimes prevent countries from using price competitiveness through national currency devaluation but push countries to adjust through cost competitiveness. In case of negative exogenous shock they are forced to implement deflationary measures such as internal devaluations. These measures take the form of domestic prices and labour costs compression.

Yet the EMU is not the first nor the only monetary constructions in history. Various monetary constructions have been existing – ranging from the mere fixed exchange rate regime to fully integrated monetary union (e.g. the US monetary union).

Among others, the Gold Standard regime is interesting to analyze because it outlines some similarities with the current EMU's framework. Particularly, the interwar period is interesting. After the WWI, countries returned to the Gold Standard but experienced growing imbalances before the 1929 crisis. This situation is similar – yet with some differences – to the situation of the EMU prior to the Global Financial Crisis. The current account of the entire EMU has been globally balanced since the Euro's introduction but before 2008, core countries experienced current account surpluses while the periphery (i.e. GIIPS countries) ran ever-growing current account deficits.

Once these crises occurred, the EMU and the Gold Standard acted as a straightjacket preventing countries from recovering. In the midst of the 1929 Great Depression, countries implemented deflationary measures.

These measures worsened the economic situation and can be partly held responsible for the rise of totalitarianism and its political chaos. Countries only recovered by exiting the Gold Standard in the subsequent years.

Similarly, Eurozone's countries also implemented deflationary measures in the aftermath of the 2007-2008 Global Financial Crisis. These measures took the form of fiscal austerity, labour market flexibilization or internal devaluations. These decisions are politically costly. Some new parties from all over the political spectrum questioned the utility of the European common currency. From Syriza to the Alternative für Deutschland or the 5-star movement, the rise of alternative parties is a careful reminder of how deep some parts of the population were affected by the Global Financial Crisis and the subsequent political decisions.

In this master thesis, we empirically assess the impacts and costs of internal devaluations implemented in the aftermath of the Global Financial Crisis on both current account rebalancing and unemployment rate. This approach is close to the one followed by Stockhammer and Sotiropoulos (2014). They extensively examine the existing empirical literature on the relationships between competitiveness and current account balance and unemployment.

To the best of our knowledge, such analysis has never been done with quarterly data. Using quarterly data enables us to perform such empirical analysis from the introduction of the Euro onwards.

Moreover, quarterly data are useful to highlight spatial and temporal heterogeneity in the EMU. The equations estimated in Stockhammer and Sotiropoulos serve as a baseline and are adapted to quarterly data. However, the available quarterly data are subject to noise – especially seasonal and calendar variations.

We proxy internal devaluations by changes in Unit Labour Costs. We empirically investigate the effects of changes in Unit Labour Costs on both current account balance and unemployment. To do so, we construct a relative measure of Unit Labour Costs which compares the growth of country-specific Unit Labour Costs with the one of the EMU's average.

For the current account, we control for relative GDP growth and real per capita income. We take the former variable in growth rate and the latter in level. Level of real per capita income aims at capturing the catching-up term.

For the unemployment relationship, we control for business cycle – as proxied by the output gap. Hence, our unemployment equation consists in an Okun's law together with changes in relative Unit Labour Costs.

We use both quarterly and annual data. The data are extracted and retrieved from Eurostat. We first estimate our two relationships with quarterly data. We observe some dependence between cross-sections and heterogeneity with regard to the parameters. Dynamic adjustments also play a role. We use mean group estimators with a dynamic specification in order to tackle these issues. We estimate our equations for the entire EMU as well as for subgroups of countries. In the light of the 'Core-Periphery' dualism, we focus on differences between GIIPS and core countries. We also estimate our equations after and before the Global Financial Crisis to assess whether it had an impact on Eurozone countries.

We further investigate the convergence hypothesis in terms of living standards within subgroups of countries.

Due to noise in quarterly data, we then estimate again our relationships with annual data. With annual data, we control for additional structural variables which are not available on a quarterly basis. We do not discriminate between the pre- and post-crisis situation due to a lack of sufficient observations but rather compute Chow structural break tests to assess the impact of the Global Financial Crisis.

Our results confirm the existence of spatial and temporal heterogeneity between the core and the periphery – as our stylized facts suggest. However, we are not able to econometrically verify every aspect of these facts.

Moreover, we should remain careful given the inherent limitations of our empirical approach. For the pre-crisis period (i.e before 2008), we find with quarterly data a rather limited impact of changes in relative Unit Labour Costs on current account. After the crisis, we observe a negative effect of internal devaluations – as proxied by relative Unit Labour Costs growth – on current account for GIIPS countries after 2008. We do not observe such effect for core countries. This confirms our prediction. It seems that current account rebalancing was only borne by the periphery. But at what costs?

Regarding unemployment pattern, our results do not show any sign of a direct effect of internal devaluation on unemployment after the crisis. The dramatic surge of the periphery's unemployment does not seem to be explained directly by internal devaluation. In our opinion, the explanation can be found in the fact that our econometrical analysis does not display any Okun's law.

Besides, the results we obtain with annual data should be interpreted with care given the rather limited amount of annual observation available.

As a concluding remark, internal devaluations reduced GIIPS countries' current account deficits but we are unable to empirically estimate the cost of such measures in terms of unemployment.

This thesis is structured as follows. This part (I) constitutes an introduction to current and past challenges faced by monetary constructions. Then, we dwell on these challenges by outlining some theoretical and historical aspects (part II). Specifically, we review the Gold Standard regime and link its framework to the current EMU's architecture.

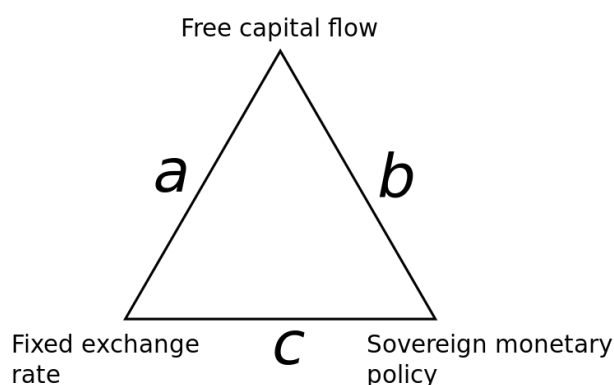
Next, we enter the quantitative part (part III). First, we introduce our data and theoretically discuss the links between them based on the existing literature. We have a first look at them by displaying some correlation. Second, we construct our model based on the previous discussion. We then estimate our model and interpret the results. We discuss these results in the light of our research question. Eventually, we conclude (part IV).

II. Theoretical analysis

1. Trilemma of international finance

The trilemma of international finance has been developed by Robert Mundell (1960) and is often referred to the impossible trinity. This trinity represents three economic choices a country cannot choose simultaneously. It can only pick two. The trilemma provides a convenient organizing framework for international macroeconomics (O'Rourke and Taylor, 2013) and is depicted in Figure 1.

Figure 1: The impossible trinity (Mundell, 1960)



The incompatibility of these three options is based on the uncovered interest rate parity. Domestic interest rate equals foreign interest rate plus the expected change in exchange rate between the countries' currencies. Obviously, this parity holds only if a country chooses free capital flow which allows for arbitrage operations. These operations equalize expected returns at home and abroad.

Therefore, if a country accepts open capital market (i.e. free capital flow), the government must choose fixed exchange rate or sovereign monetary policy and give up the other. This in turn yields only three possibilities:

A) **Free capital flow and fixed exchange rate.** In line with the uncovered interest rate parity, if a country leaves capital free and wants to stabilize its currency, domestic interest rates should equal foreign ones since there is fixed exchange rate. This situation rules out sovereign monetary policy by preventing a country from using interest rates to stabilize inflation or to cope with a recession.

But what about external devaluation? In theory, exchange rates are fixed but countries can always renege their commitment a fixed parity. For example, countries decided to devalue their currency by exiting the Gold Standard regime in the aftermath of the Great Depression (see the discussion below).

However, this possibility is obviously denied when countries share the same currency. In a monetary union, external devaluation (i.e. exchange rate devaluation) is not an option anymore. Instead, adjustment to exogenous shocks should take place by other mechanisms.

This is the situation within the EMU. Within the Eurozone, capital flows are allowed from a country to another. Moreover, every Eurozone member has de facto a fixed exchange rate under the common currency. This denies a sovereign monetary policy.

The 2007-2008 Global Financial Crisis (GFC) constituted a major exogenous shock which required adjustments within the Euro area. Indeed, as we will see, the GFC highlighted the need for a readjustment of the EMU regarding imbalances. One way of rebalancing the Eurozone was to devalue the real and effective exchange rate.

To do so, deficit countries implemented internal devaluation – a compression of domestic prices and labour costs.

In conclusion, in the absence of exchange rate flexibility, external devaluation is ruled out. Instead, adjustments take place internally through internal devaluation which have some deflationary effects and are politically costly to implement. A fixed exchange rate tends to exacerbate imbalances because adjustments are more difficult to achieve.

- B) **Free capital flow and sovereign monetary policy.** Following the uncovered interest rate parity, an open economy willing to set domestic interest rates different from the ones abroad can no longer ensure a fixed exchange rate.

The Eurozone as a whole and other developed economies (the USA, UK or Canada) are characterized by this arrangement. These countries are what De Grauwe (2011) call “stand-alone” countries. The Euro is not pegged to any currency, its course is floating. Capital flows with the rest of the world are allowed. The EMU’s monetary policy is thus independent (i.e. sovereign) and dealt at the supranational level by the European Central Bank.

- C) **Fixed exchange rate and sovereign monetary policy.** In order to have these two features, a country must control capital flows.

This option prevailed in the aftermath of World War II and cast into concrete under the Bretton Wood regime. This regime collapsed when capital flows were no longer regulated with the emergence of offshore financial markets such as the euro-dollar market.

2. Internal devaluation throughout history

The goal of this section is to put monetary constructions into perspective by pointing out some common features – and differences – throughout history. By analysing structural elements of monetary unions and exchange rate regimes that took place in the past, this section aims at reviewing adjustments to shocks that occurred in the framework of anterior monetary constructions. More precisely, we investigate the effects of internal devaluations in the aftermath of an exogenous shocks within these previous monetary constructions.

The creation of the EMU is obviously not the first attempt in history to form a monetary union. A monetary union potentially encompasses a wide range of various arrangements. Monetary constructions range from fully-fledged unions to mere exchange rate agreements (see table 1). The US monetary union is an example of the former. This union is more than a mere monetary union inasmuch as it also embodies a fiscal and political union. The latter is exemplified by the Gold Standard – a regime in which currencies were linked to a common standard – gold. In between these two monetary constructions lay various monetary agreements.

O'Rourke and Taylor (2013) establish a table in which they compare various monetary unions. This table is displayed in Table 1. We have chosen not to present every monetary union reviewed by O'Rourke and Taylor but rather to focus on two – the US monetary union and the Gold Standard regime.

Looking back at history turns out to be useful to draw parallels but also to outline the uniqueness of historical events. The history of the Gold Standard is a rich source of lessons on how adjustment across countries takes place in modern economies and policies (O'Rourke and Taylor, 2013).

Table 1: Comparing Monetary Unions

	Gold Standard	US monetary union	EMU
Does it eliminate exchange rate variability?	No	Yes	Yes
Does it eliminate national currencies?	No	Yes	Yes
Is exit easy?	Yes	No	No
Is there a temporary escape clause?	Yes	No	No
Is there a common central bank?	No	Yes	Yes
Are high-denomination coins mutually acceptable?	No	N/A	N/A
Are low-denomination coins mutually acceptable?	No	Yes	Yes
Is paper currency mutually acceptable?	No	Yes	Yes
Is there a fiscal union?	No	Yes	No
Is there a political union?	No	Yes	No
Is there a banking union?	No	Yes	Yes
Is the union symmetric?	Yes	Yes	Yes
High labour mobility?	Partial	Yes	No

Source: O'Rourke and Taylor (2013)

Table 1 compares the key features of the three different monetary constructions. The common feature of these fixed exchange rate regimes is the loss of monetary sovereignty. As explained in the previous section, fixed exchange rates – in the presence of free capital flow – constrain national monetary policy. In theory, the exchange rate cannot be used as an adjustment mechanism at a national level.

In practice, only matter the two first lines of Table 1. Monetary unions such as the EMU or the US one eliminate de facto exchange rate variability by imposing a common currency. Hence, adjustment in case of an exogenous shock can only take place through internal devaluation – a compression of domestic prices and wages. These internal devaluations put countries' economies at risk by imposing deflationary pressures at the domestic level.

However, monetary agreements as the Gold Standard do not prevent countries to renege their commitment regarding fixed exchange rate. A trade-off between the benefits and the costs of exiting such monetary agreements exists. Following the Great Depression, some countries were not able to maintain their gold convertibility and decided to go off the Gold Standard regime. The benefits of exiting the Gold Standard outweighed the advantages of remaining into the regime. The following subsections outline the difference between the EMU and the two other monetary unions and draw some conclusions on adjustment mechanisms.

a. The Gold Standard

The Gold Standard was a monetary regime under which every country decided to peg its currency to an external numeraire – gold. Each national currency was expressed in terms of gold and therefore exchange rates are fixed between participants – surrounded by a fluctuation bound covering transportation costs. In the words of Eichengreen (1992), the three basic features of the Gold Standard are:

- (i) Inconvertibility between domestic money and gold at a fixed official price;
- (ii) Freedom for private citizens to import and export gold;
- (iii) A set of rules relating the quantity of money in circulation in a country to that country's gold stock.

As mentioned in Table 1, Gold Standard was primarily a national arrangement. The Gold Standard can be viewed as a fixed exchange rate regime but there was no common central bank nor supranational institutions to manage such a regime.

Hence, a country could decide to exit the regime in time of distress by suspending the free convertibility of its national currency. As stated by Eichengreen (2008), countries under Gold Standard were able to peg under normal circumstances precisely because they could float in periods of exceptional volatility. In contrast, countries under the EMU have de facto agreed to abolish exchange rate volatility by abolishing their national currency, without a clear way of exiting the Eurozone (table 1).¹

i) Theoretical adjustment mechanisms under the Gold Standard

In theory, the Gold Standard mechanism presents many advantages. It is seen as a source of stability in terms of prices and incomes. In this view, the Gold Standard works as an automatic stabilizer preventing balance-of-payment imbalances from becoming unsustainable.

Under the Gold Standard, such imbalances induce international gold movement. Balance-of-payment surpluses lead to gold inflows while balance-of-payment deficits induce gold outflows. Gold movements were the ultimate means of balance-of-payment settlements (Eichengreen, 1992). This mechanism is referred to the “price-specie flow”. The underlying basic intuition has been first elaborated by David Hume in a letter to Montesquieu in 1749 – latter developed in his book “*Of the Balance of Trade*” in 1752.

From point (iii) the Gold Standard regime is characterized by “a set of rules relating to the quantity of money in circulation in a country to that country's gold stock”. Thus, national money supplies are backed by countries gold reserves.

Note however that this mechanism works only if central banks do not intervene to offset gold movements. In the absence of these intervening policies – called “sterilization” or “neutralization” – the above-mentioned “automatic” adjustment forces take place.

¹ A set of rules to enter the EMU exists (article 140 – Treaty on the Functioning of the European Union) but no rule, procedure nor mechanism to exit it.

Adjustment mechanisms to balance-of-payment disequilibrium under the Gold Standard work as follows. When a country runs a balance-of-payment surplus, this country experiences a gold (specie) inflow amounting to the value of its net balance-of-payment surplus. This increases the country's money supply which in turn increases prices. The inflation brought by gold inflows in turn reduces the country's international competitiveness and impedes exports. This prevents a country from running an ever-growing balance of trade surplus.

In contrast, when a country accumulates balance-of-payment deficit, this country experiences a gold (specie) outflow amounting to the value of its net balance of trade deficit. By the same above-described mechanism, this reduces the domestic money supply and in turn imposes downward pressure on domestic prices. This deflation brought by gold outflows restores the country's international competitiveness and boosts exports. The mechanism prevents a country from running excessive balance-of-payment deficits.

In a nutshell, as stated by Hume (1752), an "increase in domestic prices due to the gold inflow would discourage exports and encourage imports, thus automatically limiting the amount by which exports would exceed imports".

By automatically offsetting the surpluses and deficits of countries, the Gold Standard regime prevents unsustainable imbalances from occurring. The Gold Standard acts as an automatic stabilizer and pushes countries to equilibrium with regard to their balance-of-payment. This is what makes the Gold Standard regime – still today – appealing.

ii) The Gold Standard in practice

The Gold Standard varied at different times and places. This section focuses on the interwar period and the subsequent abandon of the regime following the 1929 economic crisis. This is so because the interwar period shows some relevant similarities with the current EMU situation.

The Gold Standard turned out to be successful in Europe during the prewar period (1880-1913) in terms of prices and incomes stability. More precisely, the regime was even more successful since it guaranteed exchange rate stability.

Nevertheless, some authors argue that the monetary arrangement did not work as smoothly as predicted by the theory prior to World War I. Among others, Triffin (1968) highlights the contrast between the “core” countries (i.e. the more advanced economies at that time – namely the industrialized Europe) and the “periphery” (especially Latin America). For “core” countries, the Gold Standard was a source of a stability. For the periphery, the system was a source of instability. The periphery relied on capital inflows from “core” countries. The cyclicity of these capital flows caused the periphery to be highly dependent and thus vulnerable on fluctuations of those capital movements. This asymmetry was due to international capital movements. Capital movements took mainly the form of intergovernmental loans. Private capital flows played a very limited role at the time. We will further show that this contrast between core and peripheral countries was further aggravated in the interwar period.

This situation is similar to the one experienced by the EMU in the aftermath of the introduction of the Euro until the outbreak of the GFC (2002 until 2008). As we will later see, the European periphery experienced massive capital inflows from the “core” which came to a sudden stop once the GFC started.

In spite of the well-identified (table 1) differences between the EMU and the Gold Standard, the latter gives lessons on adjustment mechanisms under fixed exchange rate regime even during the prewar period. Eichengreen and Temin (2010) claim that the Gold Standard and the EMU share the common feature that they both “facilitate business and communication in good times but intensify problems when times are bad”.

Let’s now focus on the interwar period (1919-1939). Before World War I, the Gold Standard ensured exchange rate stability and proved to be a mechanism which prevented countries from running unsustainable balance-of-payment imbalances.

Our main goal is to understand why the Great Depression lasted so long. More precisely, we want to know whether the monetary regime in place during the interwar period – the Gold Standard – impeded countries from recovering. We want to study in a historical perspective the impact of monetary regimes on economic performances in times of crisis.

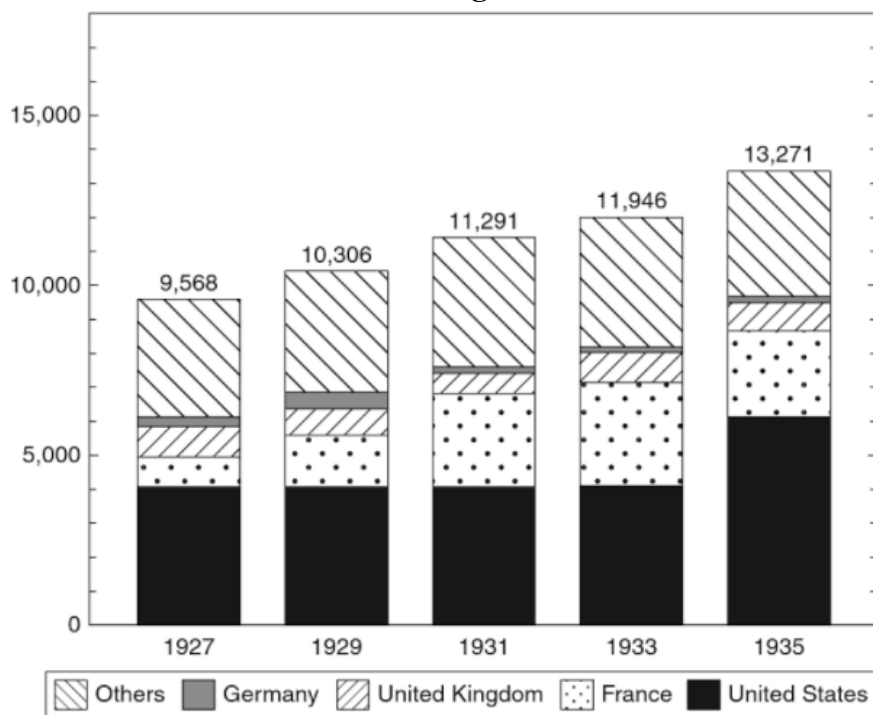
The Gold Standard worked much less smoothly after World War I than it had before. O'Rourke and Taylor (2013) identify two reasons.

First, the interwar period was characterized by growing asymmetry in terms of balance-of-payments positions – some countries running ever-growing surpluses or deficits. On one hand, the United States emerged as a net lender to the rest of the world – especially to Latin America and Germany – after World War I. These lending were mainly intergovernmental loans. They maintained a fragile equilibrium and introduced dependency relationships.

Private capital flows did not significantly contribute to exacerbate these imbalances.

On the other hand, the balance-of-payment of other industrialized nations deteriorated. For example, Britain accumulated large deficits, especially from 1925 onwards – the year on which the pound returned at its pre-war parity. As a result, gold flew from deficit countries to surplus ones. This situation is depicted in Figure 2.

Figure 2: International distribution of gold reserves, 1927-1935, in millions of U.S. dollars of constant 1929 gold content



Source: Hardy (1936), pp. 92-93

France and the USA experienced huge gold inflows at the expense of Germany and the United Kingdom. These countries experienced huge gold depletions. As we will explain later, the Gold Standard regime was characterized by asymmetries in terms of adjustments. Adjustments to imbalances were only borne by the balance-of-payment deficit countries.

The fragile equilibrium during the interwar period relied on these intergovernmental loans. Indeed, these growing imbalances were not an issue as long as capital continued to flow from the United States.

The Gold Standard continued to operate pretty smoothly until the US started to tighten their monetary policy in 1928. This imposes balance-of-payment pressures on other countries which were forced to implement stricter fiscal and monetary policies to avoid growing deficit and to maintain their gold convertibility. These ever-growing pressures were not sustainable anymore and some countries unilaterally decided to go off the Gold Standard from 1929 onwards.

This divergence in terms of balance-of-payment is similar to the one in the Eurozone before the 2007-2008 Global Financial Crisis (see discussion about current account imbalances). As in the interwar period, growing imbalances were not a major issue until the GFC occurred. Once the GFC started, capital flows from the core to the periphery came to a sudden stop.

Second, World War I represented a major political quake. Voting rights were extended and nominal wages were stickier. This made the adjustment costs higher than before the war.

As a side note, Triffin (1968) stresses the overestimated role of changes in wages as part of the adjustment process during the prewar period. In his point of view, adjustments to imbalances took place through price differentials rather than downward wage adjustments. Nevertheless, adjustments under Gold Standard were more politically costly than ever (Eichengreen, 1992).

Once again, this situation is similar to the one experienced by the EMU. Given the high degree of social protection in Europe, internal devaluations are far more politically costly than the external ones.

Besides, Eichengreen (1992) provides an additional explanation. Following World War I, the interwar period was characterized by a general distrust between countries. The subsequent lack of cooperation and credibility regarding countries commitment to the Gold Standard paved the way of its disintegration.

Moreover, O'Rourke and Taylor (2013) stress “the asymmetry between countries experiencing balance-of-payments deficits and surpluses. There was a penalty for running out of reserves (and being unable to maintain the fixed value of the currency), but no penalty (aside from foregone interest) for accumulating gold. The adjustment mechanism for deficit countries was deflation rather than devaluation, that is, a change in domestic prices instead of a change in the exchange rate.” The Gold Standard acted as economic and monetary straightjacket during the Great Depression. Indeed, in order to maintain gold convertibility, inflationary fiscal and monetary measures were not an option anymore.

This situation is similar to the one experienced by the Eurozone. The Euro removed the exchange rate risk between countries. In good times – before the Global Financial Crisis – the common currency facilitated business and enhanced growth. The peripheric countries of the EMU (especially the GIIPS) experienced significant private capital inflows and accumulated high current account imbalances.

However, in bad times – during the Global Financial Crisis – adjustments were only borne by deficit countries in the periphery (De Grauwe, 2012). As the Gold Standard, the Euro constrained Eurozone's members from devaluating their currency. The difference is that today Eurozone's members cannot exit the zone as easily as countries could exit the Gold Standard regime in the 1930's.

Besides, the so-called “Stability and Growth Pact” (SGP) impedes EMU’s members from running fiscal deficit or accumulating debt. In theory, the pact also prevents the Euro area from following inflationary monetary measures.

As the Gold Standard, the Euro combined with the SGP acts as a straightjacket in times of crisis. This prevents countries from recovering. Worse, it deepens the crisis by imposing fiscal austerity which in turn pushes countries into deflationary circles.

Let’s now focus on the mechanisms which enabled Gold Standard’s participants to recover from the Great Depression.

The recovery of countries from the Great Depression was twofold. Countries went off the Gold Standard by suspending gold convertibility. This in turn enables them to use exchange rate as an economic tool in order to regain international competitiveness. This was the case for Czechoslovakia where devaluation was followed by an increase in exports.

However, exiting the Gold Standard regime was a necessary but not a sufficient measure to actually recover. Devaluation combined with fiscal stimulus was at the core of countries recovery in the aftermath of the Great Depression. As stated by Eichengreen (1992), exiting the Gold Standard was the precondition to question fiscal discipline. Following World War I and its subsequent broader political representativeness, financial orthodoxy was challenged by new political forces. For instance, the recovery in Belgium was underpinned by higher domestic spending following the devaluation while exports and international competitiveness only played a minor role.

In a sense, the Gold Standard and the EMU shared the same logic. By restraining fiscal and monetary inflationary measures, these two monetary arrangements aim at ensuring price and income stability. Yet, we have seen that in times of crisis, such monetary constructions impede adjustment mechanisms to take place.

Regarding the Gold Standard, this view is shared by O’Rourke and Taylor (2013). Countries moved out of the Great Depression by exiting the Gold Standard – not by implementing internal devaluation. As they argue, “regaining monetary independence, one way or another, was the route to recovery”.

Regarding the EMU, its architecture remains incomplete and fragile. Compared to other fully-fledged monetary unions – such as the United States – or to “stand-alone” countries (countries which issue debt in a currency over which they exert control – the United Kingdom), the Euro area experienced a longer and more severe crisis. It turns out that its flawed architecture did hamper full recovery. In the same manner, the SGP did not bring stability nor growth to the zone but rather proved to be an impediment to full recovery.

Given the identified similarities and differences between the Gold Standard and the EMU, the final lesson of the Gold Standard period for the current EMU’s configuration goes to O’Rourke and Taylor (2013): “The experience of the 1930s is not only a cautionary tale of the limitations of adjustment strategies based on internal devaluation and fiscal austerity, but an illustration of the power of monetary policy and of the value of macroeconomic policy flexibility.”

b. The US monetary union

On the contrary, the US monetary union is more than a mere arrangement between the 50 States. As mentioned in table 1, the US monetary union is part of a broader project – the United States of America. This fully-fledged monetary union embodies a genuine fiscal union backed by a political union.

The US is closer to the Mundell Optimal Currency Area (OCA) than the EMU. This theory developed by Mundell in the 60's considers three criteria that should be satisfied by a geographical unit in order to implement a common currency.

One of these criteria is labour mobility. Labour mobility is higher in the US monetary union than in the Eurozone (see table 1). The two other criteria – the integration of markets and the symmetry of shocks – are also more likely to be met in the US than in the Euro area. This topic has been extensively discussed and there is a consensus among scholars about this conclusion. For a comprehensive study of the difference between the US monetary union and the EMU in terms of the Mundell OCA criteria, see for example O'Rourke and Taylor (2013).

c. The EMU

As explained in table 1, the US monetary union and the Gold Standard regime share some common features with the EMU.

Yet the EMU is unique (Eichengreen, 2008). In his paper, Eichengreen claims that there is no historical precedent for Europe's monetary union. As a consequence, he stresses the importance of nuance while drawing lessons from history.

The key feature – and problem – of the EMU is the fact that it is a monetary union without a budgetary union. The Eurozone members are all members of the EU, but remain independent states (O'Rourke and Taylor, 2013). Monetary policy is dealt at supranational level with the ECB while budgetary policy remains mainly a national prerogative.

This asymmetry of competencies makes the EMU incomplete and thus fragile (De Grauwe, 2012). In this sense, the EMU – in the absence of a common budgetary union – is characterized by the same fragility as a fixed exchange rate system.

The inherent fragility of the EMU arises from the fact that member state governments issue debt in a “foreign” currency – the Euro, a currency over which none member of the Eurozone has individual control.

In that regard, members of a monetary union face the same problem as emerging countries. Issuing debt in a currency over which a country does not have any control works as an “original sin” that “leads these countries into a bad equilibrium full of pain and misery” (Eichengreen et al., 2002). For a detailed discussion and modeling about the differences between members of a monetary union and “stand-alone” countries, see De Grauwe (2011).

III. Empirical analysis

As mentioned in the introduction, we use data from Eurostat to perform our analysis. We use single dataset and merge them in order to have a unique database. Table 2 displays the data we extract from Eurostat – the ones we call “core”. In our further investigation, we explain how we adjust and retrieve these data following what we want to analyze.

Table 2: Quarterly core data used in our investigation

Indicator	Unit	Source	Periodicity	Range	Adjustment
Nominal Unit Labour Costs (NULC)	2010=100, based on persons	Eurostat	Quarterly	2000Q1 to 2017Q3	Unadjusted data
Unemployment	% of active population	Eurostat	Quarterly	2000Q1 to 2017Q3	Seasonally adjusted data
Current Account	% of GDP	Eurostat	Quarterly	2000Q1 to 2017Q3	Unadjusted data
Population	Thousand persons	Eurostat	Quarterly	2000Q1 to 2017Q3	Unadjusted data
GDP	Market price, million euros	Eurostat	Quarterly	2000Q1 to 2017Q3	Seasonally and calendar adjusted data ²
GDP deflator	Chain linked volume, 2010=100	Eurostat	Quarterly	2000Q1 to 2017Q3	Seasonally and calendar adjusted data ³

Our quarterly database contains 19 cross-sections⁴ represented over 71 quarters (from 2000q1 to 2017q3). We thus obtain $20 \times 71 = 1420$ unique observations. With these 20 cross-sections, we construct four subgroups. The “EMU Core” – Austria, Belgium, Finland, France, Germany and the Netherlands – the “EMU Periphery” – Greece, Ireland, Italy, Portugal and Spain – the “EMU New” represented by countries which joined the EMU after 2002 – Cyprus, Estonia, Latvia, Lithuania, Malta, Slovakia and Slovenia.

Moreover, we also further use annual data to check the consistency of our quarterly results for two reasons. First, there is noise in quarterly data that might alter and bias our analysis. For example, the Greek current account is nearly close to balance during its third quarter while in huge deficit for the three remaining quarters. Second, we want to add some control variables to refine our results. However, these variables are not always available on a quarterly basis (e.g. long-term unemployment). However, using annual data decreases the number of observations available.

² Unadjusted data for Slovakia

³ Unadjusted data for Slovakia

⁴ The 19 EMU current members – Austria (AUT), Belgium (BEL), Cyprus (CYP), Estonia (EST), Finland (FIN), France (FRA), Germany (GER), Greece (GRC), Ireland (IRL), Italy (ITA), Latvia (LVA), Lithuania (LTU), Luxembourg (LUX), Malta (MAL), the Netherlands (NLD), Portugal (PRT), Slovakia (SVK), Slovenia (SVN), Spain (ESP).

Hence, we are torn between getting enough data for our analysis and the quality of these same data. We display in table 3 the variables we use on an annual basis. The first six variables are the same as in Table 2 but expressed annually. The following ones are used as control.

Table 3: Annual core data and control variables

Indicator	Unit	Source	Periodicity	Range
Nominal Unit Labour Costs (NULC)	2010=100, based on persons	Eurostat	Annually	2000 to 2016
Unemployment	% of active population	Eurostat	Annually	2000 to 2016
Current Account	% of GDP	Eurostat	Annually	2000 to 2016
Population	Total	Eurostat	Annually	2000 to 2016
GDP	Market price, million euros	Eurostat	Annually	2000 to 2016
GDP deflator	Chain linked volume, 2010=100	Eurostat	Annually	2000 to 2016
Long-term Unemployment	% of active population	Eurostat	Annually	2000 to 2016
General Government fiscal balance	% of GDP	Eurostat	Annually	2000 to 2016
Exports of Goods and Services	Current price, million euros	Eurostat	Annually	2000 to 2016
Imports of Goods and Services	Current price, million euros	Eurostat	Annually	2000 to 2016

Our annual database contains 19 cross-sections – the same as the quarterly database – represented over 17 years (from 2000 to 2016).

1. Stylised facts

a. Competitiveness in the EMU

The question of how to measure competitiveness is always a sensitive issue. There exists no consensual view about macroeconomic competitiveness. Krugman (1994) even describes the concept of a competitiveness as a “Dangerous Obsession”. A country’s competitiveness encompasses both quantitative and qualitative measures. In this paper, we focus only on the quantitative part - through price and cost competitiveness. This is so because in the absence of exchange rate flexibility, adjustments are made internally through prices and especially through wages (see the labour cost discussion below).

However, one should bear in mind non-price competitiveness while assessing a Eurozone’s countries competitiveness.

Specifically, we focus on Unit Labour Costs (ULC). Unit labour costs are generally viewed as a broad measure of international competitiveness and mainly used among economists.

Unit labour costs are defined as the ratio of labour costs to labour productivity. As mentioned before, the ULC we use are based on persons. Therefore;

$$ULC = \frac{\frac{\text{Compensation of Employees}}{\text{Employees}}}{\frac{\text{Total Output}}{\text{Total Employment}}}$$

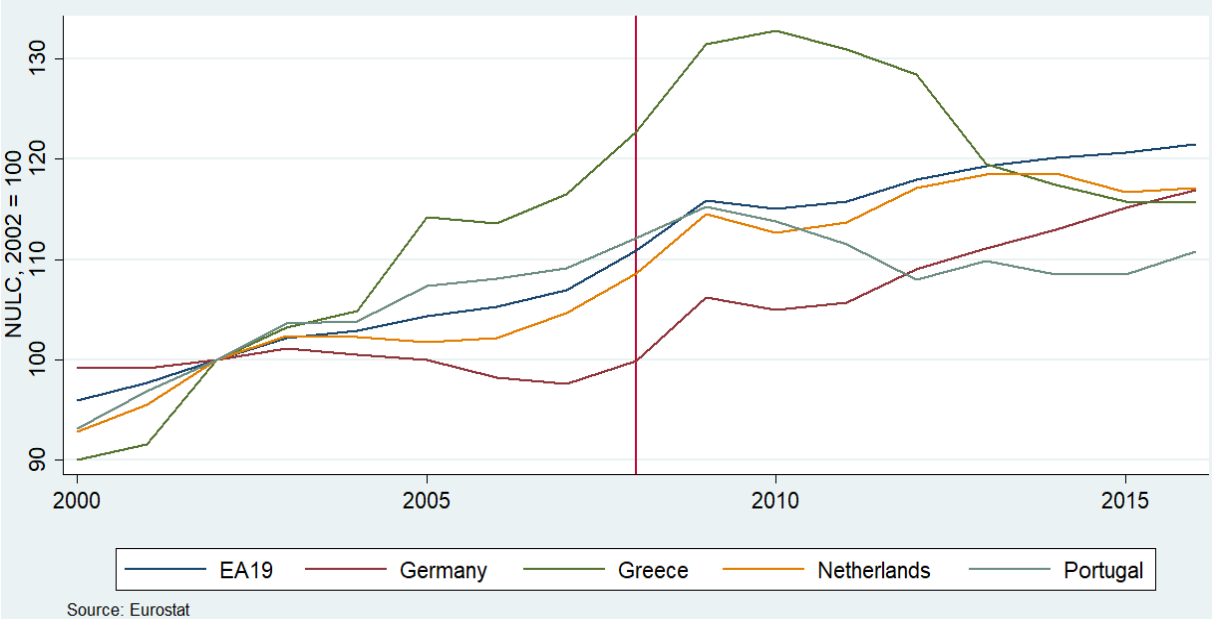
The numerator (Compensation of Employees over Employees) represents labour costs and the denominator (Total Output over Total employment) measures labour productivity.

Following the introduction of the Euro, EMU’s countries diverged drastically regarding their competitiveness. Countries of the periphery (i.e. the so-called GIIPS – Greece, Italy, Ireland, Portugal and Spain) experienced large losses of competitiveness during the boom years (Gros, 2016). Sinn (2013) argues that this divergence was consubstantial to the Euro (that this ‘lack of competitiveness was brought about by the Euro itself’).

In the meantime, the competitiveness of core countries (i.e. Germany, the Netherlands, Belgium, Finland and Austria) remained stable or even increased. Wages in Germany were restrained while demand-driven growth in the South led to a deterioration of competitiveness. Figure 3 expresses this situation by displaying the evolution of the nominal ULC (2002 = 100). We display yearly data of nominal ULC due to noise in quarterly data. We have chosen to represent EMU’s core by Germany and the Netherlands, the periphery by Greece and Portugal and to compare them to the Euro area as a whole. We do so because these four countries best illustrate the so-called ‘core-periphery’ dualism (more on this issue in the current account part, section b).

This divergence led to imbalances within the Eurozone (De Grauwe, 2012). Section b reviews the subsequent increasing current account imbalances during the pre-GFC period.

Figure 3: Unit Labour Costs based on persons in the Eurozone (2000 to 2016), annual data, selected countries, 2002 = 100



This chart shows the country-specific evolution of ULC. Even though we have 2010 as a base year from Eurostat, we compute the year 2002 – the introduction of Euro – as a base year. The most interesting is the national evolution compared to other countries – especially when comparing core to periphery countries.

Indeed, prior to the GFC (i.e. before the vertical red line), the periphery – represented here by Greece and Portugal – experienced relatively important losses in competitiveness as the Unit Labour Costs' evolution suggests. The Portuguese nominal ULC evolved pretty much in line with the EMU average (EA19) – although slightly higher. In contrast, the Greek one surged from 100 (2002) to 122,7 (2008).

Compared to core countries, Greek competitiveness positions drastically deteriorated during the pre-crisis year. On the contrary, the increase of core countries ULC was smaller than the Eurozone's average. As for Portugal, the evolution for the Netherlands was in line with the EMU average – although slightly smaller. However, German ULC decreased between 2002 and 2008. To conclude, the relative competitiveness positions of core countries compared to the GIIPS significantly improved.

The example of Germany is interesting. German ULC slightly decreased during the pre-crisis period. This wage restraint – sometimes referred as the “Wage moderation” – in Germany has been highlighted by many scholars such as Gros (2016). In his point of view, high unemployment during the early 2000's better explains the stability of German nominal ULC – and thus its competitiveness gains over EMU's partners. He suggests that changes in competitiveness are the result of macroeconomic variables rather than stemming from political choices.

In the aftermath of the GFC (i.e. after the vertical red line), ULC of EMU's countries were on the rise. The recession and its subsequent sharp fall of total output seem to have prevailed over other variations of ULC's determinants.

However, the divergence with regard to ULC needed to be tackled. In that time, Sinn (2013) claimed the periphery did not need debt-financed stimulus programmes.

In his point of view, these programmes ‘are a painkiller that dampens the symptoms but does nothing to cure the underlying illness’. He instead advocated internal devaluation and fiscal austerity for southern countries in order to improve their competitiveness. If we considered ULC as a proxy for internal devaluation, this seems to have been achieved. Following the implementation of internal devaluation in the periphery, ULC started to decrease for Greece and Portugal while the ones in core countries rose constantly. As stated by Myant and al. (2016), internal devaluation has been asymmetrically implemented in the Euro area. Nowadays, ULC of the four selected countries are below the EMU average.

b. Current account in the EMU

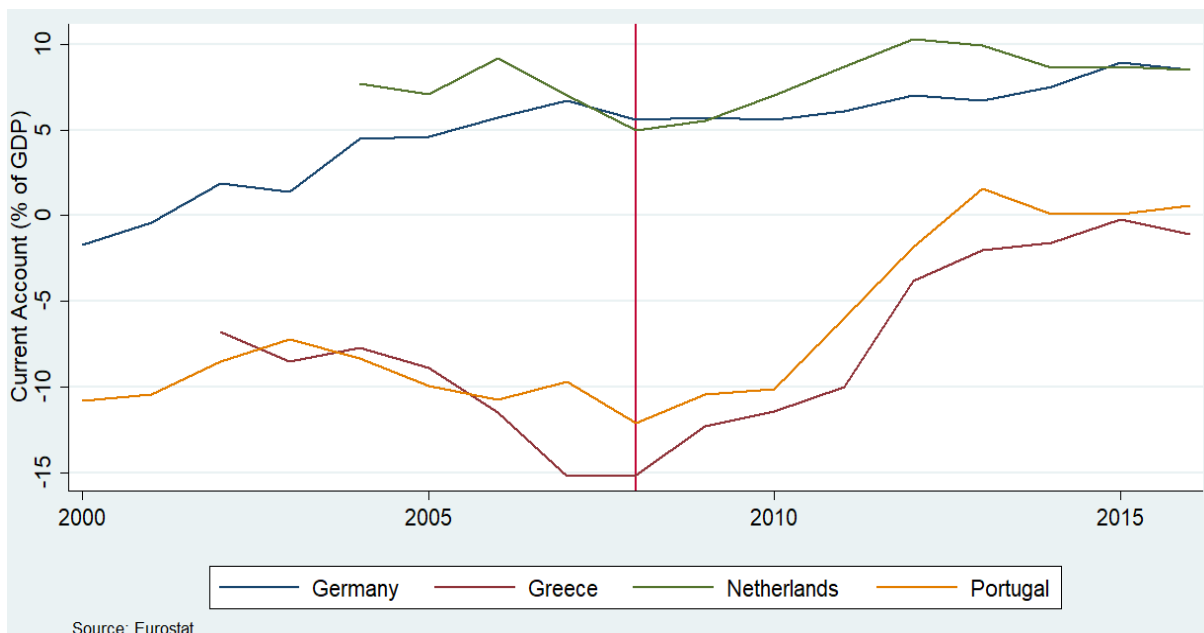
The current account of the EMU as a whole is close to balance. However, following the above-mentioned competitiveness divergence, some countries ran ever-growing current account deficits while some others accumulated large surpluses. Lane (2010) argues that imbalances within the Euro area have become wider and more persistent following the Euro's introduction in 2002. Besides this great divergence in terms of relative competitiveness position, another mechanism could have explained the growing imbalances experienced within the EMU prior to the GFC.

Indeed, as suggested by neoclassical economic theories, lower income countries should run current account deficit since they offer higher rates of return on investment.

Symmetrically, higher income countries should accumulate current account surpluses. Lower income countries should thus catch up with higher income countries in terms of per capita GDP. Initial positions in terms of per capita GDP should explain the development of current accounts. Prior to the Global Financial Crisis, these current account imbalances were considered as a normal catching-up process. Hence, Blanchard and Giavazzi (2002) were optimistic regarding growing current account imbalances within the Eurozone when the euro was introduced. They considered these imbalances to be good.

These imbalances are displayed before and after the GFC (represented by the vertical red line) in Figure 4. As for NULC, we display yearly data of current account due to noise in quarterly data.

Figure 4: Current Account in the Eurozone as % of GDP (2000 to 2016), annual data, selected countries

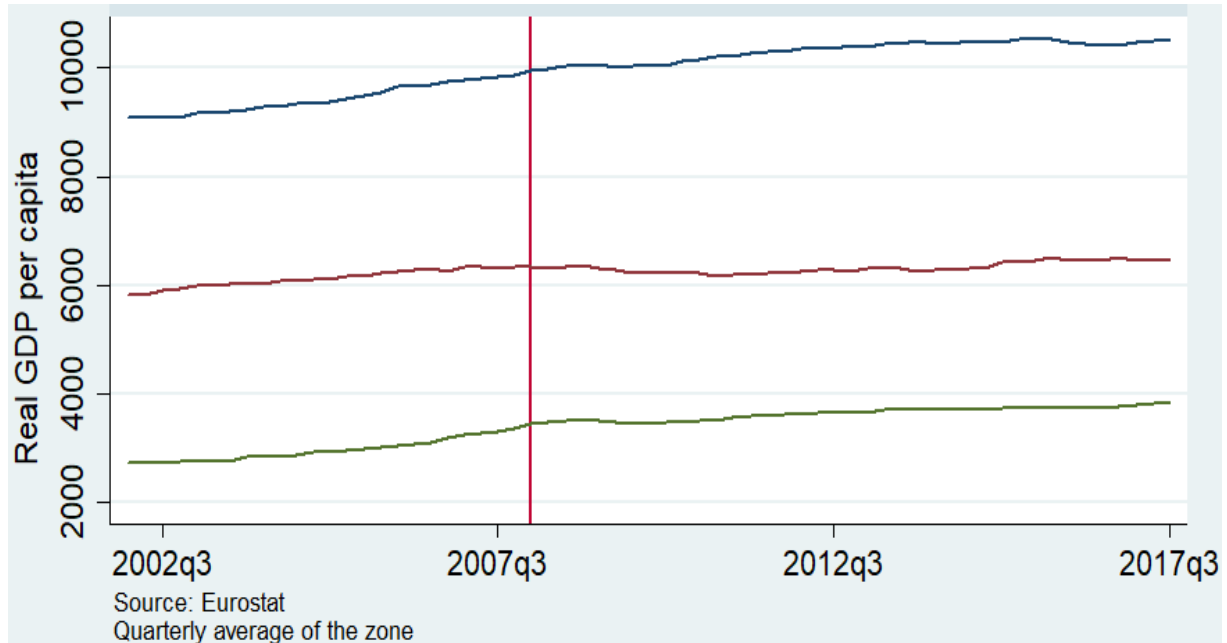


As one can see, EMU countries current account positions diverged significantly from the introduction of the Euro onwards. Some countries began to accumulate ever-growing deficits. Indeed, the Greek current account deficit ranged from 6,8% of GDP in 2002 to 15,1% in 2007. In Portugal, the situation was similar: -8,5% of GDP in 2002 to -9,7% in 2007.

Similarly, core countries registered large and persistent surpluses. The core countries surpluses were as large as the periphery deficits. Indeed, the surplus of Germany reached 6,7% of GDP at the outbreak of the crisis (2007). The one of the Netherlands raised to 7% at the same period. This divergence in terms of current account is often referred to the “Eurozone current account ‘core-periphery’ dualism” (Cesaroni and De Santis, 2015).

Nevertheless, the neoclassical theory also stipulates these imbalances should be paired with strong economic growth in deficit countries able to rebalance in the long run the initial divergences regarding current account. Figure 5 shows the growth patterns for the three above-mentioned subgroups of countries.

Figure 5: Catching-up process by EMU's subgroups, 2002q1-2017q3



The three lines of Figure 5 represent the quarterly average of real GDP per capita for each of the three EMU's subgroups. The blue one is the one for the "EMU Core", the red for the "EMU Periphery" and the green one for the "EMU New". The three lines show a rising trend – even if it is less obvious for the periphery. In the aftermath of the GFC (as represented by the red vertical line), the three groups experienced a slight decrease in their respective real GDP per capita. Real GDP per capita of GIIPS countries will only return to its pre-crisis level in late 2014. This was much quicker than for the two other groups.

Although real GDP per capita is in constant evolution during the period, we do not see any sign of catching-up on the graph – GIIPS and new countries do not graphically seem to converge towards core countries living standards.

As one can see, the above-mentioned imbalances were not matched with stronger growth in deficit countries. These imbalances turned out to be bad. Eichengreen (2010) shows that these imbalances were driven by 'domestic distortions' such as bubble-driven asset booms or excessive budget deficits. The outbreak of the Global Financial Crisis highlighted the need for a rebalancing of the Eurozone in terms of current account. This has been partially achieved as Figure 3 suggests.

Following the outbreak of the GFC, the peripheral countries current account deficits started to narrow in late 2010. For example, the current account of Greece and Portugal still represented around -10% of GDP by the end of 2010 and finally were (close to) balance in 2013 (1,6% for Portugal and -2% for Greece). On the contrary, this readjustment from the periphery was not matched by a decrease in current account surpluses from the core of the EMU.

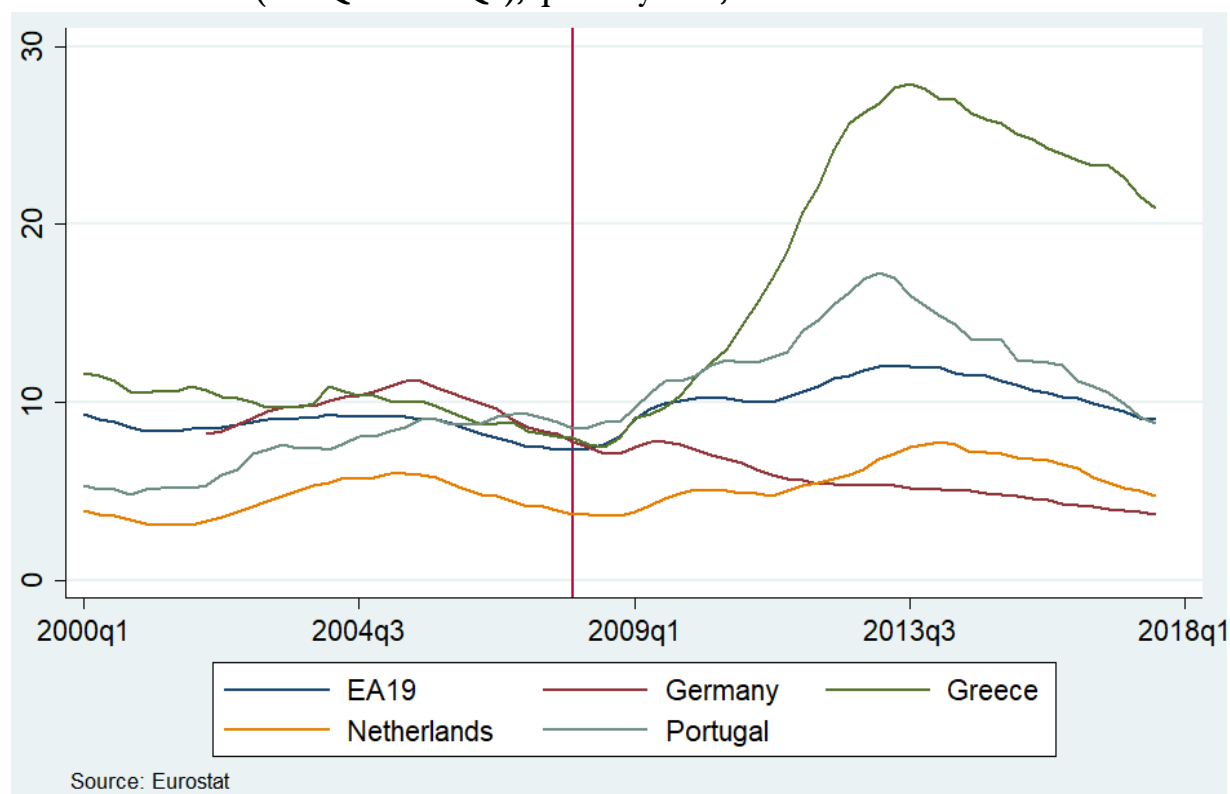
Germany and the Netherlands even accumulated higher surpluses after the GFC. As a result, the current account of the Eurozone (EA19) as a whole started to increase in 2011 to reach 4% of GDP by 2016 (2016Q1).

As for NULC, there seemed to have an asymmetry in the adjustment processes in terms of current account.

c. Unemployment in the EMU

How do these imbalances and their subsequent rebalancing affect employment in the Eurozone? This section aims at quickly showing the pre-crisis situation but above all to showing the costs of such rebalancing in the aftermath of the GFC. Figure 6 displays the unemployment rate as a percentage of active population in the Euro area for some countries from 2000q1 to 2017q3. Unlike NULC and current account, we display quarterly data because unemployment does not behave erratically.

Figure 6: Unemployment rate in the Eurozone as % of active population (2000Q1 to 2017Q3), quarterly data, selected countries



Prior to the GFC (represented by the red vertical line), unemployment in the EMU's countries evolved in line with each other. Except for Portugal, Eurozone's unemployment started to decline in 2005. The overall unemployment reached 7,3% of labour force in the first quarter of 2008⁵.

This pattern was sharply different after the GFC. Eurozone members started to diverge in terms of unemployment. Unemployment in GIIPS countries rose dramatically. Youth employment was even worse. In Greece, unemployment rose continuously in the direct aftermath of the GFC and surged to 27,9% by late 2013 (2013Q3). The situation was similar in Portugal where the unemployment rate reached 17,3% in 2013 (2013Q1).

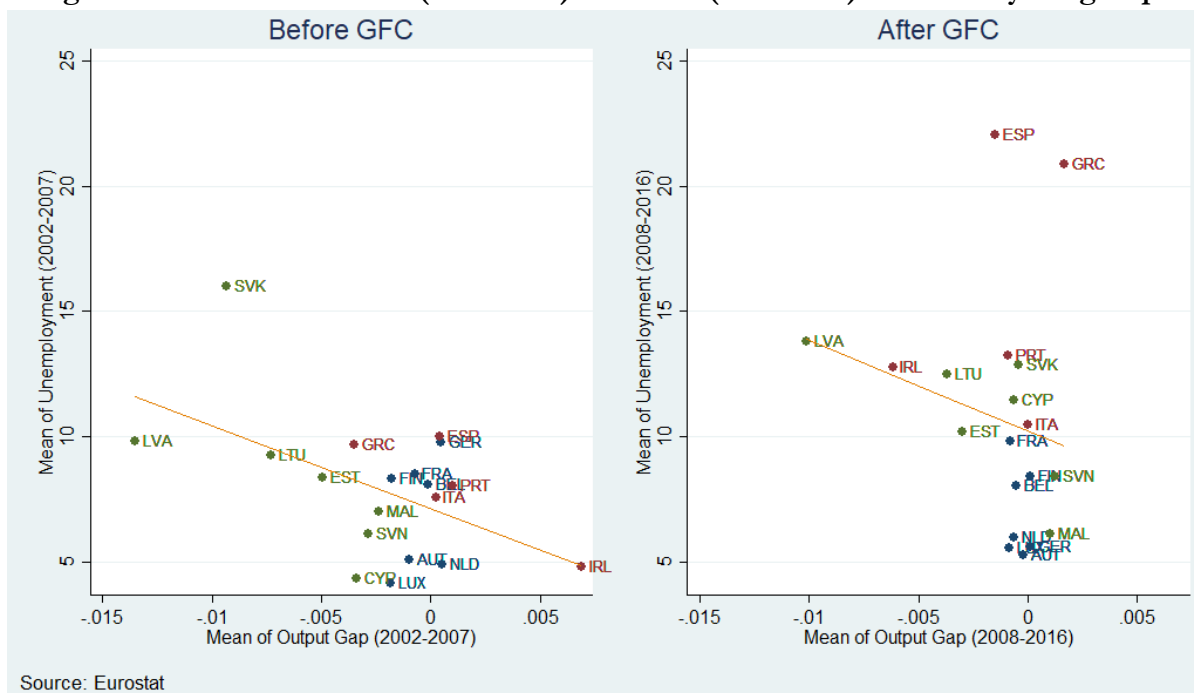
⁵ It is worth noting in Figure 6 that unemployment in Germany was the highest of the selected countries during the 2005-2006 period. It reached its peak in the second quarter of 2005 (11,2%). At that time, Germany was considered the poor cousin of Europe. Seven years later, the German unemployment rate was the lowest (5,4% in 2012Q2) of the zone.

On the contrary, unemployment in Germany slightly increased in the following months of the GFC (from 7,1% in 2008Q3 to 7,8% in 2009Q3) but has been decreasing since then. By late 2016, unemployment reached 4% of active population.

The effects of the GFC on the Netherlands were more lasting than in Germany. Unemployment rate reached 7,8% in 2014 first quarter when it started to decrease – in line with the overall unemployment of the Eurozone.

Furthermore, we want to have a quick overview of the relationship between the output gap and unemployment – namely the Okun’s law. More specifically, we want to graphically test how this relationship evolve over time and over countries. We want to see whether there is any difference before and after the GFC and whether we can see similar patterns over subgroups of countries. Figure 7 displays such relationship and its spatiotemporal heterogeneity with annual data. The left graph exposes the pre-crisis situation (2002-2008) while the one to the right the situation after the GFC (2008-2016). Blue dots represent core countries, red ones the periphery and green dots the newcomers – as defined above.

Figure 7: Okun’s law before (2002-2008) and after (2009-2016) the GFC by subgroups



The fitted value – as represented by orange straight lines – shows a negative relationship between the output gap and unemployment – the Okun’s law. The slope of the Okun’s law seems to slightly vary after the crisis – where it is flatter than the pre-crisis pattern.

As mentioned before, we observe the dramatic changes in unemployment in the aftermath of the GFC – with Greece (GRC) and Spain (ESP) as outliers.

Besides, we also find a spatial divergence on the right-hand graph. Aside from Slovakia (SVK) the pre-crisis situation seems to show a relative homogeneity among the above-mentioned subgroups – namely a positive output gap correlated with relatively low unemployment.

On the contrary, the right-hand graph displays two distinct clusters. First, the core countries' situation does not seem to vary before and after the crisis. They are in both cases represented in the lower right corner – a slightly positive output gap correlated with rather low unemployment. Second, the EMU periphery switched from the lower right corner to the upper left one – the one characterized by a negative output gap and high unemployment. The third group – countries which later joined the EMU – displays various situation. After the GFC, Malta (MAL) and Slovenia (SVN) are in the core group while the Baltic states – Estonia, Latvia, Lithuania – are closer to the periphery's position.

d. Unit root tests

Besides all the various tests carried out in the previous section, we must test the stationarity of our data – otherwise we might end up with spurious regression outcomes. To do so, we conduct appropriate unit root tests for panel data. Table 4 displays the results we obtain for the six variables (column 1) using quarterly data. Table 5 summarizes our results. CA and U are the dependent variables are the same as in Table 2. The four other ones are the independent variables we retrieve from Table 2. We detail our data retrieving in the following section.

Table 4: Panel unit root tests, quarterly data

Panel Unit Root Test					
Variables	Tests	LVL	LVLDM	DIFF	DIFFDM
Current Account	Hadri	18.538	17.781		
	Hadri_p	0.000	0.000		
	Fisher	99.008	49.116	1046.342	987.852
	Fisher_p	0.000	0.071	0.000	0.000
	PCADF ⁶	-3.970		-19.217	
	PCADF_p ⁷	0.000		0.000	
Log of GDP_{pc}	Hadri	126.530	110.727		
	Hadri_p	0.000	0.000		
	Fisher	76.590	31.447	312.177	349.210
	Fisher_p	0.000	0.765	0.000	0.000
	PCADF	1.474		-14.551	
	PCADF_p	0.930		0.000	
Log of Relative GDP	Hadri	131.994	115.782		
	Hadri_p	0.000	0.000		
	Fisher	86.401	24.503	287.560	309.608
	Fisher_p	0.000	0.956	0.000	0.000
	PCADF	2.331		-13.811	
	PCADF_p	0.990		0.000	
Log of Relative ULC	Hadri	116.433	54.811		
	Hadri_p	0.000	0.000		
	Fisher	175.572	159.664	1329.800	1316.714
	Fisher_p	0.000	0.000	0.000	0.000
	PCADF	-3.180		-20.116	
	PCADF_p	0.001		0.000	
Unemployment	Hadri	115.225	81.531		
	Hadri_p	0.000	0.000		
	Fisher	52.561	37.660	136.322	114.582
	Fisher_p	0.058	0.485	0.000	0.000
	PCADF	2.437		-5.941	
	PCADF_p	0.993		0.000	
Output Gap	Hadri	1.471	14.290		
	Hadri_p	0.071	0.000		
	Fisher	139.583	126.969	559.497	524.675
	Fisher_p	0.000	0.000	0.000	0.000
	PCADF	-5.964		-18.515	
	PCADF_p	0.000		0.000	

In Table 4, the statistics of various tests and their corresponding p-value(_p) are displayed. We compute three different tests (column 2) that all allow for heterogeneity – which is at the core of our analysis. We first conduct these tests with unemployment in level (LVL, column 3) and then demean it (LVLDM, column 4). We do the same using the first difference of unemployment (DIFF, column 5 and DIFFDM, column 6).

⁶ Pesaran CADF

⁷ _p represents the p-value of the tests.

The first test (HADRI)'s null hypothesis is stationarity while the alternative one is that some panels present unit root. The two others test the null of non-stationarity and have various alternative hypothesis ("at least one panel is stationary" for Fisher and "some panels are stationary" for PCADF).

Table 5: Summary of panel unit root tests

Variables	<i>Level</i>	<i>1st difference</i>	<i>Integrated of order</i>
Current Account	Stationary	Stationary	0
Log of RYpc	Non-Stationary	Stationary	1
Relative GDP growth	Non-Stationary	Stationary	1
Relative ULC growth	Stationary	Stationary	0
Unemployment	Non-Stationary	Stationary	1
Output Gap	Stationary	Stationary	0

2. The model

In this paper, we focus on the impacts and costs of internal devaluation on both current account rebalancing and unemployment rate. Following the data description part, we build a quantitative model with panel data. First, we review the existing macroeconomic literature regarding the determinants of current accounts. We incorporate the ULC as a driver of current account imbalances. Second, we investigate the key drivers of unemployment and link it to ULC.

a. Internal devaluation and current account

The current account of a country consists of its trade balance (net trade in goods and services, i.e. exports minus imports), its net current transfers and net incomes from abroad. A current account surplus over a given period means a country is a net lender to the rest of the world over the period while a current account deficit means a country is a net borrower to the rest of the world.

What drives current account in the Eurozone? There is no 'one-size-fits-all' answer to this question. The key drivers of current accounts in the EMU have been extensively investigated for many years. Various – quantitative and qualitative – drivers exist.

Chinn and Prasad (2003) investigated the medium-term determinants of current account in industrial and developing countries. They found a positive relationship between current account and government budget balances and initial stocks of foreign assets.

Barnes et al. (2000) presented an extensive review of literature regarding current account imbalances in the Euro Area. They cite previous empirical investigations using panel-econometric techniques. The study reaffirms the key role of fundamental determinants of current account positions such as GDP per capita, initials net foreign assets or demographic variables.

Moreover, they also stress the contribution of trade openness and structural rigidities as drivers for current account positions.

Berger and Nitsch (2010) observed that imbalances within the EMU have significantly increased since the introduction of the Euro. These imbalances tend to have become more persistent due to the common currency. This is in line with the prediction that the absence of a flexible exchange rate tends to exacerbate imbalances. They also find a negative impact of growth differential on bilateral trade balance.

Additionally, we have found relevant to introduce two recent studies for our analysis on the Eurozone.

First, Belke and Dreger (2013) claimed that the above-mentioned catching-up theory is not sufficient to explain the sharp divergence in the Euro area in terms of current account imbalances. As an additional explanation, they argued ‘relative government debt and competitiveness are more relevant to capture the evolution, in particular in deficit countries’. Specifically, they observed a negative effect of real exchange rate (RER) on current account balance and argued that countries ran external deficits because of their lack of competitiveness. Therefore, they suggested a reduction in Unit Labour Costs in deficit countries to reduce imbalances. They advocated for internal devaluations for deficit countries – as ‘a deterioration of competitiveness is not feasible for surplus countries’. In this paper, we only focus on Unit Labour Costs (ULC) changes while Belke and Dreger dwell on changes in ULC and relative prices through the RER.

Second, Cesaroni and De Santis (2015) divided the explanatory variables of current accounts into four categories: macroeconomic fundamentals (e.g. real and effective exchange rate, fiscal balance ratio to GDP), time and country dummies (e.g. core-periphery groups), capital openness (e.g. financial openness index) and governance indicators (e.g. Government effectiveness).

More specifically, they investigated the effects of financial integration in determining current account positions. They found a negative impact of the former on the latter. This impact was even more important after the introduction of the Euro. Following this introduction, financial integration reduced the home-bias and fed the ‘core-periphery dualism’ in the EMU.

As a first approach, we regress current account on real GDP per capita, log of real GDP and the relative measure of Nominal Unit Labour Costs without taking into account dynamics. The results can be found in Appendix. We conclude that this first specification suffers from serial correlation, cross-sectional dependence and heterogeneity of the parameters. Moreover, fixed effects are preferred over pooled OLS and random effects.

We refine our model accounting for the issues we have identified above. The equation (1) we estimate works as follows;

$$CA_{i,t} = a_{i,t} + \sum_{j=1}^k b_{i,j} \cdot CA_{i,t-j} + c_{i,j} \log(RYpc_{i,t-4}) + \sum_{j=0}^k d_{i,j} \cdot \Delta \log(RULC_{i,t-j}) + \sum_{j=0}^k e_{i,j} \cdot \Delta \log(RGDP_{i,t-j}) + v_{i,t} \quad (1)$$

$$\text{where } v_{i,t} = a_i + \theta_t + u_{i,t}$$

with a_i the unobserved fixed effect, θ_t the unobserved time effect and $u_{i,t}$ the idiosyncratic error.

CA stands for current account and is expressed in level. We add lags of current account to capture short-run adjustments.

RYpc represents real GDP per capita as Nominal GDP is deflated by the GDP deflator (2010 = 100) and divided by population. Real GDP per capita is expressed in level. We regress this variable for the previous year at the same quarter (t-4). Indeed, as in Chinn and Prasad (2003) for net foreign assets, we want to test the initial position of per capita income. Following the discussion on good and bad imbalances, the initial level of per capita income should be, in principle, negatively correlated with current account. A country whose initial per capita income is low will catch up with richer countries by accumulating current account deficits. Hence, we expect $c_{i,j}$ to be negative as a result of the so-called good imbalances – an increase in GDP per capita leading to decrease in current account balance.

RGDP stands for Relative real GDP and RULC, Relative Unit Labour Costs. From these two variables, we construct the same relative measure as follows:

We compute the country-specific Relative Unit Labour Costs (RULC) as $\frac{NULCi,t}{NULCEMU,t}$. It measures the Nominal Unit Labour Costs of country i at time t compared to the average of the EMU at the same time t . This is why we call it Relative Unit Labour Costs. Taking the first difference of the log of this expression gives us the difference between the country-specific NULC growth rate (i.e. $\Delta \log NULCi,t$) and the EMU average NULC growth rate (i.e. $\Delta \log NULCEMU,t$) such as:

$$\Delta \log ULCi,t - \Delta \log ULCEMU,t = \Delta \log \left(\frac{NULCi,t}{NULCEMU,t} \right) = \text{RULC growth}$$

Following the discussion above (Belke and Dreger, 2013), we expect a higher NULC growth rate for the country i compared to the NULC growth rate of the EMU (i.e. $\text{RULC} > 0$) to have a negative impact on the current account balance. Hence, we expect $d_{i,j}$ to be negative.

The same logic applies for Relative real GDP. We compute the log Relative real GDP in the same way as for the RULC – by dividing country-specific real GDP by Eurozone's GDP at the same period t .

As for the RULC, we thus obtain a relative measure of the country-specific real GDP compared to the Eurozone real GDP. Taking the first difference of the relative log real GDP yields the difference between the country-specific real GDP growth rate and the EMU average real GDP growth rate. In a sense, we follow the Berger and Nistch (2010) approach with regard to GDP growth. They compute growth differential and observe it has a negative impact trade balance. Following this result, we expect $e_{i,j}$ to be negative since a domestic higher growth rate compared to the one of the EMU gives rise to a decrease in current account.

Unlike per capita income, we express the relative variables in growth rate.

Furthermore, we take into account serial correlation (lagged dependent and independent variables), heterogeneity of the parameters (allowing for country-specific parameters) and country fixed effects. Cross-sectional dependence is further dealt with appropriate econometric techniques. In a nutshell, the current account depends on per capita income, GDP growth rate and changes in relative ULC.

b. Internal devaluation and unemployment

While assessing the effects of internal devaluation on unemployment, one cannot ignore the effects of other explanatory variables. Specifically, we build a model taking into account the impacts of changes in total output on unemployment.

The negative statistical correlation between business cycle and unemployment has been defined as an empirical finding – the Okun's law. However, there is no 'one-size-fits-all' coefficient to describe this inverse relationship.

As the above-mentioned Figure 5 suggests, adjustments in terms of unemployment in the EMU are asymmetric. In other words, the Okun's law is characterized by temporal and spatial heterogeneity. This is even more the case within the Eurozone (Stockhammer and Sotiropoulos, 2013 – citing several empirical studies).

Moreover, what is the impact of internal devaluation on unemployment? As mentioned before, internal devaluation is proxied by Unit Labour Costs. Changes in ULC are supposed to have opposite effects in a temporal perspective.

In the short run, internal devaluation imposes deflationary pressure on domestic economies by reducing wages. As stated by Myant and al. (2016) 'the effects of lower wages in an economy that has already suffered a recession are much more direct, as they are associated with lower incomes and consumption.' Lower incomes and consumption reduce aggregate demand.

The impacts of a recession are aggravated by these additional deflationary measures. Through this mechanism, there is a theoretical causal relationship between ULC and unemployment. Diminishing relative ULC first lead to a rise in unemployment.

In the long run, internal devaluation is meant to restore competitiveness and help countries recover. In a longer perspective, diminishing relative ULC are supposed to decrease unemployment. As stated by Myant and al. (2016), 'internal devaluation is a painful process insofar as it typically requires that unemployment rises in order to put pressure on wage demands in the private sector'.

Furthermore, as stated before, Gros (2016) argues that – in contrast of one could think – competitiveness is driven by macroeconomic variables rather than political choices. Here we take this approach but we would like to test whether changes in relative ULC (e.g. following internal devaluations) can have an impact on unemployment. In other words, we estimate a classical Okun's law – as displayed in the previous graphs – to which we add competitiveness.

As a first approach, we regress unemployment on output gap and the Relative Unit Labour Costs without taking into account dynamics. The results can be found in Appendix. As for the current account equation, we conclude that this first specification suffers from serial correlation, cross-sectional dependence and heterogeneity of the parameters. Moreover, fixed effects are preferred over pooled OLS and random effects.

Subsequently, the equation (2) we estimate works as follows:

$$\Delta U_{i,t} = a_{i,t} + \sum_{j=1}^k b_{i,j} \cdot U_{i,t;j} + \sum_{j=0}^k c_{i,j} \cdot \text{Output Gap}_{i,t;j} + \sum_{j=0}^k d_{i,j} \cdot \Delta \log(\text{RULC}_{i,t;j}) + v_{i,t} \quad (2)$$

$$\text{where } v_{i,t} = a_i + \theta_t + u_{i,t}$$

Where ΔU represents changes in unemployment – recall that unemployment is $I(1)$. The output gap is a rate of potential GDP. We compute the quarterly output gap by using the Hodrik-Prescott filter to separate the cyclical and structural part from real GDP. We expect $c_{i,j}$ to be negative – as a positive output gap leads to a decrease in unemployment.

As for the current account part, $\left(\frac{\text{NULC}_{i,t}}{\text{NULCEMU,t}}\right)$ represents the Relative Unit Labour Costs (RULC).

We take the log first difference as to obtain the relative ULC growth. We expect $d_{i,j}$ to be positive since a higher country-specific NULC compared to the EMU means a loss of competitiveness which positively impacts unemployment.

Finally, $v_{i,t}$ is the composite error term – as for the current account equation.

Changes in unemployment is thus a function of output gap and of RULC. This equation consists in a Okun's law for which we control for changes in relative competitiveness. Furthermore, this model accounts for serial correlation (lagged dependent and independent variables), heterogeneity of the parameters (allowing for country-specific parameters) and country fixed effects. Cross-sectional dependence is further dealt with appropriate econometric techniques.

3. Results

a. Quarterly data

Current account and Relative ULC

Having established that cross-section dependence and heterogeneity of the parameters were indeed an issue, we estimate the current account equation (1) for the entire Euro area with different econometric techniques. Using Hausman tests, we are able to discriminate between efficient and consistent estimators. Our results are displayed in Table 6.

Table 6: Heterogeneous panel estimates with quarterly time dummies, 2002q1-2017q3, (dependent variable – CA divided by 100)

	DFE	MG	DCCE
CA _{t-1}	0.354*** (0.114)	0.306*** (0.079)	0.155* (0.077)
Log of RYpc _{t-4}	0.0953 (0.077)	-0.176* (0.070)	-0.00496 (0.221)
RGDP growth	-0.0810 (0.322)	-0.452* (0.177)	-0.151 (0.241)
RGDP growth _{t-1}	-0.293 (0.420)	-0.373* (0.187)	-0.183 (0.237)
RGDP growth _{t-2}	-0.476 (0.370)	-0.327* (0.160)	-0.228 (0.181)
RULC growth	-0.124 (0.063)	-0.0988 (0.057)	-0.0397 (0.600)
RULC growth _{t-1}	-0.132 (0.090)	-0.0622 (0.097)	0.00968 (0.100)
RULC growth _{t-2}	-0.0528 (0.081)	-0.0233 (0.092)	0.0228 (0.094)
N	1082	1082	1044
Countries	19	19	19
rmse	0.0414	0.0316	0.0267
R ²	0.449	0.725	0.498
Hausman MG	45.90 (0.000)		
CSD	-2.758 (0.006)	-1.661 (0.100)	-2.095 (0.036)

Standard errors between parentheses, p-values for Hausman and CSD tests between parentheses.
DFE for Dynamic Fixed Effect; MG for Mean Group; DCCE for Dynamic Common-Correlated Effect
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

First, we estimate again the equations using Dynamic Fixed Effects (DFE, column 1). DFE is the Dynamic homogeneous Fixed Effect estimator and does not allow for heterogeneity in the parameters. On the contrary, Mean Group (MG, column 2) estimators allow for full heterogeneity of the parameters by taking the unweighted means of the underlying cross-section estimates.

We compute a Hausman test in order to discriminate between these estimators. In line with the results we obtain using the Swamy coefficients (see Appendix), we reject at 1% the null hypothesis of parameters' homogeneity. We prefer Mean Group (MG) estimators over Dynamic Fixed Effects.

Second, we estimate our equation using Dynamic Common-Correlated Effects (DCCE, column 2). This technique adds time-varying cross-section means of the variables in an attempt to reduce cross-sectional dependence – but to no avail. Cross-sectional dependence remains an issue. In fact, MG estimators cope better with this issue. Therefore, we will further use MG estimators for the current account equation.

The results from Table 6 suggest dynamic adjustments matter since the lagged of CA is significant in every estimator. For the MG estimator, the level of log real GDP per capita has a negative impact on current account four quarters later. A one percentage point log real GDP per capita increase leads to a 0.2 percentage point decrease in current account the following year for the entire panel. Hence, our results suggest that an increase in per capita income reduces the current account. This contradicts the above-mentioned prediction of “good imbalances” – a lower level of per capita income correlated with higher current account deficits.

Moreover, the sign of contemporaneous impact of relative GDP growth on current account for the MG specification (column 2, line 3) is in line with our theoretical predictions. The coefficient implies that a one percentage point increase in log relative GDP leads to a -0.5 percentage points decrease in current account. Interestingly, we also see that lagged relative GDP have a significant negative impact on current account – yet in a smaller magnitude than its contemporaneous effect. Nevertheless, nothing can be concluded from the impact of relative ULC growth on current account from table 1.

Using Mean Group estimators, we further estimate the CA/RULC relationship highlighting spatial (the ‘Core-Periphery’ dualism) and temporal (before and after the GFC) heterogeneity in the Eurozone. Table 7 displays our results.

Table 7: Spatial and temporal heterogeneity in the Euro area, 2002q1-2017q3, Mean Group estimators with quarterly time dummies (dependent variable – CA divided by 100)

	Before the GFC (2002q1 to 2007q4)		After the GFC (2008q1 to 2017q3)	
	Core	GIIPS	Core	GIIPS
CA _{t-1}	-0.0853 (0.215)	0.300 (0.224)	-0.0504 (0.159)	0.147 (0.155)
Log of RYpc _{t-4}	0.421* (0.193)	-0.00924 (0.373)	-0.145 (0.126)	-0.799* (0.359)
RGDP growth	-0.548 (0.735)	-0.851 (0.477)	-0.599 (0.581)	-0.0831 (0.769)
RGDP growth _{t-1}	-0.229 (0.670)	-0.285 (0.748)	0.326 (0.877)	0.671 (0.543)
RGDP growth _{t-2}	0.772 (0.537)	0.668 (0.512)	-0.168 (0.522)	-0.0635 (0.334)
RULC growth	0.256 (0.241)	-0.308 (0.213)	-0.0121 (0.087)	-0.274* (0.128)
RULC growth _{t-1}	0.203 (0.142)	-0.274 (0.195)	0.0925 (0.142)	-0.311 (0.167)
RULC growth _{t-2}	0.300 (0.261)	-0.190 (0.161)	0.170 (0.246)	-0.0632 (0.094)
N	137	100	245	175
Countries	7	5	7	5
rmse	0.0198	0.0138	0.0334	0.0211
R ²	0.813	0.919	0.464	0.910
CSD	-1.840 (0.0657)	-3.161 (0.0016)	1.359 (0.1740)	-3.671 (0.0002)

Standard errors between parentheses, p-values for CSD tests between parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The results we obtain from Table 7 are mostly not significant. Yet one can conclude that before the GFC, a rise in the level of per capita income induced an increase in current account for core countries. Interestingly, the opposite occurs for GIIPS countries after the GFC with a negative relationship between these two variables.

For GIIPS countries, relative ULC growth had an impact after the GFC on current account. A one percentage point decrease in RULC growth led to a 0.3 increase in current account. Our results suggest that current account rebalancing has been achieved through competitiveness gains in GIIPS countries – but not in core countries.

Besides, cross-sectional dependence is more an issue for GIIPS than for core countries. We do not reject the null of cross-sectional independence for core countries.

Unemployment and Relative ULC

As for the current account equation, we first estimate the unemployment equation (2) with the same econometric techniques. Using Hausman tests, we discriminate between efficient and consistent estimators. Our results are displayed in Table 8.

Table 8: Heterogeneous panel estimates with quarterly time dummies, 2002q1-2017q3, (dependent variable – ΔU divided by 100)

	DFE	MG	DCCE
U_{t-1}	-0.0101 (0.014)	-0.00378 (0.019)	-0.122*** (0.034)
Output Gap	-0.0183 (0.020)	-0.0171 (0.030)	-0.0505 (0.037)
Output Gap _{t-1}	-0.00126 (0.018)	0.00149 (0.028)	-0.0233 (0.021)
Output Gap _{t-2}	0.116* (0.051)	0.0940* (0.041)	0.00795 (0.027)
RULC growth	-0.00344 (0.002)	-0.00579 (0.004)	-0.000981 (0.003)
RULC growth _{t-1}	-0.00411 (0.002)	-0.0100 (0.005)	-0.00845* (0.004)
RULC growth _{t-2}	-0.00168 (0.002)	-0.00502 (0.005)	-0.00400 (0.004)
constant	-0.00176*** (0.000)	-0.00249 (0.001)	0.0174*** (0.003)
N	1140	1140	1102
Countries	19	19	19
rmse	0.00465	0.00447	0.00394
R ²	0.381	0.497	0.210
Hausman MG	37.70 (0.000)		
CSD	-2.472 (0.0134)	-3.454 (0.0005)	-3.312 (0.0009)

Standard errors between parentheses, p-values for Hausman and CSD tests between parentheses.

DFE for Dynamic Fixed Effect; MG for Mean Group; DCCE for Dynamic Common-Correlated Effect

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

We compute a Hausman test to assess which of the efficient (DFE) or consistent (MG) estimator is the most appropriate. Once again, we clearly do reject the null hypothesis of parameters homogeneity. We tend to prefer Mean Group estimators over Dynamic Fixed Effects.

Moreover, the Dynamic Common-Correlated Effects estimators do not solve the cross-sectional problem. Hence, we will use the Mean Group estimates to compute the unemployment equation. As for the current equation, we further compute in Table 9 the spatial and temporal heterogeneity in the EMU with regard to unemployment.

Table 9: Spatial and temporal heterogeneity in the Euro area, 2002q1-2017q3, Mean Group estimators with quarterly time dummies (dependent variable – ΔU divided by 100)

	Before the GFC (2002q1 to 2007q4)		After the GFC (2008q1 to 2017q3)	
	Core	GIIPS	Core	GIIPS
U_{t-1}	-0.381** (0.112)	-0.376 (0.281)	-0.158*** (0.045)	0.0169 (0.061)
Output Gap	0.0559 (0.038)	0.297* (0.138)	-0.0347 (0.032)	0.0995 (0.063)
Output Gap $_{t-1}$	-0.0465 (0.066)	-0.0807 (0.063)	-0.0389 (0.036)	-0.0155 (0.123)
Output Gap $_{t-2}$	0.0963 (0.061)	-0.0718 (0.129)	0.0282 (0.030)	0.221 (0.156)
RULC growth	0.0114 (0.018)	-0.0107 (0.011)	-0.00474 (0.011)	-0.0149 (0.011)
RULC growth $_{t-1}$	0.0141 (0.019)	0.0116 (0.009)	0.000368 (0.008)	-0.0131 (0.012)
RULC growth $_{t-2}$	0.00559 (0.007)	0.0237* (0.010)	0.00503 (0.015)	-0.000748 (0.008)
constant	0.0211* (0.010)	0.0188 (0.013)	0.0101** (0.004)	-0.00769 (0.006)
N	147	105	252	180
Countries	7	5	7	5
rmse	0.00217	0.00249	0.00218	0.00373
R ²	0.701	0.705	0.552	0.843
CSD	-2.895 (0.0038)	-3.507 (0.0004)	-3.559 (0.0004)	-4.696 (0.0000)

Standard errors between parentheses, p-values for CSD tests between parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

We cannot say that much on the impacts of the output gap and relative ULC on unemployment since the coefficients are not statistically significant. However, we can assess that dynamic adjustments play a role for core countries before and after the GFC since lagged unemployment is significant at respectively 1% (before the GFC) and 0.1% (after the GFC).

We obtain significant results for GIIPS countries before 2008.

Quite puzzling, we do not observe a significant effect of business cycle on unemployment. Our results are only significant for GIIPS countries before the GFC. We do not conclude there exists a contemporaneous Okun's law – rather the opposite since the coefficient is positive (0.3). This is counter-intuitive and different from the stylized facts we have displayed above.

On the contrary, we find a positive relationship between RULC growth and unemployment for GIIPS countries before the GFC. A one percentage point increment in relative ULC induced a 0.2 percentage point increase in ΔU two quarters later. This is quite puzzling since the huge divergence in terms of competitiveness for GIIPS countries was not matched by an increase in unemployment. Note however that this coefficient is quite small.

Besides, as the CSD statistic and its p-value suggest, cross-sectional remains an important issue in every specification. Unlike with the current account equation, we are unable to solve the CSD problem even when discriminating by subgroups.

Convergence hypothesis

Recall that the log of Real GDP per capita is a non-stationary variable. This keeps us from estimating the so-called catching-up hypothesis – i.e. the convergence to core countries in terms of living standard. As highlighted by Blanchard and Giavazzi (2002), current account imbalances were seen as good inasmuch as they resulted from a normal catching-up process. Figure 5 provides a first look at the convergence hypothesis within the EMU.

We would like to test whether peripheral countries and countries which later joined the EMU have been catching up with core countries since 2002. We also want to assess whether the GFC impacted the catching-up process.

Indeed, we have so far only highlighted the ‘Core-Periphery’ dualism. What about the EMU latecomers – namely Cyprus, Estonia, Latvia, Lithuania, Malta, Slovakia and Slovenia? Due to a lack of data (the quarterly Cypriot current account is only available from 2008 onwards), we were not able to compute the same equation as for core and peripheral countries. Yet we have enough observations to test for the convergence hypothesis.

We follow the same procedure as in Chapsa et al. (2018) and Erçakar (2018). We refer to these papers in terms of methodology. The differences with this paper are that we use quarterly data and we make the analysis before and after the GFC. Hence, we test the following relative variable for unit roots:

$$\text{Log}\left(\frac{\text{RYpc}_{i,t}}{\text{RYpc}_{\text{core},t}}\right) = \log \text{RYpc}_{i,t} - \log \text{RYpc}_{\text{core},t}$$

where $i = \text{GIIPS or New}$ (i.e. the seven above-mentioned EMU’s latecomers)

We thus test the difference between the log real GDP per capita of group i and the log real GDP per capita of core countries. This is the variables we display in Figure 5.

When the unit root test of this difference is non-stationary, we conclude that the real per capita GDP of this group is not converging towards the one of core countries. As in Chapsa et al. (2018), we have chosen to compute two common unit root tests – namely the Hadri tests (whose H_0 : stationarity) and the Breitung test (whose H_0 : unit root). Table 10 displays our results.

Table 10: Unit root tests for the convergence hypothesis

Quarters	Groups	Test (p-value)	Level	1 st difference
Prior to GFC (2002q1- 2007q4)	GIIPS – Core	Hadri	7.750	
			(0.000)	
		Breitung	0.532	-0.580
			(0.703)	(0.281)
	New – Core	Hadri	7.302	
			(0.000)	
	Breitung	0.534	0.596	
		(0.703)	(0.724)	
Post GFC (2008q1 – 2017q3)	GIIPS – Core	Hadri	3.749	
			(0.000)	
		Breitung	0.716	-2.725
			(0.763)	(0.003)
	New – Core	Hadri	18.584	
			(0.000)	
	Breitung	0.571	-2.022	
		(0.716)	(0.022)	

Our conclusion of these tests is simple: in each combination, we conclude that our variables are non-stationary. As a conclusion, we reject the convergence hypothesis.

b. Annual data

We have decided to perform the same analysis with annual data using fixed effects. We perform the analysis with annual data for the two above-mentioned reasons (i.e. noise in data and robustness check). We compute three additional variables derived from the ones presented in Table 3: *Trade openness* - the sum of total imports and exports of goods and services as a part of GDP, *Structural rigidities* – proxied by long-term (more than one year) unemployment and *Fiscal Balance* – the general government fiscal balance as a percentage of GDP.

Regarding dynamics, we empirically determine the number of lags we include by using the Baltagi-Wu LBI statistic⁸. As for quarterly data, we include (yearly) time dummies but do not perform the pre – post GFC estimation as with quarterly data – due to a lack of sufficient data. We rather perform Chow structural break tests to check whether our estimations are different before and after the GFC.

Besides, we would like to assess the impact of the Euro on countries where it was later introduced, namely Cyprus, Malta, Slovakia, Slovenia, Estonia, Latvia and Lithuania. For these countries, we include the dummy variable “EURO” which takes the value 1 if the country is part of the EMU, 0 otherwise.

We first estimate the current account equation and then the unemployment one. We continue to focus on spatial and temporal heterogeneity as in the previous section.

⁸ No critical values tables are currently available for the Baltagi–Wu LBI but we consider that a value well below 2 constitutes an issue.

Current account and Relative ULC

As with quarterly data, we estimate the effect of lagged real per capita income, contemporaneous and lagged relative GDP growth and relative ULC growth on current account. Table 11 displays the results we obtain for respectively the entire panel (“All”, column 1) and then the three subgroups. We report the LBI statistic for each estimation.

Table 11: Results from the CA – RULC equation, 2002-2016, fixed effect estimators with yearly time dummies (dependent variable – CA divided by 100)

	All	Core	GIIPS	New
CA _{t-1}	0.590*** (0.067)	0.729*** (0.100)	0.544* (0.173)	0.316** (0.059)
Log of RYpc _{t-1}	0.0986*** (0.021)	-0.0964 (0.062)	0.0949 (0.077)	0.0644 (0.048)
RGDP growth	-0.175 (0.173)	-0.361* (0.115)	0.395* (0.117)	-0.390 (0.223)
RGDP growth _{t-1}	0.301*** (0.063)	-0.0238 (0.144)	-0.262 (0.314)	0.148 (0.170)
RULC growth	-0.338** (0.100)	0.00478 (0.099)	-0.257 (0.178)	-0.258 (0.128)
RULC growth _{t-1}	0.138* (0.066)	-0.160* (0.065)	0.0254 (0.067)	0.0622 (0.107)
Trade openness	0.00332 (0.013)	-0.0170* (0.006)	0.00695 (0.077)	0.0177 (0.011)
Structural rigidities	0.00317*** (0.001)	-0.00470** (0.001)	0.00109 (0.002)	-0.00166 (0.003)
Fiscal Balance	-0.000448 (0.001)	-0.000343 (0.001)	-0.000331 (0.001)	-0.00170 (0.002)
EURO				-0.0267* (0.009)
constant	-0.412*** (0.087)	0.497 (0.290)	-0.320 (0.287)	-0.316 (0.204)
N	262	95	74	93
Countries	19	7	5	7
R ²	0.781	0.798	0.918	0.858
LBI	2.181	2.218	1.867	2.193

Robust standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Dynamic adjustments matter since the lag of current account is significant at 0.1% for the entire panel and core countries, 1% for countries which later joined the EMU and 5% for the periphery. The other coefficients are statistically significant mainly for the entire Eurozone and core countries.

With regard to the EMU as a whole (column 1), a rise in real GDP growth rate has a positive impact on the current account the next year. More interestingly, relative ULC has a negative contemporaneous impact on current account for the entire panel. This effect is significant at 1%. A one percentage point increase in the relative ULC decreases the current account balance by 0.4 percentage point the same year.

The lagged term is significant at 5% but has – quite surprisingly – the opposite effect. A one percentage point increment in the relative ULC increases the current account balance by 0.1 percentage point the year after. We also find small positive statistically significant impact of structural rigidities on current account for the entire panel. This coefficient is negative for core countries as well as the trade openness coefficient. The more liberalized trade is, the less important current account is.

Regarding core countries (column 2), we observe a contemporaneous negative effect of real GDP growth and a positive lagged effect of relative ULC growth on current account. On the contrary, our results suggest for GIIPS countries (column 3) a contemporaneous positive effect of real GDP growth on current account – while we would have expected this coefficient to be negative. This confirms our prediction of asymmetry within the Euro area. However, we are not able to further investigate this heterogeneity in the light of the GFC. We rather perform Chow structural break test to assess whether the GFC has had an impact on these coefficients.

Regarding the countries which later joined the EMU (column 4), the introduction of the Euro is significant at 5%. The coefficient means that entering the Euro area led to a 2.7 percentage point decrease in the current account.

Unemployment and Relative ULC

As for the current account equation, Table 12 displays the results we get for respectively the entire panel and then the three subgroups. We report the LBI statistic for each estimation.

Table 12: Results from the Unemployment – RULC equation, 2002-2016, fixed effect estimators with yearly time dummies (dependent variable – ΔU divided by 100)

	All	Core	GIIPS	New
Unemployment _{t-1}	0.473*** (0.084)	0.206 (0.116)	0.456*** (0.048)	0.444 (0.184)
Output Gap	-0.0265 (0.039)	0.0439 (0.035)	0.0127 (0.048)	-0.0295 (0.068)
Output Gap _{t-1}	0.187** (0.060)	0.0800 (0.048)	0.372* (0.092)	0.0535 (0.060)
RULC growth	-0.0589*** (0.014)	0.0375 (0.019)	-0.0445 (0.033)	-0.0713 (0.031)
RULC growth _{t-1}	0.0507** (0.016)	0.0101 (0.031)	0.0469 (0.018)	0.0906** (0.021)
Trade openness	0.00890 (0.005)	0.00929* (0.003)	0.0138 (0.027)	0.00827 (0.009)
Trade openness _{t-1}	-0.0147** (0.005)	-0.00440 (0.004)	-0.0318 (0.025)	-0.0159 (0.008)
Structural rigidities	0.0140*** (0.001)	0.0141*** (0.001)	0.0128*** (0.001)	0.0142** (0.002)
Structural rigidities _{t-1}	-0.00816*** (0.001)	-0.00217 (0.003)	-0.00689** (0.001)	-0.00800** (0.001)
Fiscal Balance	-0.000177 (0.000)	-0.000334 (0.000)	-0.000270 (0.000)	-0.000299 (0.000)
Fiscal Balance _{t-1}	-0.000478 (0.000)	-0.000508 (0.000)	-0.000501 (0.000)	-0.000490 (0.001)
EURO				-0.00595 (0.004)
constant	0.0282*** (0.003)	0.0219** (0.004)	0.0406** (0.007)	0.0275*** (0.005)
N	268	94	75	99
Countries	19	7	5	7
R ²	0.976	0.973	0.991	0.971
LBI	1.822	1.894	1.964	1.778

Robust standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

As mentioned before, one would expect a negative relationship between business cycle and unemployment. However, we see a positive statistically significant lagged effect of the output gap on unemployment for the entire panel (column 1). We find a similar result for GIIPS countries. As with quarterly data, our results do not back the Okun's law.

More interestingly, the relative ULC growth and its lag have an opposite effect on unemployment. We observe a negative contemporaneous impact but a positive lagged one on unemployment for the entire panel. A one percentage point rise in the relative ULC growth leads to a 0.06 decline in unemployment but in a 0.05 percentage point increase the following year. These results confirm the above-mentioned effect of internal devaluations on unemployment. In the short-run, internal devaluation – as proxied by a decrease in relative ULC – contracts further the domestic demand which in turn raises the unemployment rate. In a longer perspective, internal devaluation restores competitiveness and leads to a decline in unemployment.

However, we are not able to extend such results to GIIPS or core countries. Note that this lagged effect is even bigger (0.09) for countries which later joined the EMU. Regarding these countries, it is worth noting that the Euro's introduction has not led to significant changes in unemployment. Besides, structural rigidities – as proxied by long-term unemployment – is very significant for the four estimations. However, the results are quite puzzling. We observe a positive contemporaneous effect but a negative lagged one.

As mentioned previously, we would like to know whether the GFC affected our two relationships. We compute Chow structural break test to check whether the differences between and after the GFC are significant. The Chow structural break test consists in testing the joint significance of the post GFC year dummies. Table 13 displays our results.

Table 13: p-value of structural break tests

Equation	All	Core	GIIPS	New
CA – RULC	0.0144	0.0070	0.4318	0.0171
U – RULC	0.0000	0.0598	0.0348	0.0263

With regard to the entire panel and the EMU's latecomers, we draw the same conclusion. The post GFC year dummies are jointly significant meaning the GFC has had an impact on both relationship.

Regarding the Core and the Periphery, we once again notice a dualism. For the unemployment equation, year dummies are jointly significant for both groups – yet at a different level (5% for GIIPS, 10% for core countries).

For the current account equation, the dummies are jointly significant for core countries but not for the GIIPS. This result contrasts with the result we obtain with quarterly data – namely that relative ULC had an impact on current account balance after the GFC.

c. Discussion

It turns out to be difficult to assess the role Unit Labour Costs played in the Eurozone. Before the 2008 Global Financial Crisis, GIIPS countries ran ever-growing current account deficits while core countries accumulated current account surpluses. This pattern is often referred to the ‘Core-Periphery’ dualism. This situation was seen as caused by competitiveness divergence led by domestic demand-driven boom in southern countries. Indeed, the EMU’s periphery experienced a surge in ULC compared to its core. However, our empirical results do not confirm such prediction. Before the GFC, we do not find any statistically significant impacts of changes in relative ULC on current account balance.

The outbreak of the GFC stressed the need to tackle these global imbalances – both in terms of competitiveness and current account. In the aftermath of the GFC, countries which had ran excessive current account deficits and experienced losses of competitiveness should do the exact opposite: regaining competitiveness in order to resorb their current account deficits. To do so, they implemented internal devaluation measures such as wages and cost compression. Using mean group estimators, we observe for GIIPS countries a negative and statistically significant impact of relative ULC on the current account balance. For the periphery, a one percentage point decrease in ULC compared to the EMU’s ULC average led to a 0.3 percentage point increase in current account after the GFC. It seems that southern countries regained competitiveness by limiting the evolution of ULC compared to other countries of the zone. In the absence of exchange rate flexibility, peripheral countries were able to reduce their respective real and effective exchange rate to tackle their current account deficits.

However, we do not notice such impact for core countries. This confirms the asymmetry of adjustments within the Euro area after the GFC.

Nevertheless, this rebalancing within the EMU came at a cost. Before the GFC, country-specific unemployment rates evolved in a relatively homogeneous way – in line with the EMU average. We find a rather limited positive effect of changes in relative ULC on unemployment for GIIPS countries.

After the GFC, unemployment patterns were very different within the Eurozone. Unemployment – especially youth unemployment – dramatically rose in GIIPS countries while remaining stable in core countries. Internal devaluations put deflationary pressures on these already weakened economies. However, our results with quarterly data do not display a direct impact of changes in relative ULC on unemployment rate.

Besides, our results do not display a significant impact of the output gap on unemployment – the Okun’s law. Hence, we cannot assess whether changes in relative ULC had an indirect impact (through GDP’s contraction) on unemployment rate. Yet performing Chow structural break test with annual data indicates that the relationship between relative ULC and unemployment has changed in the aftermath of the GFC.

To conclude, internal devaluations did play a role in rebalancing GIIPS countries’ current account but we are unable to empirically estimate the cost of such measures in terms of unemployment.

After having studied the ‘core-periphery’ dualism in the light of the GFC, countries which later joined the Eurozone constitute a third subgroup of interest. Given the limited amount of quarterly data available for these countries, we have not performed the same tests as for the two first subgroups. Instead, we dwell on the convergence hypothesis – convergence towards core countries living standards. We compute unit root tests of the difference between these countries log real GDP per capita and core countries log real GDP per capita. We observe that this variable is non-stationary and thus conclude that these countries do not catch up with the core. We do the same analysis with GIIPS log real GDP per capita and draw the same conclusion. Our results suggest that the introduction of the Euro has not led to the expected convergence in terms of GDP per capita. Southern and Eastern Europe living standards – even if they improve – do not catch-up with the ones of Northern Europe.

We control the above-mentioned results with three additional variables; *Trade openness*, *Structural rigidities* and *Fiscal Balance*. To overcome the rather erratic quarterly data, we control our results using annual data with fixed effect estimators.

Regarding the relationship between current account and relative ULC (table 11), we do find a statistically significant impact of the latter on the former for the entire panel between 2002-2016. We observe a negative contemporaneous significant impact but a positive significant lagged one. The additional variables do not seem to be relevant since they are not statistically significant. Only the structural rigidities – as proxied by long-term unemployment – are significant in explaining changes in current account. We notice a significant negative contemporaneous impact but a positive lagged one.

However, these results should be interpreted with care inasmuch as the estimations display an abnormally high R^2 . A similar comment applies to the relationship between unemployment and relative ULC.

Regarding the relationship between unemployment and relative ULC (table 12), we also find a statistically significant impact of the latter on the former for the entire panel between 2002-2016 – a negative contemporaneous significant impact but a positive significant lagged one. This seems to corroborate the results of Myant and al. (2016): internal devaluations have a negative impact on unemployment in the short term but a positive one in the longer run.

The three above-mentioned additional variables are not significant – except for structural rigidities. For the three subgroups, we observe a positive contemporaneous impact but a negative lagged one. But this result is likely due to the high correlation between unemployment and long-run unemployment.

Finally, we compute Chow structural break tests (table 13) since we have too few observations to discriminate between prior and post GFC period with annual data. The dummies are jointly significant indicating the GFC had an impact on both relationships – for the three subgroups.

However, the quantitative inquiry we have performed shows several limitations. We use both quarterly and annual data.

Regarding quarterly data, we study a period ranging from 2002 q1 to 2017 q3. We take into account the heterogeneity of the parameters by using mean group estimators and by discriminating between subgroups of countries and periods (i.e. prior and post GFC). However, cross sectional dependence remains problematic in each combination. We were not able to solve this issue. This clearly hinders the statistical inference.

We confine our analysis to only one lag given the limited number of observations. A further study could incorporate more lags for the quarterly analysis.

Moreover, an additional problem arises with quarterly data. There is some noise in these quarterly data. A further study could use calendar adjusted data. This is why we want to confirm the results we obtain with quarterly data with annual data.

Regarding annual data, we study a period ranging from 2002 to 2016. One may argue this period is too short to obtain consistent results. We use fixed effect estimators but do not account for heterogeneity of the parameters nor for cross-sectional dependence. Rather, we test for structural break to assess whether the GFC has had an impact on our relationships.

IV. Conclusion

In this master thesis, we shed some light on the effects of the Global Financial Crisis Eurozone's members. To do so, we emphasize the flaws in the architecture of the Euro area. We relate this framework to past and current monetary constructions. Then we study the impacts of internal devaluations after 2008 and highlight the difference between core and peripheral countries in terms of competitiveness, current account balance and unemployment. Our approach is twofold.

First, we compare the EMU's architecture with other monetary constructions. We strongly believe that part of the answers to the current Eurozone's problems can be found in history. Putting this architecture in an historical perspective and comparing it with different monetary constructions offers relevant answers to the turbulences the EMU faced.

We quickly review the differences between the EMU and the US monetary union. Then we highlight the common features between the EMU and the Gold Standard regime. These two monetary constructions are different – the EMU is part of a broader political project while the Gold Standard was only a monetary agreement between nations – but display similarities that are interesting to outline. These two fixed exchange rate regimes were hit by economic crises – the 1929 crisis for the Gold Standard and the 2008 Global Financial Crisis for the EMU. Before these crises, they experienced growing imbalances among their members. After these crises, they encountered long-lasting economic turmoil that led to political earthquakes.

Regarding the Gold Standard, the interwar period was characterized by war reparations, growing labour unionization and intergovernmental distrust. The regime was not able to rebalance the large balance of payments deficits and surpluses. Once the 1929 crisis occurred, the system acted as a straightjacket for countries which were unable to devalue. Countries recovered from the Great Depression by exiting the Gold Standard. Yet one argues that it was too late to prevent the rise of totalitarianism in Europe.

Regarding the EMU, it experienced growing imbalances in terms of current account and competitiveness following the introduction of the Euro in 2002. These imbalances were considered as good but the start of the GFC changed this point of view. These imbalances were in fact bad and needed to be tackled. Without a way to exit the Euro area, deficit countries rather implemented deflationary measures such as internal devaluations. These measures had terrific economic and political consequences. Internal devaluations indeed reduced current account deficit. But this is believed to have come at the cost of forgone output and employment. The rise of populism and anti-Euro feelings in Europe are a serious warning of the limits of these politics.

In a nutshell, as explained by Eichengreen, the EMU and the Gold Standard share the similarity to enhance business and communication when times are good but intensify problems when times are bad.

Second, we empirically investigate the effects of internal devaluation on current account and unemployment. We follow the Stockhammer and Sotiropoulos (2013) approach which consists in quantitatively estimating the costs of internal devaluations in the aftermath of the Global Financial Crisis. We adapt this approach with new data and further econometric techniques.

We construct and estimate a current account and an unemployment equation. In our setup, the current account is driven by level of per capita income, relative GDP growth and relative Unit Labour Costs growth. The unemployment equation consists in a Okun's law to which we add relative Unit Labour Costs growth as control. Moreover, we account for heterogeneity in the parameters, cross-section dependence and dynamic issues. We estimate these two equations using both quarterly and annual data. The data is extracted and retrieved from Eurostat. For quarterly data, we use mean group estimators and estimate our equations before and after the GFC and for subgroups of countries. Specifically, we highlight the 'Core-Periphery' dualism. For annual data, we use fixed effect estimators and estimate our equations for subgroups of countries. We further compute Chow structural break tests to determine whether the GFC has an impact on our coefficients.

Besides, for countries which later joined the EMU, we want to assess whether joining the European Union and adopting the Euro gives rise to a convergence towards core countries' living standard. For these countries, we test the convergence hypothesis using unit root tests of the difference of per capita income.

As a result, we find a negative impact of relative ULC growth on current account in GIIPS countries after the GFC. Competitiveness gains – a reduction of relative ULC – improved current account balance. We do not identify such effect for core countries. Our results suggest that adjustments in terms of current account were only borne by deficit countries in the aftermath of the GFC. This is in line with De Grauwe (2012). As for the Gold Standard regime, it seems there is penalty for accumulating current account deficits but no penalty for running current account surpluses.

We then turn to the impacts of such rebalancing on unemployment. Our results are rather limited. We do not find any effect nor, quite surprisingly, any sign of Okun's law.

Moreover, we find for the EMU as a whole that internal devaluations first raise unemployment but in turn reduce it by increasing competitiveness. We do not find such opposite sign in our coefficients for core nor GIIPS countries.

Therefore, we conclude that GIIPS addressed their current account deficits by regaining competitiveness but we are unable to assess the cost of this rebalancing in terms of unemployment. We only focus on ULC changes to explain unemployment. Further studies could dwell on the mechanisms that explain this surge in unemployment in GIIPS countries after the GFC. Perhaps other deflationary measures such as fiscal austerity could better explain this development.

Regarding countries which later joined the Euro area we find that the introduction of the Euro led to a decrease in current account. We do not observe such effect for the unemployment equation. For these countries, we do not find any sign of convergence towards core countries living standard. Out of curiosity, we also test the convergence hypothesis for GIIPS countries and draw the same conclusion as for new countries: they do not converge towards the Core in terms of living standards.

As an additional remark, the results we obtain with annual data should be interpreted with care. We consider – on purpose – a narrow time span and have a rather limited amount of observations – especially for the annual analysis.

As a concluding remark, establishing precisely the sign and the magnitude of the impacts of internal devaluations turns out to be difficult. We observe some rather puzzling results or results that are not displayed graphically. Moreover, cross-sectional dependence remains an issue even when estimating subgroups of countries or well-defined periods of time.

However, our results indicate spatial and temporal heterogeneity in terms of adjustments within the Eurozone. As during the Gold Standard regime, current account rebalancing in the Euro area were incurred by peripheral countries after the GFC. The costs of these adjustments seem to have been way higher in the periphery than in core countries.

In the midst of the Global Financial Crisis and the subsequent sovereign debt crisis, decisions were taken without considering lessons learned from the past. These decisions had serious political consequences as far as to question the very existence of the Euro. Or maybe European leaders consciously took these decisions. Hasty or deliberate decisions? The debate is still open. If the former prevails, European decision-makers and the ones who advise them should definitively take a closer look at history. If the latter predominates, incomplete monetary unions such as the EMU not only intensify economic problems when times are bad but annihilate solidarity and encourage bunker mentality.

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Appendix

We compare various tests and different estimators using Pooled OLS (POLS, column 1), Fixed Effect (FE, column 2), Random Effect (RE, column 3) and the Swamy Random Coefficients estimator (SRC, column 4). We display our results in Table 3.

Table 3: Current Account and Unit Labour Costs, Comparative table of static models, 2002q1-2017q3

	(1) POLS	(2) FE	(3) RE	(4) SRC
RYpc	0.000820*** (0.000)	-0.00418* (0.002)	0.000990*** (0.000)	0.0115 (0.007)
Growth rate	0.372*** (0.107)	36.11*** (7.051)	1.110* (0.474)	-31.56 (32.366)
Relative ULC	1.281 (1.907)	-14.34*** (3.542)	-5.409 (8.390)	-12.73 (7.075)
constant	-10.14*** (1.098)	-352.9*** (65.848)	-19.04*** (4.833)	303.2 (307.374)
N	1140	1140	1140	1140
R ²	0.250	0.173		
POOL ^{a)}			0.000	
HET ^{a)}	0.009	0.000		
SERIAL ^{a)}		0.012	0.000	
CSD ^{a)}		0.000	0.000	
Hansen ^{a)}			0.000	
Homogeneity ^{b)}				2583.651

Robust standard errors in parentheses

a) P-values of tests for the five first tests. POOL: Breusch-Pagan Lagrange Multiplier poolability test. HET: Breusch-Pagan LM test for heteroskedasticity (POLS); respectively, Wald test for groupwise heteroskedasticity (FE). SERIAL Wooldridge test for serial correlation of errors (FE), respectively Baltagi-Li test for first-order serial correlation (RE). Hansen-J overidentification test for random effects (RE), robust for heteroskedasticity.

b) The P-value for the Homogeneity test is 0.000; Homogeneity of parameters rejected

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3 sheds light on the limits of our baseline model. As we could expect with panel data, poolability is clearly rejected (at 1%, following the Breusch-Pagan LM poolability test).

Indeed, there seems to have some country specific effects, especially country specific fixed effects as we reject the null hypothesis of the Hansen-J overidentification test (i.e. we reject the fact that there is no correlation between the independent variables of our model and its unobserved fixed effect ai).

Two additional issues arise. First, our baseline model suffers from cross-section dependence (we reject – at 1% – the null which states error terms are independent across cross sections). This means there is some correlation between the cross-section units. Countries under study have been damaged by a common shock – the Global Financial Crisis – though in different amount. This leads us to the second issue. We also reject – at 1% – that parameters are homogeneous. As intuition suggests, every EMU country – or subgroup of countries – has been hit by the GFC in a different magnitude. And this is what this paper is all about – showing the different responses among EMU countries, especially in the light of the ‘core-periphery’ dualism of the Euro area.

We compare various tests and different estimators using Pooled OLS (POLS, column 1), Fixed Effect (FE, column 2), Random Effect (RE, column 3) and the Swamy Random Coefficients estimator (SRC, column 4). We display our results in Table 4.

Table 4: Unemployment and Unit Labour Costs, Comparative table of static models, 2002q1-2017q3

	(1) POLS	(2) FE	(3) RE	(4) SRC
Output Gap	-29.57*** (7.739)	-34.10*** (8.353)	-34.00*** (8.408)	-51.85** (17.669)
RULC	-11.82*** (1.369)	-6.608 (3.611)	-6.719 (3.654)	-7.220 (5.867)
constant	9.221*** (0.122)	9.240*** (0.016)	9.239*** (0.689)	8.929*** (0.591)
<i>N</i>	1260	1260	1260	1260
<i>R</i> ²	0.083	0.077		
POOL ^{a)}			0.000	
HET ^{a)}	0.000	0.000		
SERIAL ^{a)}		0.000	0.000	
CSD ^{a)}		0.001	0.000	
Hansen ^{a)}			0.009	
Homogeneity ^{b)}				4061.514

Robust standard errors in parentheses

a) P-values of tests for the five first tests. POOL: Breusch-Pagan Lagrange Multiplier poolability test. HET: Breusch-Pagan LM test for heteroskedasticity (POLS); respectively, Wald test for groupwise heteroskedasticity (FE). SERIAL Wooldridge test for serial correlation of errors (FE), respectively Baltagi-Li test for first-order serial correlation (RE). Hansen-J overidentification test for random effects (RE), robust for heteroskedasticity.

b) The P-value for the Homogeneity test is 0.000; Homogeneity of parameters rejected

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

We can draw the same conclusions as for Table 3 regarding current account. First, we have to consider country specific fixed effect as we reject the null hypothesis of both poolability (at 1%) and of absence of correlation between explanatory variables and unobserved fixed effect (at 1%). Second, this model suffers from both cross-section dependence and heterogeneity of parameters. Third, omitting dynamics leads to biased coefficients since the baseline model suffers from serial correlation.

Indeed, unemployment does not react instantaneously to business cycle (i.e. evolution of output gap). This delay is likely to be longer with regard to RULC.