Monetary Policy and Macroeconomic Imbalances in Currency Unions

Filippo Gori*

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Abstract

In the euro area a single interest rate is set centrally by the European Central Bank but macroeconomic conditions, including inflation, vary significantly across states. This implies significant variation in the real interest rate in single euro area economies. This paper documents the link existing between the buildup of macroeconomic imbalances and relative monetary policy stance across euro area members, from the constitution of the currency union to the beginning of the economic crisis in 2008. Relative monetary policy slack is found to be related to the build-up of cross-country imbalances concerning, among others, unit labor cost, current account and the real exchange rate. However a comparison with the US suggests that macroeconomic imbalances are not implicit in currency unions: across US states relative monetary policy tightness is still related to developments in key macroeconomic variables at regional level, but this link is substantially weaker. This paper explains the difference between the US and euro area experience making reference to the concepts of labor mobility and fiscal centralization: if labor flows are in principle substitute for capital flows, a centralized fiscal policy is able to offset unstable macronomic buildups relating to unavoidable cross-regional differences in monetary policy stance.

1 Introduction

The presence of macroeconomic imbalances in the euro area is at the center of the current debate over the macroeconomic stability of the currency union, generating great concern among European policy makers. Within the gergon of the European Central Bank and of the European Commission, imbalances do not involve only a country external position (current account) but also a number of other indicators which generally refer to the concepts of competitiveness (i.e. unit labour cost, real effective exchange rate, export market share), economic overheating (inflation, asset prices, unemployment) and indebtedness

*International Economics Section, The Graduate Institute of Geneva, PO Box 136, CH-1211 Geneva 21, Switzerland. Email: filippo.gori@graduateinstitute.ch , web http://filippogori.wix.com/filippogori

(public and private debt). Imbalances are generally defined as *macroeconomic developments which are considered unstable and that can cause significant economic risk during correction or unwinding phase*[1]. The European Commission monitors periodically a number of macroeconomic variables[2] within the framework of the Macroeconomic Imbalance Procedure (henceforth MIP). In this context an imbalance is signaled when a variable crosses a previously defined absolute distributional threshold. In this paper when alluding to the build-up of imbalances I will refer to the approaching of such macroeconomic variables toward those thresholds.

The debate on the origin of imbalances among countries of the euro area is open. In this paper I focus on the role of relative monetary policy stance, which mechanically originates in the form of cross-country heterogeneity in real interest rates due to inflation differentials. I begin the investigation by providing empirical evidence of significant differences in the relative tightness of monetary policy across euro area countries. The Eurozone being a currency union, a single interest rate is set by the policymaker, while individual states' economic conditions might vary considerably. The presented evidence suggests that, especially in the period from 2003 to the beginning of the crisis in 2008, for some countries such as Spain, Greece and Ireland the policy interest rate was too low with respect to their fundamentals. The analysis goes arguing that lower than desirable relative monetary stance is related to the build-up of macroeconomics imbalances in those countries.

To empirically characterize this relationship, I estimate a panel regression comprising a number of variables considered in the MIP, regressing them on Taylor residuals, proxies for relative monetary policy stance and thus real interest rates. Relative monetary policy tightness is found to be a significant predictor of variables such as unit labor cost, current account, credit to the private sector and the real effective exchange rate.

Clearly the existence of a common interest rate is implicit in every currency union. A relevant question for policy makers is whether the accumulation of macroeconomic imbalances across regions should be accepted as an intrinsic frailty of currency areas or not. To answer this question I consider the case of the US, where fifty states share a single monetary policy. By developing an analysis similar to the one implemented for the euro area (even if facing tighter data limitations) I show that a link between relative monetary policy slack and imbalances across US states is significantly weaker.

Facing such different results in when the same analysis is implemented across US and euro area states, explaining why relative monetary policy relates to imbalances becomes a key policy question. I argue and provide supportive empirical evidence that (at least) two factors can explain this difference in results: labor mobility and a centralized fiscal policy. The former because labor flows are substitute for capital flows in the matching process of firms and their inputs. The latter because a centralized fiscal policy, contrary to

[1] ECB.

[2] These are the current account balance, export market share, real effective exchange rate HICP deflated, nominal unit labor cost, private sector credit flow, unemployment rate and house price consumption deflated. In addition to these stock variables are considered but not in this analysis.

regional fiscal implementation, tend to equalize cyclical differences across regions and thus acts toward macroeconomic rebalancing.

This work builds on a range of different research streams. It relates to the research by Fagan and Gaspar (2007), Brzoza-Brzezina (2010) and the ECB (2003) suggesting a role for real interest rate yield differentials as a primary source of imbalances among countries of the euro block. After joining the Euro area sovereign yields of some peripheral countries of the euro area decreased significantly, while persistent differences in inflation at national level produced wedges in real yields which fueled current account deficits and a boom private and public consumption. In this paper however I refer more generally to monetary policy stance thus implicitly abstracting from sovereign risk considerations. To some extent the evidence developed in this paper relates to the work of Maddaloni and Peydro (2011) and Hau and Lai (2013), who also used taylor residuals to characterize the relationship between monetary policy slack and (in order) loose credit standards and risk shifting.

The part of the analysis specifically focusing on real ULC makes reference to the New Keynesian Models with pricing equations including labor shares as in Gali and Gertler (1999) and Smets and Wouters (2007), an empirical evaluation is also in Watson and King (2012). About the relationship between production functions and labor share I follow aspects of the traditional narrative by Hicks in the Theory of Wages (1932) also making reference to the exposition of Blanchard (1997), Bantolila and Saint Paul (2003), Lebrun and Perez (2011), Arpaia et al (2009)). Aspects of the characterization of regional heterogeneity across US states refer to the work of Blanchard and Katz (1992), Del Negro et al (2007) together with the vast literature on convergence among US states. Specifically on euro area macroeconomic imbalances this paper refers to the large descriptive literature on the macroeconomic developments of euro area converging economics until 2008 but also, among the others, Milesi Ferretti and Tressel (2012), Blanchard and Giavazzi (2002) and Wyplosz (2012).

The analysis follows this order: in the first section I briefly review of the process of growing macroeconomic imbalances for some euro area countries; then I evaluate monetary policy stance for all main countries of the block since 1999. The main evidence is provided in the subsequent section, where I relate individual countries's monetary policy stance with macroeconomic imbalances. Then a comparison with the US is provided together with elements of a model which are able to theoretically characterize the empirical investigation developed. The last paragraph is devoted to the design of monetary policy rule adjusted for imbalances.

2 Imbalances in the Euro area: Build-up and Unfolding

Within the terminology of the European Central Bank and of the European Commission, the concept of imbalances is interpreted extensively; this conveys a number of economic developments which are considered unstable in nature and that would imply relevant cost

for the economy in case of unfolding, but also a number of competitiveness (i.e. unit labour cost, real effective exchange rate, export market share) and indebtedness indicators. This extensive interpretation has little in common with the existing literature which focuses on international imbalances, centering the analysis on current account disequilibria. However even if rigid links among internal and external imbalances do not exist, obviously enough different macroeconomic imbalances represent sides of the same medal, as they are connected to the extent they all are expression of a single general equilibrium.

Making reference to the interpretation of main European policy insinuations, in this paper the concept of imbalances is defined as developments in a number of key macroeconomic variables which are persistent and potentially unstable. Persistent because showing trends and unstable as potentially self-fulfilling and explosive.

Figures 1 to 3 display the evolution of the current account, nominal unit labor cost, real effective exchange rate and export market share for major euro area countries since 1999. For some countries a phase of imbalances accumulation is clearly identifiable since 1999.So-called converging economies such as Spain, Ireland, Greece and (to a lesser extent) Portugal experienced until 2007 persistent and increasing current account deficits, a sizable increase in unit labor costs a significant real appreciation and losses in export market share.

This initial phase characterized by diverging trends in key economic variables is then followed by a phase of correction, started with the beginning of the economic crisis in 2008. Since then all variables showed a converging path, as a matter of fact reducing cross-countries differentials.

Few facts stand out from the figure presented:

1) Between 1999 to 2008 and especially after 2003, current accounts of converging economies have been persistently deviating from those of core countries of the union, with the former accumulating large deficits and the latter showing balances or surpluses (figure 1).

2) Over the same period, countries showing current account deficits also suffered real exchange rate appreciations (figure 2).

3) Nominal unit labor costs, a proxy for labor competitiveness[3], in Ireland, Greece and Spain, increased dramatically since 1999, while in other countries like Germany and Austria it showed substantial stability or moderate increase (figure 3).

4) Timing: significant wedges in the above mentioned variables for euro area countries are observable since 1999 but since 2003 they widened until the beginning of the crisis. Since 2008 macroeconomic imbalances have been unfolding steeply.

[3]Under the assumption that labor cost represents the most relevant share of firms cost structures. This indicator could be particularly ineffective in measuring companies' costs in periods or countries where credit scarcity is an issue, as it completely ignore financing costs.

3 One Policy for All? A simple Monetary Policy Rule

The Eurozone being a currency union, a unique policy rate is set by the ECB, as a general rule, by looking euro area harmonized indicators. Harmonized macroeconomic variables however results from the aggregation of a possibly disperse set of country level data. Within the framework of price stability for example, the objective of keeping the harmonized inflation rate below the 2 percent threshold, almost certainly requires a subset of countries to have price growth rates higher and lower this fixed target. It is little surprising then to discover that a unique monetary policy stance might fit poorly single countries' fundamentals. If the possibility of achieving sub optimal monetary policy stance for a subset of countries is implicit in a currency union, this paper is concerned with the consequences of persistent relative monetary policy slack in certain countries and its connection with macroeconomic imbalances.

To assess the relative monetary policy stance in countries of the Eurozone I estimate a simple interest rate rule, where the instrument of monetary policy is the EONIA, the rate of uncollateralized interbank overnight lending for the euro area; this rate is taken as reference by the ECB when implementing Main Refinancing Operations (MRO).

The simple policy rule considered has the following specification:

$$i_t^* = i^* + \beta([E_t[\pi_{t+h}|\Omega_t] - \pi^*) + \gamma(E_t[\tilde{y}_{t+h}|\Omega_t]) \tag{1}$$

where i_t^* is the desired nominal EONIA rate π_{t+h} denotes the price change at time $t+h$ expressed in percentage points, π^* is the target inflation level and , $\tilde{y}_{t+h}$ is the output gap at time $t+h$ defined as the percent deviation of output from its natural level[4]. Ω_t denotes the information set available at time t and i^* the desired level for the EONIA when both output and inflation gaps are zero[5].

Simple policy rules like equation 1 represent the behavior of a central bank having a quadratic loss function on the deviation from inflation and output from their optimal level and they have been used extensively in the literature to assess monetary policy stance.

[4]Output gap is calculated using HP filter.

[5]It should be noted that I avoid a specification which includes interest rates inertia, such as the ones described by an autoregressive rule for interest rates:

$$i_t = \rho i_{t-1}^* + (1-\rho) i_t^* \tag{2}$$

This is because empirical evidence suggests that in these specifications the vast majority of variation in interest rates movements is explained by lagged values of the policy variable, while the marginal contribution of inflation and output gap shocks is somehow limitedThe inertia coefficient for policy rules estimated for the Euro area ranges from 0.8 to 0.98 (Blattner and Margaritov, 2010). A reason of this finding is in the relevant information content of lagged values of policy rates which also contain expected values of inflation and output gaps. Generally the inertia coefficient contains also the potential error in the estimate of the appropriated forward structure of the policy rule. This could impede the characterization of framework where the adequacy of policy rates should be measured primarily on the basis of fundamental characteristics of single countries.

This analysis abstains from considering the period of the crisis (from the end of 2008 onward), this is because throughout this time the interest rate channel was severely disrupted and the EONIA a poor measure of effective monetary policy stance. In determining the extent monetary policy in the Euro area was adequate for all member countries this paper avoids venturing into a perilous definition of optimal monetary policy. Abstracting from any judgment over the adequateness of the policy stance implemented by the european policy maker before 2008 over the union as a whole, I define as 'optimal' the interest rate generated by a policy rule which best describes the behavior of the EONIA, conditional on the observed euro area harmonized series of inflation and output. At this regard this policy is optimal in the sense that it best describes the European Central Bank preferences in term of aggregated output and inflation.

Deviations from this policy rate can then be considered as sub-optimal in the sense specified above, and can characterize an excessively tight or loose policy stance depending on the sign of the deviation.

Table 3 shows estimated coefficients for different specifications of equation 1. All specifications presented produce similar results in terms of relative monetary policy tightness, however for the analysis that follows, model 7 is chosen as it is the one providing the best goodness of fit together with coefficient signs which are consistent with theory.

Figures 4 to 6 display the actual and fitted values resulting from the estimation of equation 1 for the euro area as a whole and for subset of countries of the core and periphery. Predictions' confidence bands are reported for 5 percent significance level. Looking at the euro area as a whole, predicted and actual policy rates have a good fit with the only exception of a short time window between 2000 and 2001, this simple specification is able to explain almost 75 percent of variance for the EONIA rate.

Estimated coefficients β and γ delineate the preferred policy response of the European policy maker to shocks in inflation and output gap. Now I compare actual interest rates with the ones that would have prevailed in each country of the union, conditional on same policy preferences but country specific fundamentals.

In figure 5 and 6 actual policy rates are compared with fitted values for selected countries of the union. The first panel displays four major countries of the core, the second four economies of the periphery. Looking at the first panel, the predicted rate at 5 percent significance level matches the actual rate for most of the time sample for Germany, Austria and France, even in the case of the Netherlands the rate implemented by the policy maker fits reasonably well the desirable path, with a slight over tightening from the 20th to the 30th quarter (2005 - 2006). Looking at figure 6 instead it can be noted how the actual monetary policy was generally loose for Ireland, Greece and Spain. It was in average correct, but loose in the first part of the sample, for Portugal.

For the purpose of creating a synthetic indicator measuring relative monetary policy stance in each country of the union, with respect to the rate that would have prevailed if the policymaker could have implemented country specific interest rates, I construct an index which measures the deviation between these two series. This is done by measuring

the area between the two lines representing the desirable and actual path for policy rates. From a computational point of view the index corresponds to the definite integral between the two curves having the following discrete counterpart for a general country j:

$$\widehat{MPAI}^j = \sum_{t=0}^{T} \left(x_t^j b^* - i_t \right) \tag{3}$$

b^* being a vector containing coefficients $\hat{\beta}$ and $\hat{\gamma}$ estimated for the Euro area and i_t the actual EONIA rate at time t. Finally T is the number of in sample time observations. Note that if instead of considering a generic country j we had considered the entire euro area (let's call x_t in this case $\bar{x}_t^I$, representing a weighted (harmonized) average of single euro area countries' fundamentals $\bar{x}_t^I = \sum_{i \in I} w_i x_i$, where I is the set of Euro area countries thus $j \in I$) the index computed in equation 3 would simply be the sum of the estimation's residuals from equation 1. Also note that here residuals are defined as the difference between the fitted and the actual values (and not the other way around as they are typically presented in literature), this is just to have a more intuitive interpretation of their signs, as in this case to a positive residual corresponds loose monetary policy. Let's call this index MPAI, standing for monetary policy adequacy index. This measure is clearly stochastic, with variance depending directly from the variance of the estimated coefficients in b^*.

The index can be further decomposed to clarify that it is essentially driven by each country deviation's in cyclical inflation and output from euro area aggregates.

In fact:

$$\widehat{MPAI}^j = \sum_{t=0}^{T} \left(x_t^j b^* - i_t \right) \tag{4}$$

$$= \sum_{t=0}^{T} \left(x_t^j - \bar{x}_t^I \right) b^* + \sum_{t=0}^{T} \left(\bar{x}_t^I b^* - i_t \right) \tag{5}$$

The second term in equation 5 is the sum of estimation residuals from equation 1 which amounts to zero by construction; the first term represents the deviation of country j output and inflation gaps from the euro area's weighted average multiplied by the estimated coefficients β and γ from equation 1. This first term measures the business cycle difference of country j in comparison with the rest of the union.

It comes to reason that values for the index different from zero originate from values of this latter term; at each point in time t, the difference in fundamentals (inflation and output gap) between country j and the euro area can be further decomposed in order to highlight the role of the relative weight of the economy j in the currency union.

Thus after little reshuffling (see in the appendix) we can write:

$$x_t^j - \bar{x}_t^I = \left(1 - w^j\right)\left(x_t^j - \bar{x}_t^{I-j}\right) \tag{6}$$

The first term in brackets represents the (complement of the) relative size of a generic country j in the euro area, the second term how different are its fundamentals from the one of the union as a whole.

From the above formulation of this index two facts stand out: the appropriateness of the common monetary policy for a generic country j depends: i) positively on the similarity in the its business cycle with resect to the average for the currency union (magnitude of $x_t^j - \bar{x}_t^{I-j}$), ii) negatively on the size of the economy vis-a-vis with the rest of the currency area (low w^j) and on the magnitude of the coefficients β and γ representing the response of the policymaker to inflation and output gaps;

The index of monetary policy adequacy (henceforth MPAI) as defined in equation 3 serves as a synthetic representation of the cumulated monetary policy deviations from the desirable path as defined by the estimated monetary policy rule in the euro area. A positive and statistically significant value for the index indicates that monetary policy for a specific country has been excessively expansionary; conversely, a negative and statistically significant value for the same index is indication of a relatively contractionary monetary policy stance.

Figure 8 displays the MPAI for all countries of the Euro 12 block using different forward specification for the policy rule. Over the time sample considered (1999-2008) monetary policy stance is found to be relatively expansionary in all major peripheral countries, specifically (in order of magnitude) for Ireland, Greece, Spain and Portugal and to a lower extent for Italy. On the other hand, monetary policy has been relatively adequate in all other countries with the notable exception of Germany, where policy rates were higher than desirable. These results are significant at 1 percent significance level and robust to different forward specifications of the policy rule..

An indication of the average deviation of the policy rate from its desirable stance can be obtained by dividing the MPAI by the number of quarters in the sample. The resulting figure represents the average interest rates deviation from for each quester and is shown in figure 9. Considering the relevant border of the 99 percent confidence interval, interest rates were, in average from 50 to 75 bias points (depending on the specification) lower in Ireland, from 30 to 50 basis point in Greece, Spain and Portugal. There were marginally (10 basis point) higher than desirable in Germany. The magnitude of these numbers might appear at a first sight low, however it should be recalled that they averages taken over a period of almost ten years and that interest rates compounding works in a multiplicative fashion.

4 Linking Monetary Policy and Imbalances

Relative monetary policy stance varied significantly across euro area countries between 1999 and the beginning of the crisis: peripheral economies such a Spain, Greece and Ireland experienced a relative loose monetary policy while, for countries of the core, policy interest rates were about right. This section links the evidence provided so far with the process of imbalances accumulation in the euro area.

The discussion is divided in two parts: first I present graphic evidence of a link between the relative adequacy of monetary policy stance and the average buildup of imbalances for euro area countries. Second I present results from a panel regression of imbalances on cross-country monetary policy stance.

The account of a connection between imbalances and monetary policy stance starts with figure 12; this displays three scatter plots showing on the y axes the average current account balance (first panel), the average change in the real effective exchange rate (second panel), the average change in unit labor cost and on the x axes the relative monetary stance (MPAI). Positive values for MPAI stands for a relatively slack monetary policy. All the three panels presented show a clear relationship between monetary policy stance and the three variables considered. In average, countries for which monetary policy was expansionary run current account deficits (first panel), experienced real appreciation and a significant increase in unit labor costs.

4.1 Estimation

Here I present empirical evidence of the role of monetary policy stance in the buildup of macroeconomic imbalances for countries of the Eurozone. At the core of this evidence is the estimation of a panel model comprising euro area countries, in which imbalances are regressed on a variable expressing the relative monetary policy stance and controls. The cross-country variation in regional monetary tightness is then used to assess its effect on major macroeconomic imbalances. Monetary policy is normally endogenous to economic fundamentals which affect variables such as the current account, unit labor cost end in general all dimensions along which imbalances are measured. However in a currency union the cross-country variation in monetary policy stance is orthogonal to the monetary policy process. To the extent monetary policy is used to trim macroeconomic developments, I claim that this orthogonally might play a role in fueling imbalances across states of the Eurozone. A similar identification strategy is used by Maddaloni and Peydro (2011) and Hau and Lay (2013) in the context of their analysis of credit standards and the risk taking channel.

The baseline specification takes of the following form:

$$y_{it} = \alpha + \beta m_{it} + \gamma C_{it} + \epsilon_{it} \tag{7}$$

where for each country i at time t , y_{it} is a variable for which an imbalance can be observed, m_{it} is a measure of monetary policy stance and c_{it} is a vector of controls containing for each country i inflation at time t (π_{it}), output growth g_{it} and a country fixed effect ($C_{it} = [\pi_{it}, g_{it}, a_i]'$) .

The panel comprises the 12 countries belonging to the euro block since 1999 and Greece that joined in 2001. The estimation is performed on quarterly data from the ECB statistical warehouse.

Five dependent variables are considered. These are the real unit labor cost (ULC), current account (CA), the real effective exchange rate (REER), credit to the private sector and the export market share (EMS). All variables are considered in term of yearly changes in percentage points, while their choice make close reference to the variables chosen by the European Commission in their MIP [6].

I consider three different measures of monetary policy stance. The first is represented by coincident Taylor residuals from the estimation performed in paragraph 3. This variable measures the *momentary* (within quarter) monetary policy stance. The second is represented by the first lag of taylor residuals. The third, more informative about the persistence of relative monetary tightness, is represented by a 4quarter moving average of the MPAI from $t-3$ to t.

Tables 2 to 4 report estimation results for the 3 different specifications of equation 4. Coincident policy stance is positively related to real unit labor cost and negatively related to the real effective exchange rate and export market share. In table 3 policy residuals are considered with one lag. As for the previous set of regressions, one quarter lagged policy residuals are able to explain changes in export market share, real effective exchange rates and real unit labor cost. Finally, table 4 shows estimation's output when the MPAI is used

[6]The variables considered, current account (CA), real effective exchange rate (REER), credit to the private sector and export market share (EMS)) represent all the flow variables considered in the MIP, with the exception of real estate prices (which cannot be retrieved for all euro area countries since 1999), unemployment and the nominal unit labor cost (in this paper real unit labor cost in considered instead). Changes in export market share, are defined as deviations from the euro area values. However following robustness controls, results are not dependent on the use of variables which are deviation from Euro area aggregates vis-a-vis with simple changes.

The choice of the real unit labor cost (instead of the nominal unit labor cost) is based on theoretical ground: the real unit labor cost has a clearly defined and easier to deal with interpretation which relates to firms marginal cost. As in Gali and Gertler (1999) and Smets and Wouters (2007) the real unit labor cost can be interpreted as *fundamental inflation*, being the supply component of inflation on a New Keynesian Phillips Curve:

$$\pi_t = \lambda rulc_t + \beta E_t \pi_{t+1} \tag{8}$$

Iterating the above equation forward, the level of inflation at time t depends on the current and expected shocks in real unit labor cost. It then comes to reason that even the nominal unit labor cost depends critically on the level (actual and expected) of the real unit labor cost, but in a multiplicative (and more complex) fashion. However as a robustness test model 7 is estimated using nominal unit labor cost as a dependent variable. Estimated coefficient are still positive and significant.

as a proxy for monetary policy stance considering the 3 quarters preceding time t. This is a measure capturing the persistence of monetary policy stance; in this case the MPAI is a significant predictor in all equations considered.

Three conclusions stand out from the empirical analysis presented: first, relative monetary policy stance is significantly related with positive sign with changes in real unit labor cost, real exchange rate and credit to the private sector and with negative sign with the current account and export market share. It should be noted that the signs of the regression coefficients are consistent in portraying a situation in which relative monetary policy slack is related to: i) an increase in real unit labor cost, ii) growth in credit to the private sector, iii) current account deficit and iv) a loss in export maker share. As shown previously in this paper such macroeconomic developments characterized converging countries like Spain, Greece and Ireland up to 2008. Second: the current account is affected by persistent monetary policy slack, but not by coincident or lagged taylor residuals. Third (considering table 4) an average one percent deviation of the policy rate from its desirable level over the four preceding quarters causes an increase of 3.1 percent in credit to the private sector and of 1.1 percent in the real unit labor cost. It also causes a decrease of 0.043 percent in the export market share and of 0.78 percent in the current account.

5 Monetary Policy and Imbalances in the US

Are all currency union the same? Should the euro area live with cycles of macroeconomic imbalances build-up and unfolding? A natural comparison for the study of the relationship of monetary policy and imbalances is represented by the US case, where a unique interest rate is implemented vis-a-vis with fifty states, possibly showing large structural heterogeneity. As for the case of the Eurozone, the estimated coefficients of a US wide Taylor type monetary rule can be used to construct policy residuals representing the relative tightness of monetary policy in each if the states composing the federation. The analysis continues with the estimation of a model similar to equation 3 where instead of euro area countries, cross-section variation is provided by single US states. The comparison with the US case is performed taking into account three variables that can be constructed using US state level data. These are: real unit labor cost, real effective exchange rate (PPI deflated) and export market shares. The first variable is computed by diving nominal compensation of employees by nominal GDP, both at state level. The real effective exchange rate is computed in two alternative ways: by multiplying the US REER by the CPI index and then by deflating it again using GDP deflators collected at sate level[7]. The second way is by simply computing the inflation differential between individual states and the US as a whole (this is because the vast majority of trade for individual states stays within the US). No significant difference is found is the alternative use of these two indicators. Export market shares are computed using data from the US Census, data on GDP and GDP deflators

[7]This is because data on consumer price levels for individual states are not available

are from the Bureau of Economic Analysis. The frequency used is yearly[8], while the time dimension spans from 1987 to 2012[9].

Estimation results are reported in the first three columns of table 5. Here changes in real unit labor cost, real effective exchange rate and export market share are regressed on policy residuals. As in this case the frequency of observations is yearly, results shown are comparable with the ones in table 4.

Considering the first three equations few comments are worth making: first, relatively loose monetary policy stance in the US as in the Eurozone is correlated with changes in real unit labor cost, export market share and the real exchange rate. However significant difference exist in terms of the magnitude of the effect: a one percent positive deviation in the interest rate from the desirable level (loose monetary policy) is associated with a 1.1 percent increase in the real unit labor cost in the Eurozone and a decrease of only .11 percent in the US (a tenth). Similarly the effect on the real exchange rate is 2.3 percent in the euro area and only 0.5 in the US (about a fifth) and the reduction in export market share is 0.05 percent in the Eurozone comparing with 0.007 in the US (less than a tenth). The different sign of the effect of monetary policy slack on the real unit labor cost can be explained with a different elasticity of substitution in the two economies[10].

The evidence presented in this paragraph unveiled the existence of significant differences in the relationship between monetary policy stance and macroeconomic imbalances in the US and the Eurozone: in both countries relative monetary policy slack is associated with the build-up of macroeconomic imbalances, however the two cases differ significantly in terms of the magnitude of the effect. This effect is indeed much more limited across US states.

In a general perspective this result is relevant at least for two reasons: first it is supportive of the idea that, even if monetary policy implemented in a currency area might contribute to the accumulation of imbalances in some of its regions, the magnitude and thus the economic relevance of this effect varies significantly across different monetary unions. Evidence of the rise of macroeconomic imbalances in the Eurozone but not across US states, also suggests that currency unions are not dysfunctional per se nor they necessarily imply potentially destabilizing monetary policy for some of its regions. Second, if the reason behind the rinsing of imbalances in the euro area is not to be imputed simply to the setting of a unique interest rate in the currency union, it should be found in the structural differences which characterize the Eurozone in comparison to the US. These differences, together with an explanation of the results just presented are the object of the next paragraph.

[8] Quarterly data are not available for regional series.

[9] The choice of extending the time horizon from roughly ten years considered for the previous analysis is explained by the willingness to enlarge the time dimension of the dataset comparing to the large number of cross-sectional observations (fifty states). For the purpose of a robustness control I estimated the same model also for the period 1999-2012 (the same used in the analysis on Europe), results are essentially unchanged.

[10] See the appendix for derivation.

6 Explaining the Differences Between the US and the Eurozone

What makes the US case different from the Euro area? In this paragraph I explore the role of two aspects distinguishing the two economies, these are labor mobility and the role of centralized fiscal policy. The first relates to the different structural convergence of the two economies, the second to their institutional framework.

6.1 Labor Mobility

Labor mobility is a key aspect of the economic functioning of currency unions, as it is required for the efficient allocation of resources across regions of the same economic system. In a general perspective capital and labor can be thought as substitute in the matching process relating firms and workers. To this extent labor flows can partially substitute capital flows in the economic convergence that characterizes currency unions, but at the same time reducing pressure on good and asset prices and wages. More detailed data not being available it is convenient to proxy cross-regional labor mobility via migration. More in detail I estimate labor migration using the following formula:

$$M_t = \frac{\sum_{j=1}^{J} \mid \Delta P_{j,t} - \Delta P_{NJ,t} \mid}{2P_J} \tag{9}$$

Where $\Delta P_{j,t}$ is the change in population (net of external migration) for state j at time t, $\Delta P_{NJ,t}$ is the change in population in the whole currency area net of external migration. This latter value corresponds (as it excludes external migration) to the natural growth of the population of the currency union. The change in population in each state can be divided into a change due to internal population dynamics (natural population growth) and the change due to internal (to the currency union) migration ($\Delta P_{j,t} = \Delta P_{Nj,t} + \Delta P_{Ij,t}$). Assuming that the natural growth rate of the population is the same in the currency union as a whole and in each of its regions ($\Delta P_{Nj,t} = \Delta P_{NJ,t}$), the above index measures the share of the population which at time t is involved in internal migration[11]. Figure 12 shows the evolution of the share of residents involved in internal migration both in the euro area and the US. Internal migration appears to be roughly double in size in the US with respect to the eurozone.

Within the framework if the empirical analysis presented so far, the role of labor migration in determining the effect of monetary policy on imbalances could ideally be assessed through the means of an interaction term between monetary policy residuals and 10. Results from such an estimation are presented in the table 5 and 6. A note of caution is however necessary before reading these results: labor mobility improved overtime in the

[11] Y_J, t is the overall population at time t in the currency area.

euro area since 1999, but slowly. This makes an interaction between monetary policy residuals and migration significantly determined my the former variable and especially so when looking at quarterly data. This is to say that multicollinearity deeply affects the significance of this variable in the estimated models an this is confirmed by the variance inflation factors related to the two variables. The last three columns of table 5 show the effect of migration on the target relationship between monetary policy and imbalances in the US. Higher migration flows in all 3 equations reduces the effect of monetary policy slack on unit labor cost, current account and the real exchange rate. Similar evidence is found in for the euro area, where all interaction terms have opposite sign from monetary policy stance. In this case the effect of is statistically significant at 10 percent significance level only when considering the real exchange rate and export market share and at 15 percent significance level when considering the current account. What this analysis shows is that higher labor migration linearly decreases the effect of relative monetary stance on the macroeconomic variables considered. Higher internal migration in the US can thus be an explanation to the weaker relation between monetary policy stance and imbalances found for this economy with respect to the euro area.

6.2 Decentralized Fiscal Policy and Monetary Policy Stance

There are significant differences in the way fiscal policy is conducted in the US and the euro area and such differences can explain why relative monetary policy stance is strongly correlated with imbalances in the euro area and not in the US. The first difference concerns the relevance of the central, meaning currency area level, fiscal budget. As fiscal balance is by nature pro-cyclical when budget limits are binding, regional fiscal stance tends to be per se correlated with local economic conditions and thus it is expansionary in those regions where monetary policy is relatively slack. On the other hand, a centralized fiscal policy tends to be countercyclical with respect to the heterogenous economic conditions on the areas in which it is implemented, not last because of the countercyclical nature of social spending and transfers. The first case is well described by how fiscal policy is implemented in the European Union (and thus the euro area) the second by the US. In the US the federal budget represents in average from 50 to 60 percent of the total public spending, this can be seen in figure 13. It also should be noted that this figure represents an underestimation of the countercyclical potential of fiscal policy in this economy, as most fiscal spending implemented by individual states is financed with federal transfers. On the other hand, in the euro area only less than 1 percent of the overall fiscal spending is implemented at centralized level, while the vast majority of fiscal policy is carried out at national level and, as a matter of fact, persistently near the binding thresholds represented by the EU Stability and Growth pact. A very limited fiscal redistribution across euro area members can jeopardize the ability the fiscal multiplayer to offset imbalances created by relative monetary policy stance.

The institutional framework provided by the Stability and Growth pact, imposing Eu-

ropean Union's members a fiscal deficit below 3 percent, is likely to have worked as a trigger for pro-cyclical fiscal policies in member economies, to the extent euro are members persistently operated near this threshold since 1999. This provides enough justification for the evaluation the correlation of fiscal policy across euro area members with respect to relative monetary policy stance. For this purpose I estimate a simple panel where individual countries fiscal balance is regressed on the proposed index of monetary policy stance and controls. The model is the following:

$$f_{it} = \delta MPAI_{it} + \gamma g_{it} + u_{it} \tag{10}$$

The estimation is performed using the between estimator as in this case what matters is the cross-sectional relationship between fiscal policy and the relative tightness of interest rates. Results are presented in table 7: once controlling for the growth rate, fiscal balance is negatively related across euro area members with the relative tightness of monetary policy. This provides evidence of the pro-cyclicality of fiscal action in individual countries of the Eurozone: within the time sample under analysis (1999 to 2008) those countries enjoying more loose monetary policy stance also tended to have higher fiscal deficits. This evidence suggests that fiscal policy operated in fueling and not contrasting the build-up of macroeconomic imbalances across euro area countries.

The absence of significant fiscal transfers across euro area members had a role in the accumulation of macroeconomic imbalances until 2008, this was the case as during this period relative loose monetary policy paired with relatively expansionary fiscal stance. The absence of particular coordination in the implementation of fiscal policies across euro area members makes the Eurozone more vulnerable to the accumulation of macroeconomic imbalances than the US. This is due to the chronically limited cross-country transfers and the relative irrelevance of the communitarian budged comparing to the one of individual members. If the existence of differences in real interest rates in currency unions in unavoidable, fiscal policy should be designed and implemented in a way to rebalance the effect of relative monetary policy stance and not to exacerbate it. The resources available to the European Union to compensate macroeconomic disequilibria across euro area countries are limited, and in the wake of the political fractions involving the renewal of the communitarian fiscal budget, they will probably be even more so in the future. However what is more worrying to observe is that even those limited communitarian transfers were not directed toward macroeconomic rebalancing but instead were positively related to relative monetary policy stance. This is evident when looking at the second column of table 7 where net payments from the European Union are regressed on monetary policy stance and the growth rate.

If in a currency union macroeconomic imbalances arise in conjunction with cross-sectional differences in economic conditions across regions, fiscal policy should be used as a stabilizing device. This is what happens in the US. In the euro area, on the other hand, not only the institutional framework imposes much of the fiscal spending to be managed by individual states, but even the limited resources available to the European

Commission are invested in way to fuel and not to reduce the accumulation of imbalances.

7 Adjusting Monetary Policy for Imbalances

The analysis presented in this paper highlighted how macroeconomic imbalances arise in the euro area in relation to the cross-country relative tightness of monetary policy. Two solutions exist in light of the analysis presented so far for the policy maker willing to reduce imbalances formation in relation to monetary policy: first, the reduction of frictions to labor mobility across countries of he euro area and the implementation of a more effective system of cross-country fiscal transfers. These are old issues on which the eurozone achieved only limited improvements since its constitution. Second, the modification of an interest rate rule in a way to target, together with output gap and inflation, rising imbalances.

If imbalances arise from the establishment of a single interest rate vis-a-vis with different desirable rates at country level, due to relative monetary policy slack, minimizing imbalances implies solving a monotonic function of desirable policy rates for individual countries, which is decreasing in the final policy interest rate adopted. In a currency union in fact none of the regions would experience rise in imbalances if the policy maker choses an interest rate which corresponds to the maximum among the ones desirable for each of the single regions.

Following a well established literature (Clarida et al 1999), the analysis starts from considering a policy maker minimizing a quadratic momentary loss function. The introduction of imbalances in the central banker problem, implies considering the asymmetric nature of the loss associated with positive and negative interest rates deviations from the desired level. Imbalances in fact arise in cases in which interest rates are relatively low (although other costs are associated with having to high interest rates, from which the trade off). The introduction of asymmetry in a standard quadratic loss function considering interest rates' deviations from a Taylor type policy rule, is performed by imagining the loss related to imbalances taking the form of an additive component. This new component measures the deviation of the target interest rate from the maximum of the rates the optimal policy rule has identified for all individual countries.

The policy maker then solves:

$$\min_{r_t} \; L_t = (\hat{i}_t - r_t)^2 + \phi(\hat{i}_t^{max} - r_t)^2 \tag{11}$$

with $r_t \in [i_t^{min}, i_t^{max}]$ is the final policy rate chosen by the central bank, $\hat{i}_{j,t} \in I_t$ is the interest rate desirable for country j of the area[12], $\hat{i}_t$ is the desirable interest rate as described by the currency union wide policy rule so that $\hat{i}_t = i^* + \beta([E_t[\bar{\pi}_{t+h}|\Omega_t] - \pi^*) + \gamma(E_t[\bar{y}_{t+h}|\Omega_t])$.

[12] J is the set of countries within the currency union and I_t is the set of desirable interest rates for country of the area, by desirable it is meant produced by the a policy rule estimated over the currency union but using country specific output gap and inflation

Finally ϕ is a parameter stating the relative aversion of the policymaker toward imbalances and implicitly measuring the tradeoff between not having imbalances in any of the regions of the currency union and having a too high interest rate.

The above loss function is overall differentiable and concave within the interval of definition for r_t. The solution of the policymaker problem as stated in equation 11 yields to the following condition:

$$r_t = b^* \frac{\hat{i}_t + \phi \hat{i}_t^{max}}{1+\phi} \tag{12}$$

This is essentially a weighted average of the desirable interest rate in the currency union disregarding imbalances and the highest desirable interest rate considering each country individually, with ϕ as weighting parameter.

Equivalently:

$$r_t = b^* \left(\hat{i}_t + \frac{\phi}{1+\phi}(a_t - \sigma S_t) \right) \tag{13}$$

Where $S_t = (\hat{i}_t - M_t)/\sigma$ is the non-parametric skew of the distribution of the desirable interest rates for countries of the currency union M_t is its median and $a_t = \hat{i}_t^{max} - M_t$ a positive number. The above expression shows a positive relationship between the imbalances correction of the unique policy rate implemented in the currency union (second term in brackets) to the negative skewness of the distribution of single countries optimal interest rates. The factor of proportionality depends on ϕ expressing the relative weight the policy maker assigns to imbalances in its loss function.

To bridge this discussion with the adequacy of monetary policy stance measured by the index of monetary policy adequacy described above, it can be shown (details are in the appendix) that the MPAI (equation 3) is a decreasing function of ϕ. After little elaboration in fact we obtain that the policy residual at time t can be written as (assuming for descriptive purposes $x^j = x^{max}$, the general case is in the appendix):

$$MPAI^j_{t-1:t} = \frac{1}{1+\phi} b^* \left(1 - w^j\right) \left(x_t^j - \bar{x}_t^{I-j}\right) \tag{14}$$

Which shows the role of policy makers' aversion for imbalances ϕ in determining relative monetary policy stance.

8 Conclusions

In the euro area relative monetary policy stance has been significantly diverse across individual countries and especially so from 2003 to the beginning of the economic crisis. This paper provides evidence of the empirical link between the relative tightness of monetary

policy and macroeconomic imbalances in the eurozone. The characterization of this link is completed with a comparison with the US. Even in this case relative monetary policy stance is correlated with state level changes in unit labor cost, real exchange rate and export market share but the relationship is significantly weaker. This paper proposes to explain this difference on the basis of two factors: scarce labor mobility and a decentralized fiscal policy. Labor mobility reduces imbalances to the extent it substitutes cross-regional capital flows. A centralized fiscal policy is self stabilizing due to the fact that its cyclical components redistribute wealth from growing to depressed regions. This findings are consistent with the traditional theory of currency unions, stressing the importance of a more integrated labor market and fiscal policy for the stability of the Eurozone.

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A Derivation of equation 6

The first term of equation 5 can be decomposed as follow:

$$x_t^j - \bar{x}_t^I = \left(1 - w^j\right) x_t^j - \sum_{i \neq j \in I} w^i x_t^i \tag{15}$$

The last term of equation 15 being the weighted average of single country components of x_t minus country j's times its relative weight. This term corresponds to the weighed average of fundamentals in all countries but country j once rescaling all weights w_i in order for them to add up to one. This can be done by dividing all weights by $1 - w_j$, thus the average:

$$\frac{\sum_{i \neq j \in I} w^i x_t^i}{1 - w^j} = \bar{x}_t^{I-j} \tag{16}$$

which is simply the weighted average of all countries of the union but country j.

B Real unit labor cost and interest rates is a small open economy

Assuming output is produce with a CES production schedule:

$$Y_t = A_t \left[(\alpha) K_t^{\frac{\sigma-1}{\sigma}} + (1-\alpha) L_t^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}} \tag{17}$$

Where K_t, L_t and A_t are respectively capital, labor and an exogenous technological parameter, $\alpha \in (0,1)$ is the factor share for capital and σ represents factors' elasticity of substitution.

With perfect competition in output and factors markets the real unit labor cost (or labor income share) is defined as:

$$RULC_t = 1 - \alpha \left(\frac{K_t}{Y_t} \right)^{\frac{\sigma-1}{\sigma}} \tag{18}$$

Now it is convenient to treat regions of a currency union as small open economies with respect to the rest of the currency area (this specification will fit the case of individual US states and peripheral euro area economies. For a small open economy the marginal product of capital is equal to the world interest rate thus $R_t = F_k(K_t, L_t) = \alpha \left(\frac{K_t}{Y_t} \right)^{-\frac{1}{\sigma}}$. Substituting this equation in the real unit labor cost:

$$RULC_t = 1 - \alpha\left(\frac{R_t}{\alpha}\right)^{1-\sigma} \tag{19}$$

Denoting with lower cases the percentage deviations from the steady state 19 becomes:

$$rulc_t = \phi r_t + \epsilon_t \tag{20}$$

with $\phi = \frac{rule}{1-rule}(\sigma - 1)$ and $\epsilon_t = \frac{rulc}{1-rulc}(\sigma - 1)v_t$.

Equation 20 establishes a linear relation between the real unit labor and the real interest rate in international markets and it represents the theoretical base for the estimation of the equation 1 in table 4 and 5. This is because when measuring the relative tightness of monetary policy through the means of taylor residuals, an implicit reference is made to real interest rates. More specifically, monetary policy slack as measured before by the MPAI represents a situation where real interest rates are lower than desirable, thus an increase of such index corresponds to a decrease in the real interest rate.

Equation 20 has also the benefit of delivering a clear interpretation about the empirical results found in previous paragraphs: this is that the difference in responses of the unit labor cost to relative monetary policy stance across US states and euro area countries is due to different factor elasticity of substitution in regions of the two economies. In fact the sign of the relationship in equation 20 crucially depends on ϕ which, in turn, depends on σ: among euro area countries, a positive relationship between the real unit labor cost and the real interest rate suggests a factor elasticity of substation lower than one (capital and labor are low substitutes). In the US, on the other hand, the negative relationship between real unit labor cost and interest rates outlines a factor substitutability which is higher than one. Notice that this latter results does not necessary conflict with the bulk of studies characterizing an elasticity of substitution for the US lower than one, as the empirical analysis developed in this paper consider individual states.

C An Interest Rule Adjusted for Imbalances

The policy maker solves:

$$\min_{r_t} \; L_t = (\hat{i}_t - r_t)^2 + \phi(\hat{i}_t^{max} - r_t)^2 \tag{21}$$

with $r_t \in [i_t^{min}, i_t^{max}]$, $\hat{i}_{j,t} \in I_t$ being the interest rate desirable for country j of the euro area (J is the set of countries within the currency union and I_t is the set of desirable interest rates for each country of the area, by desirable it is meant produced by the a policy rule estimated over the currency union but using country specific output gap and inflation and $\hat{i}_t$ desirable interest rate as described by the currency union wide policy rule so that $\hat{i}_t = i^* + \beta([E_t[\pi_{t+h}|\Omega_t] - \pi^*) + \gamma(E_t[\tilde{y}_{t+h}|\Omega_t])$. Finally ϕ is a parameter stating the relative

aversion of the policymaker toward imbalances. The solution of the policymaker problem as stated in equation **??** yields to the following optimality condition:

$$r_t = \frac{1}{1+\phi}\left(\hat{i}_t^* + \phi\hat{i}_t^{max}\right) \tag{22}$$

Or equivalently, using a coincident policy rule and simplifying notation:

$$r_t = \frac{1}{1+\phi}\left(i^* + \beta(\pi_t^I - \pi^*) + \gamma(\tilde{y}_t^I) + \phi\left[i^* + \beta(\pi_t^{max} - \pi^*) + \gamma(\tilde{y}_t^{max})\right]\right) \tag{23}$$

$$= b^* \frac{\bar{x}_t^I + \phi x_t^{max}}{1+\phi} \tag{24}$$

Using the same notation as before x_t is a vector of variables containing output gap and inflation. This is essentially a weighted average of the desirable interest rate in the currency union disregarding imbalances and the highest desirable interest rate considering each country individually, with ϕ as weighting parameter.

Equivalently:

$$r_t = b^*\left(\bar{x}_t^I + \frac{\phi}{1+\phi} MR_t^+\right) \tag{25}$$

Where $MR_t^+ = x_t^{max} - \bar{x}_t^I$ is the distance of the mean from the maximum; with a further step we obtain an expression in which the optimal interest rate is a function of the skewness of the distribution of individual countries appropriate rates:

$$= b^*\left(\bar{x}_t^I + \frac{\phi}{1+\phi}(a_t - \sigma S_t)\right) \tag{26}$$

Where $S_t = (\bar{x}_t^I - M_t)/\sigma$ is the non-parametric skew of the desirable interest rates for countries of the current area M_t its median and $a_t = x_t^{max} - M_t$ is a positive number .

It can be shown that the adequacy of monetary policy stance as measured by the MPAI (equation 3) is a decreasing function of ϕ. After little elaboration in fact we obtain that the policy residual at time t can be written as (assuming for descriptive purposes $x^j = x^{max}$) :

$$MPAI_{t-1:t}^j = \left(x_t^j b^* - r_t\right) = \left(x_t^j b^* - b^* \frac{x_t^I + \phi x_t^j}{1+\phi}\right) \tag{27}$$

$$= \frac{1}{1+\phi} b^*\left(x_t^j - x_t^I\right) \tag{28}$$

Thus as for equation 30 we can write:

$$MPAI^{j}_{t-1:t} = \frac{1}{1+\phi} b^* \left(1 - w^j\right) \left(x^j_t - \bar{x}^{I-j}_t\right) \tag{29}$$

Which shows the role of policy makers' aversion for imbalances ϕ in determining relative monetary policy stance.

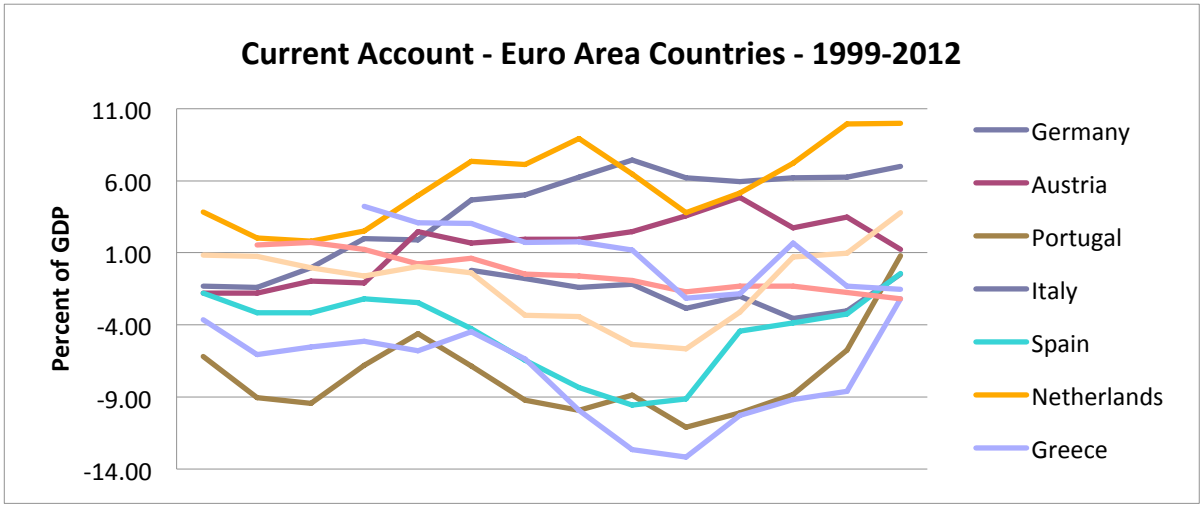
The discussion presented refers to the special case in which $x^j = x^{max}$. It is straightforward to show that the MPAI is a negative function of the parameter ϕ even in the general case in which $x^j \neq x^{max}$. In this case we would have:

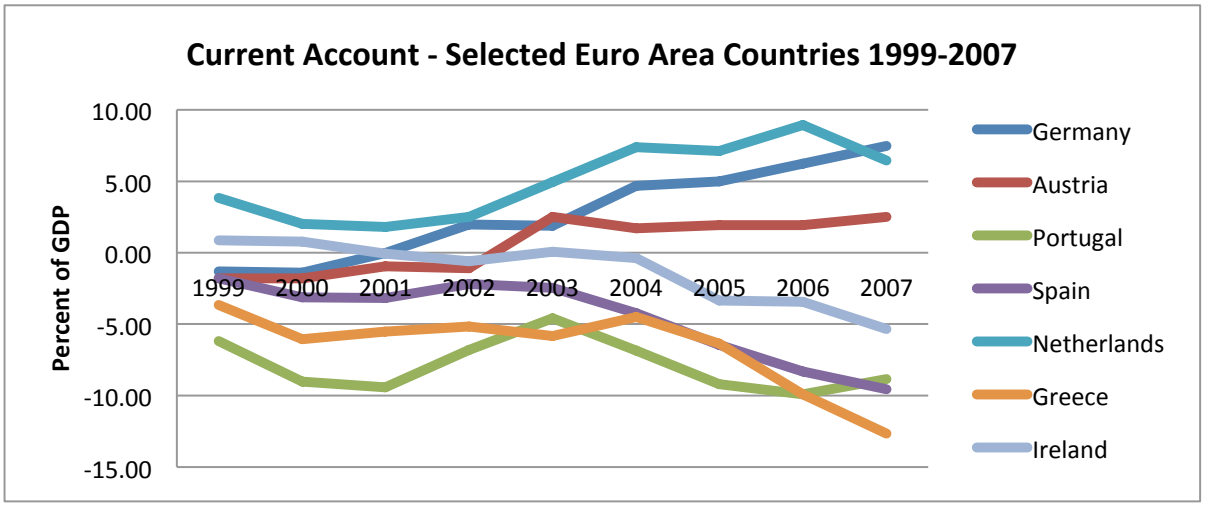
$$MPAI^{j}_{t-1:t} = \left(x^j_t b^* - b^* \frac{x^I_t + \phi x^{max}_t}{1+\phi}\right) = \frac{1}{1+\phi} b^* \left[(1 - w^j)(x^j_t - \bar{x}^{I-j}_t) - \phi(x^{max} - x^j)\right]$$

which implies $\frac{\partial MPAI^{j}_{t-1:t}}{\partial \phi} < 0 \quad \forall j : x^{max} > x^j$

$$x^j_t - \bar{x}^I_t = \left(1 - w^j\right) \left(x^j_t - \bar{x}^{I-j}_t\right) \tag{30}$$

Figure 1: Current Account Evolution for Main Euro Area Countries





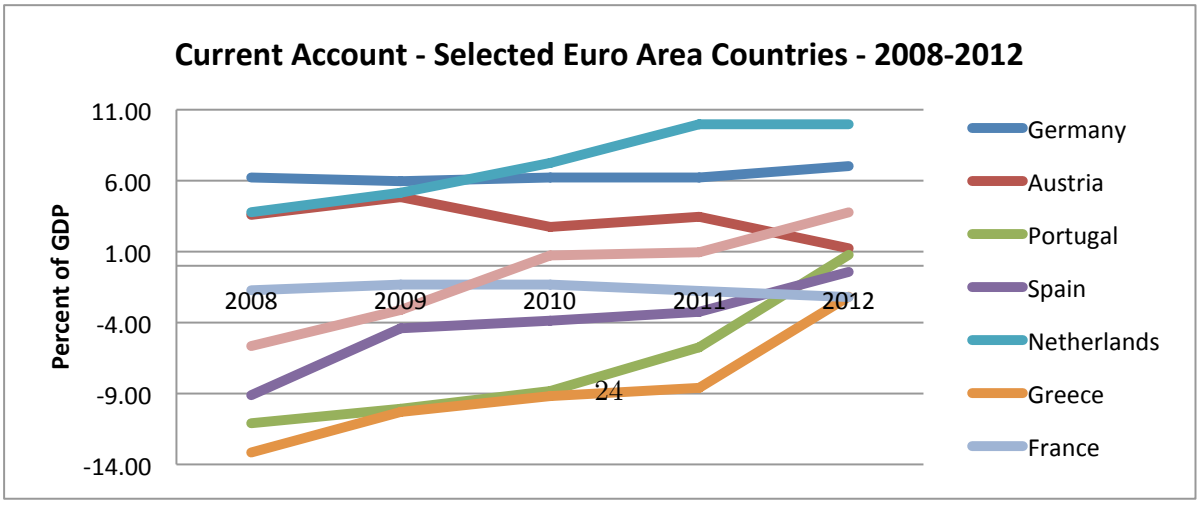
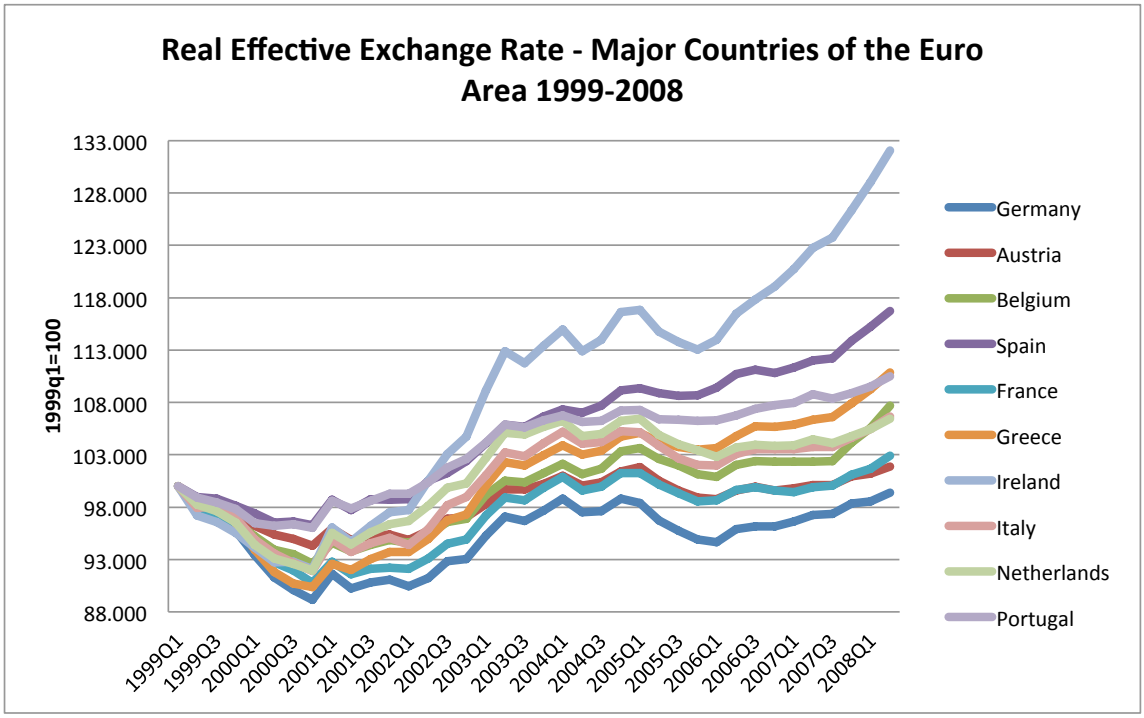


Figure 2: Real Effective Exchange Rate, Evolution for Main Euro Area Countries



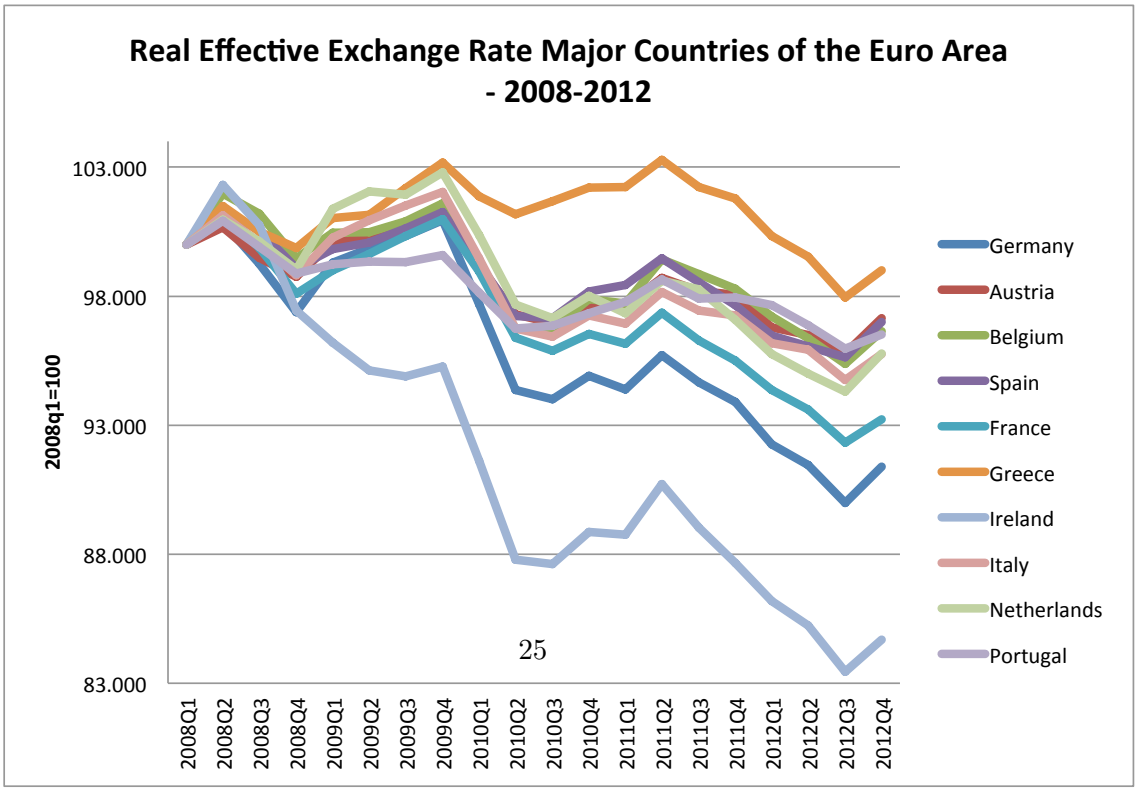
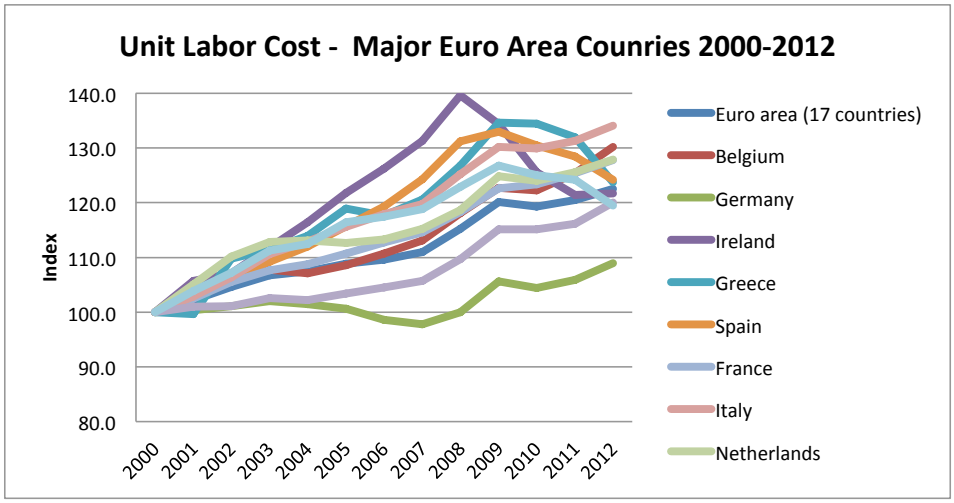
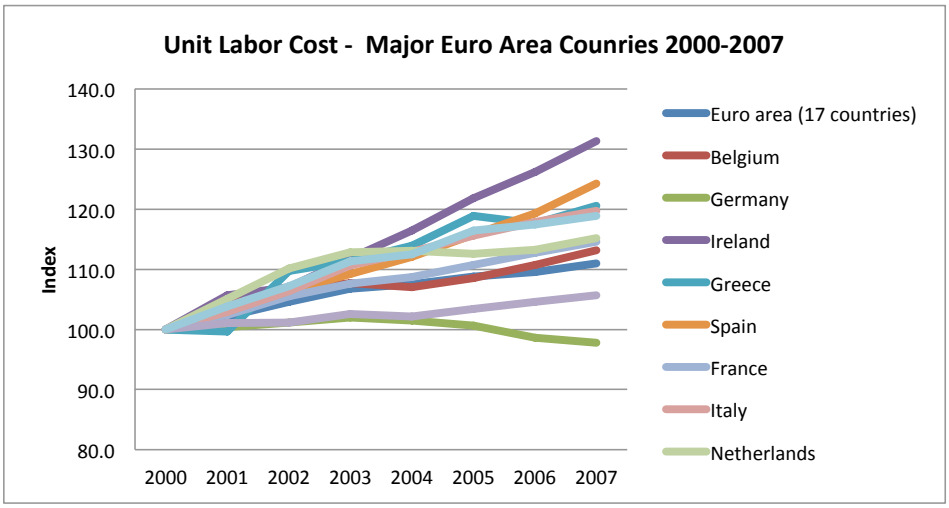


Figure 3: Unit Labor Cost,Evolution for Main Euro Area Countries





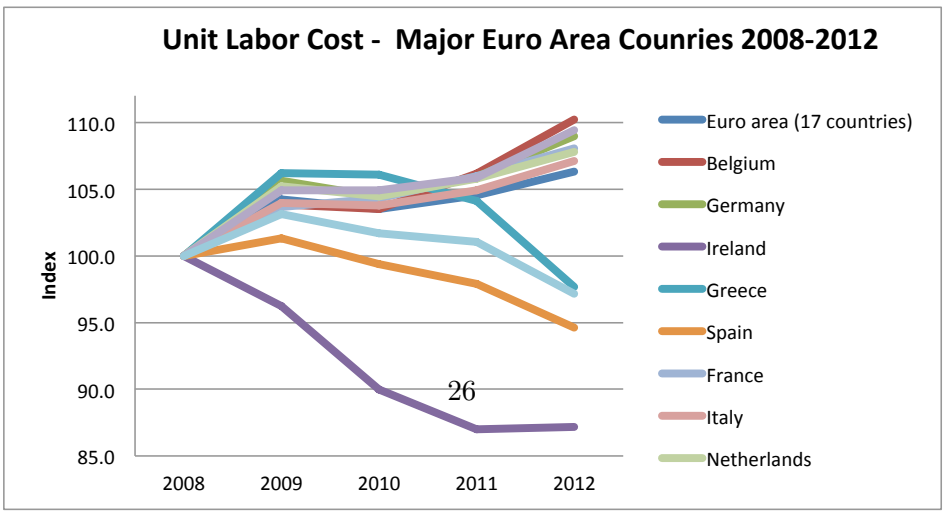


Table 1: Estimation Results for Basic Coincident and Forward Looking Interest Rate Rule, Euro Area

	(1) Eonia	(2) Eonia	(3) Eonia	(4) Eonia	(5) Eonia	(6) Eonia	(7) Eonia	(8) Eonia	(9) Eonia
Output Gap	0.562***			0.589***			0.487***		
	(0.0650)			(0.0415)			(0.0538)		
Inflation	-0.0131			0.101			0.699***		
	(0.157)			(0.124)			(0.131)		
Output Gap t+1		0.467***			0.522***			0.351***	
		(0.0671)			(0.0460)			(0.0502)	
Inflation Gap t+1		0.318*			0.430***			1.132***	
		(0.172)			(0.145)			(0.142)	
Output Gap t+2			0.352***			0.421***			0.214***
			(0.0709)			(0.0503)			(0.0540)
Inflation Gap t+2			0.676***			0.722***			1.463***
			(0.194)			(0.155)			(0.166)
Trichet (from 09/2003)				-0.811***	-0.931***	-0.908***			
				(0.112)	(0.143)	(0.177)			
National Curr. Circ.(to Jan 01)							1.093***	1.356***	1.457***
							(0.209)	(0.180)	(0.150)
Constant	2.938***	2.892***	2.869***	3.322***	3.320***	3.286***	2.630***	2.508***	2.460***
	(0.0822)	(0.0989)	(0.110)	(0.106)	(0.126)	(0.131)	(0.0692)	(0.0781)	(0.0981)
Adjusted R^2	0.638	0.512	0.414	0.845	0.782	0.667	0.744	0.715	0.700
Observations	38	38	38	38	38	38	38	38	38

Inflation is the annual percentage increase in prices for non energy and non unprocessed food. Output gap is defined as percentage deviation from natural (trend) GDP identified with HP filter. Time sample 1999q1 to 2008q2, Perfect foresight assumed fro forward variables.
Standard errors in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 4: Actual and Predicted Values for EONIA Rates, Euro Area (Coincident Policy Rule - Model 7)

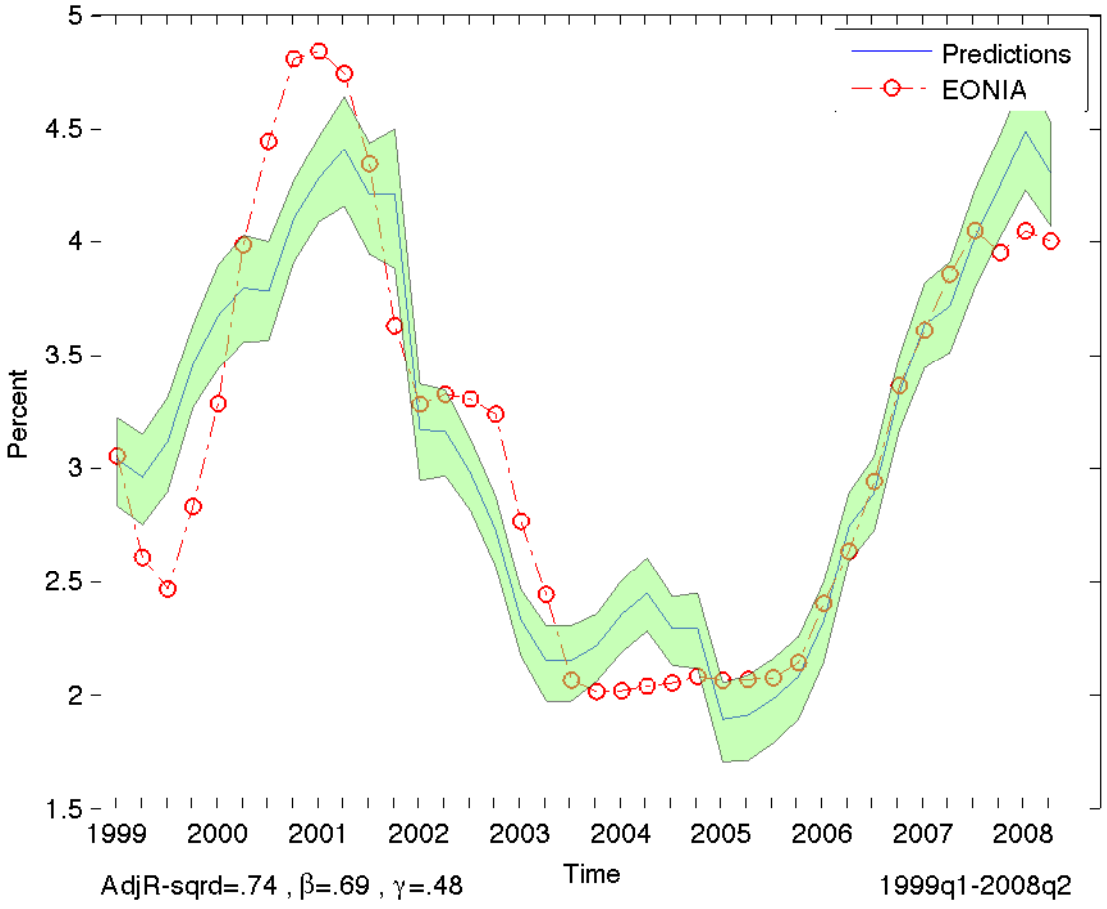


Figure 5: Actual and Predicted Values for EONIA Rates, Core (Coincident Policy Rule - Model 7)

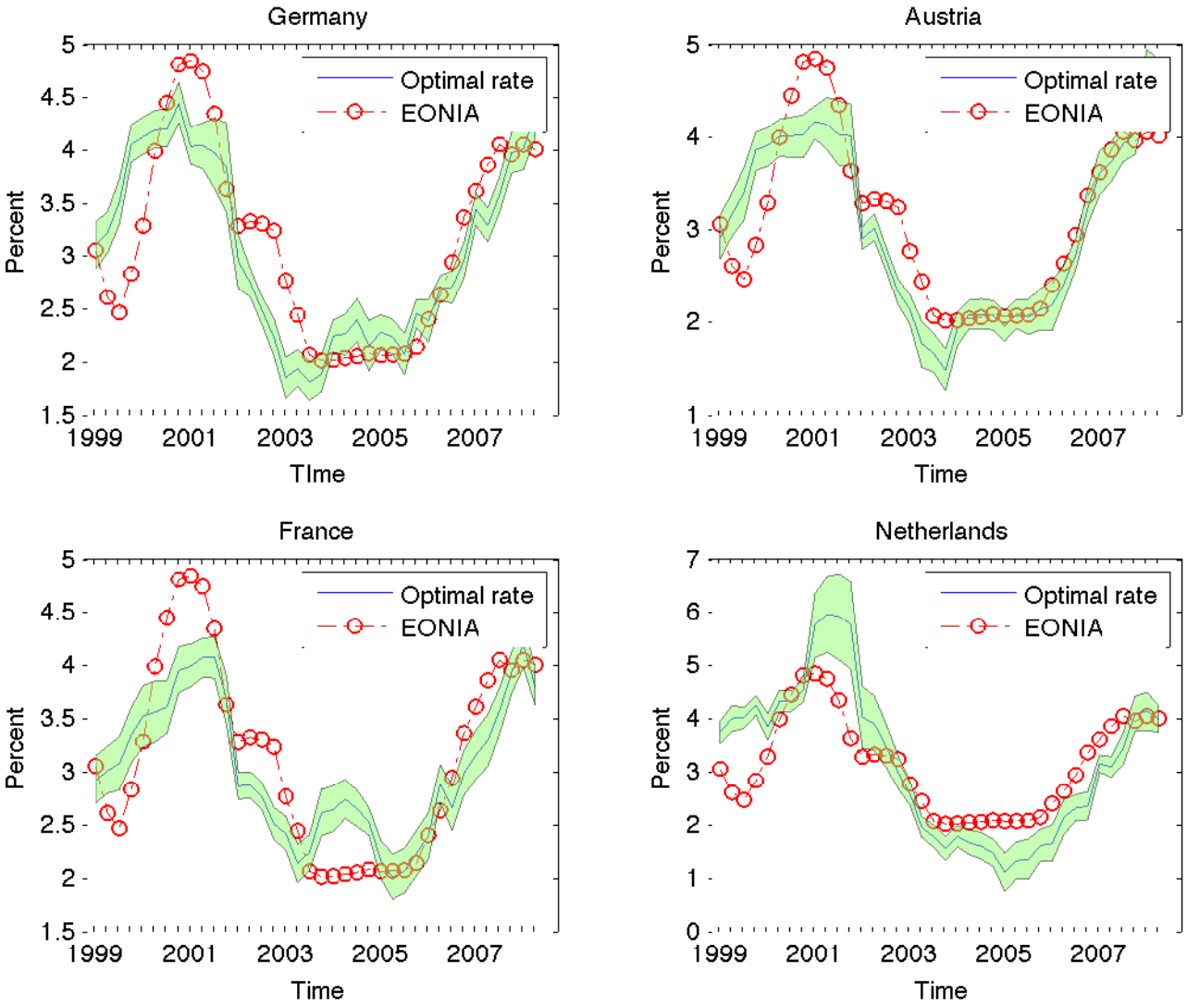


Figure 6: Actual and Predicted Values for EONIA Rates, Periphery (Coincident Policy Rule - Model 7)

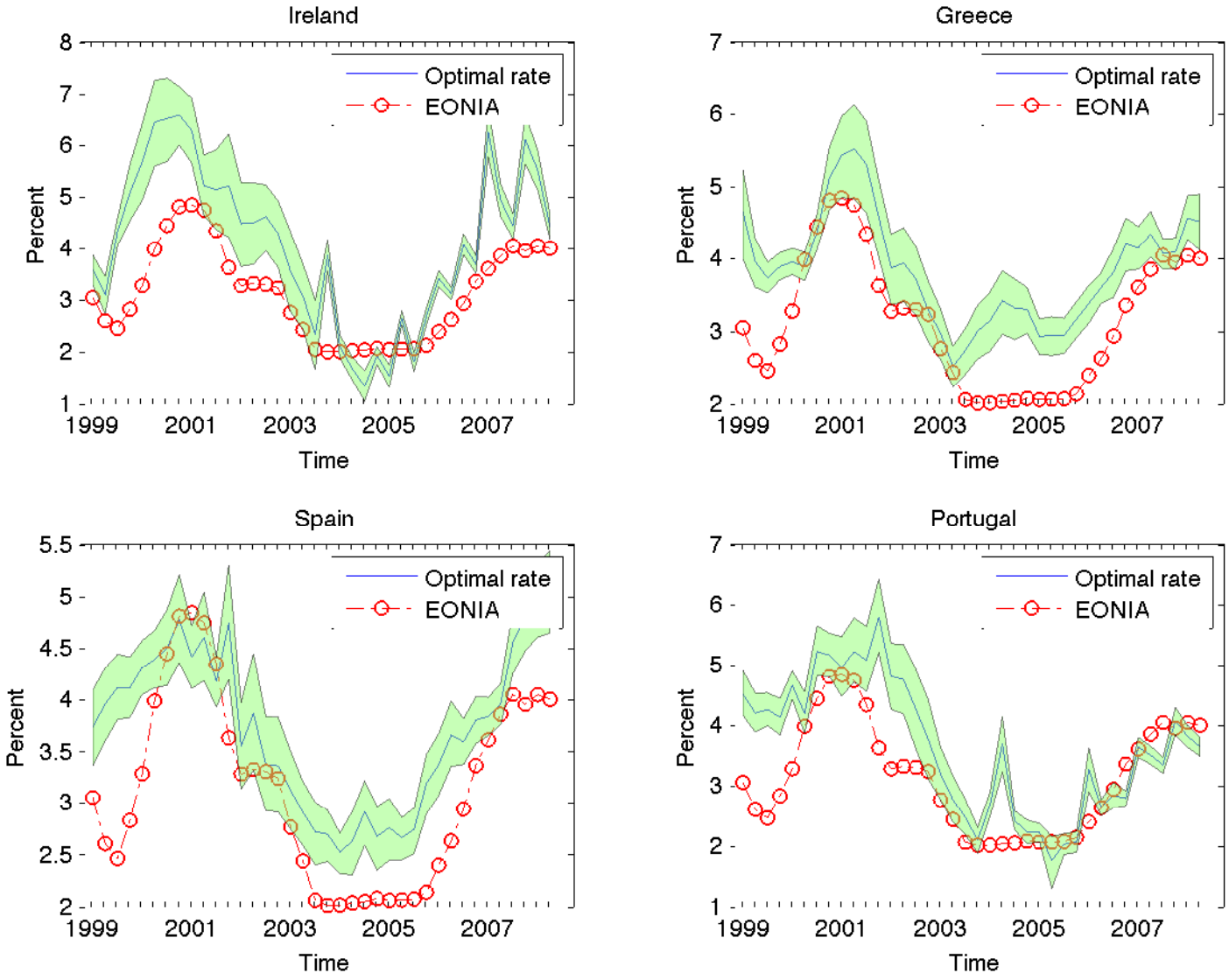


Figure 7: Index of Monetary Policy Adequacy, different specification

Average Monetary Policy Adequacy Index - Different Specifications

Lead Specification	t	t+1	t+2
Euro area	-0.02	0.05	-0.13
Belgium	-2.75	-3.08	-3.59
Germany	-12.46	-18.79	-23.71**
Ireland	36.68**	47.55**	55.72**
Greece	27.61**	37.23**	46.33**
Spain	22.1**	32.18**	39.73**
France	-3.8	-5.62	-7.35
Italy	8.39	12.07	15.02**
Cyprus	-8.05	-9.05	-6.79**
Luxembourg	20.54**	25.91	28.67**
Netherlands	2.16	2.87	2.86
Austria	-3.96	-5.98	-7.31*
Portugal	19.44	27.9	33.88**
Slovakia	58.69**	86.73	111.17**
Finland	-4.43	-7.11	-8.95
Dummies	yes	yes	yes

** 5% sig. Level

Figure 8: Index of Monetary Policy Adequacy, different specification

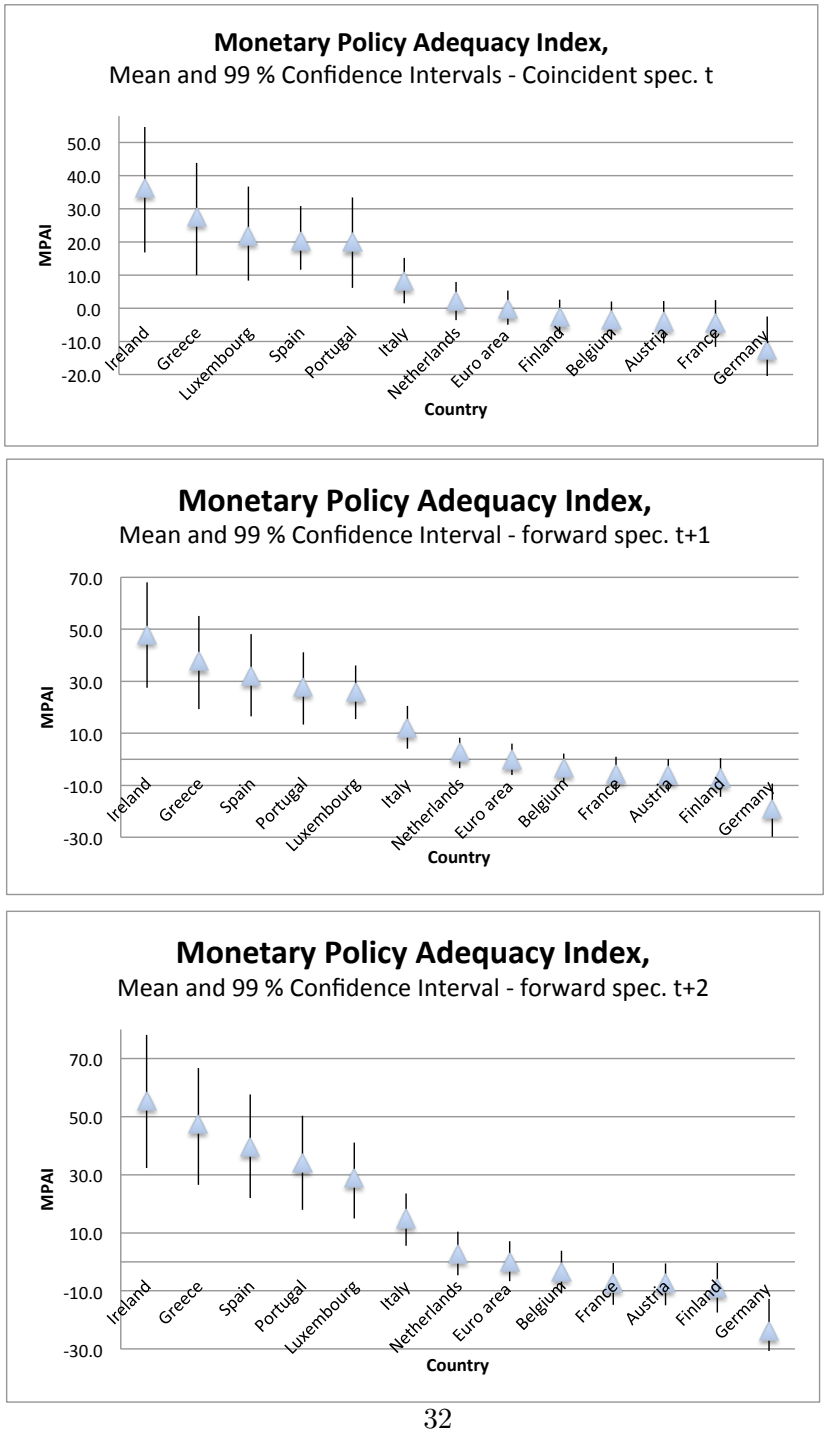


Figure 9:

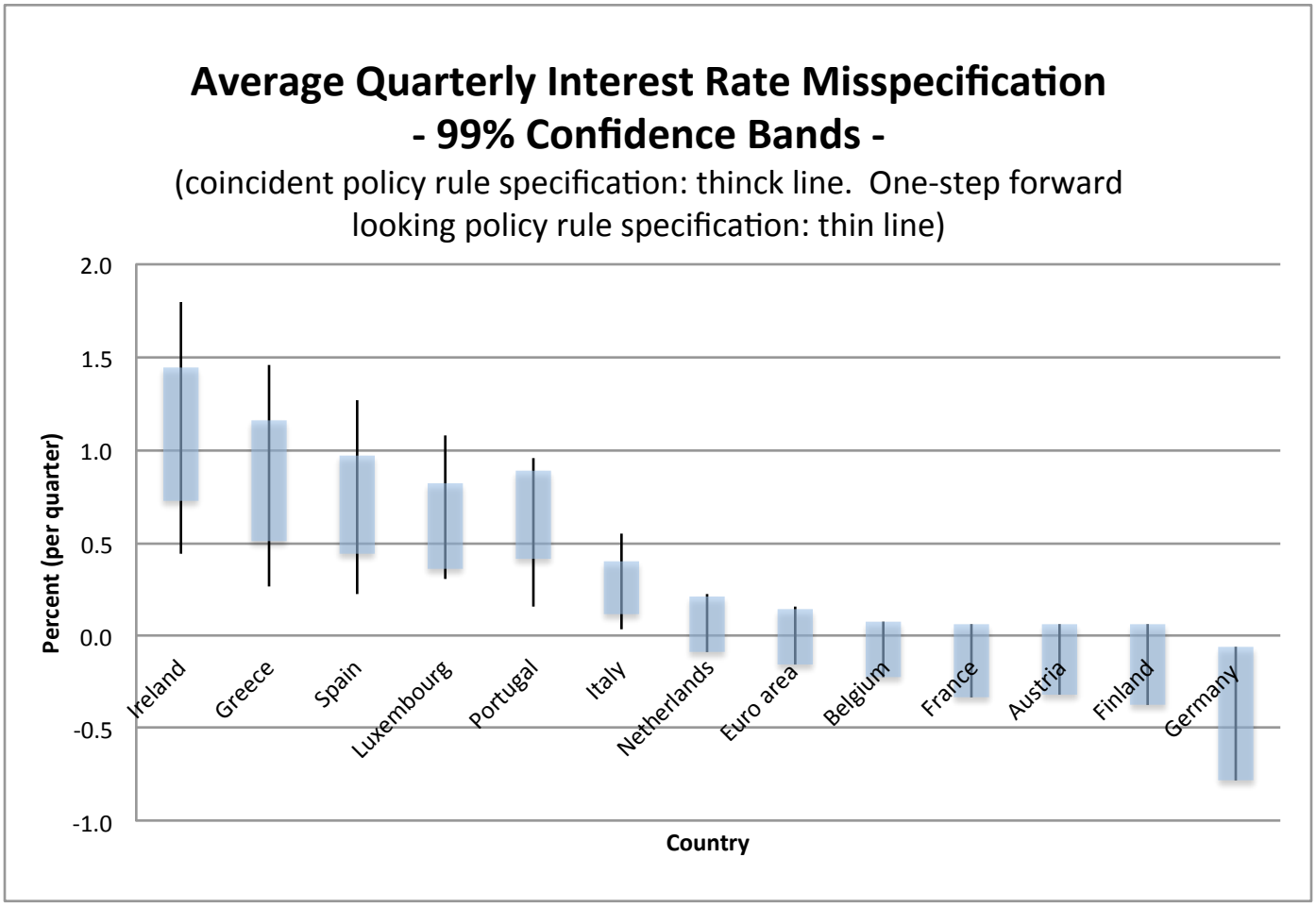

Average Quarterly Interest Rate Misspecification
- 99% Confidence Bands -
(coincident policy rule specification: thinck line. One-step forward looking policy rule specification: thin line)
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
Percent (per quarter)
Ireland
Greece
Spain
Luxembourg
Portugal
Italy
Netherlands
Euro area
Belgium
France
Austria
Finland
Germany
Country

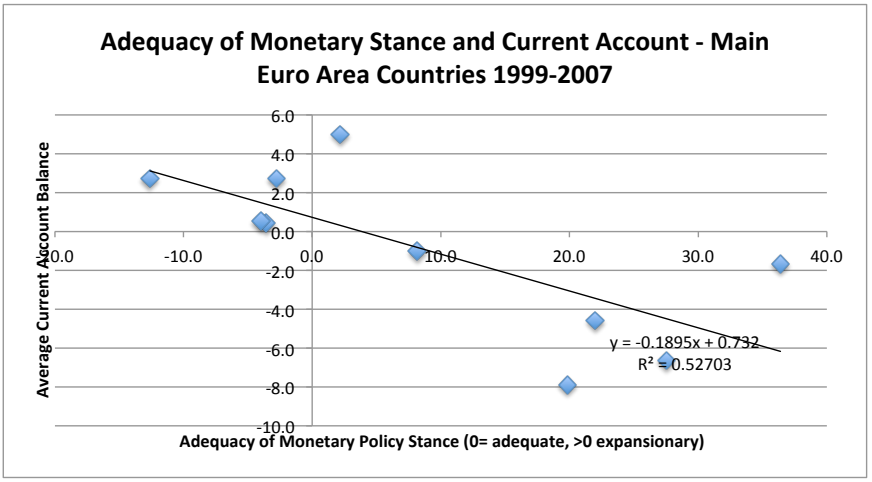
Figure 10:

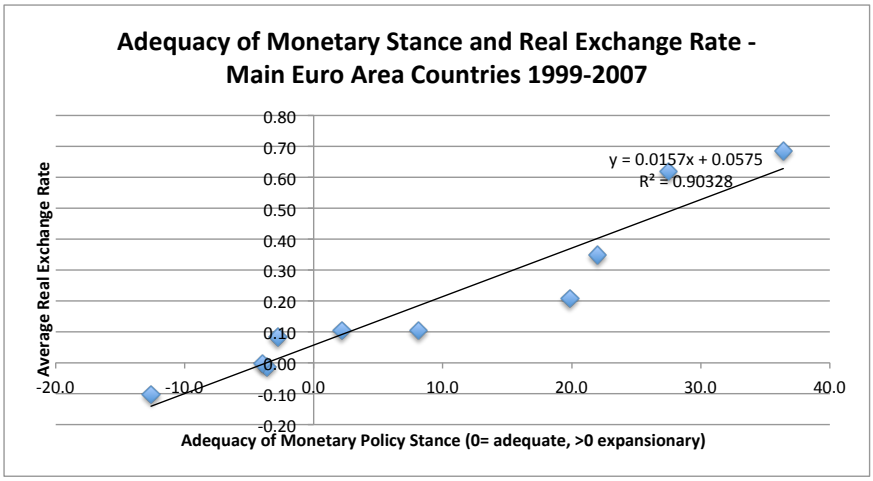
Monetary Policy and Imbalances 1999-2007

	Adequacy of Monetary Policy Stance MPAI (>0 exansionary, <0 contractionary)	Current Account % GDP	Unit Labor Cost Average y-o-y % Increase	Real Effective Exchange Rate Average y-o-y % Increase
Ireland	36.4	-1.7	3.41	0.69
Greece	27.5	-6.6	3.23	0.62
Spain	22.0	-4.6	3.15	0.35
Portugal	19.8	-7.9	2.71	0.21
Italy	8.1	-1.0	2.06	0.10
Netherlands	2.2	5.0	2.18	0.10
Belgium	-2.8	2.7	1.60	0.08
France	-3.6	0.4	1.79	-0.01
Austria	-4.0	0.5	0.55	0.00
Germany	-12.6	2.7	-0.15	-0.10

CA, REER and ULC are average over 1999-2007 (for Greece values are computed since January 2001)

Figure 11: Monetary Policy and Imbalances - 1999-2007





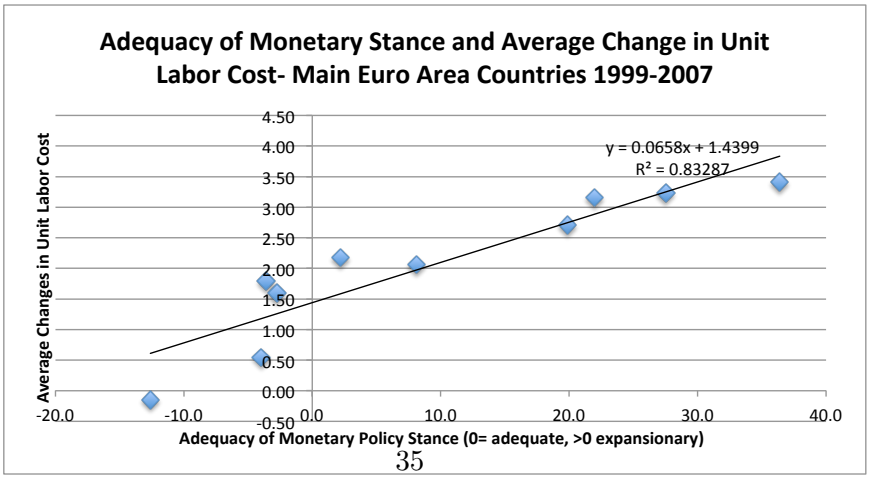


Table 2: Regression table 2: Imbalances and Monetary Policy, Coincident Policy Residuals

	(1) ULC	(2) Current Account	(3) REER	(4) Credit to Private Sec.	(5) Export Market Share
Policy Residuals	0.594**	-0.293	-1.232**	1.830*	-0.885**
	(0.238)	(0.686)	(0.216)	(0.904)	(0.179)
GDP growth	-0.755**	0.237**	0.0598	0.528**	-0.0725**
	(0.0933)	(0.0766)	(0.191)	(0.233)	(0.0325)
Inflation	-0.0967	0.457	1.645**	-1.600**	1.221**
	(0.182)	(0.470)	(0.219)	(0.705)	(0.166)
Constant	3.816**	-1.946	-2.818**	10.41**	-2.494**
	(0.762)	(1.297)	(0.924)	(2.428)	(0.445)
N	440	412	448	432	448
r2_a	0.510	0.0223	0.195	0.163	0.282

Imbalances considered are all flow imbalances contained in the EC Macroeconomic Imbalance Procedure, with exclusion of unemployment and real estate prices. Country fixed effects included, robust standard errors.

* $p < 0.10$, ** $p < 0.05$

Table 3: Regression table: Imbalances and Monetary Policy, Lagged Policy Residuals

	(1) ULC	(2) Current Account	(3) REER	(4) Credit to Private Sec.	(5) Export Market Share
L.Policy Residuals	0.697**	-0.272	-1.831**	1.958**	-0.0404**
	(0.244)	(0.529)	(0.210)	(0.871)	(0.0170)
GDP growth	-0.748**	0.226**	0.0392	0.558**	0.00364*
	(0.0874)	(0.0543)	(0.187)	(0.206)	(0.00191)
Inflation	-0.106	0.435	1.845**	-1.609*	0.0282**
	(0.200)	(0.458)	(0.254)	(0.736)	(0.00863)
Constant	3.769**	-1.815	-3.049**	10.19**	-0.0829**
	(0.759)	(1.229)	(0.841)	(2.381)	(0.0246)
N	428	403	436	421	436
r2_a	0.523	0.0214	0.283	0.167	0.0201

Standard errors in parentheses

Policy residuals are defined as deviation of the fitted from actual interest rate, a positive value indicates slack monetary policy. Imbalances considered are all flow imbalances contained in the EC Macroeconomic Imbalance Procedure, with exclusion of unemployment and real estate prices. Dependent variables computed in terms of deviations from Euro area values are REER,EMS and ULC. Country fixed effects included, robust standard errors.

* $p < 0.10$, ** $p < 0.05$

Table 4: Imbalances and Monetary Policy, Monetary Policy Adequacy Index (Average Policy Residuals from t-4 to t)

	(1) ULC	(2) Current Account	(3) REER	(4) Credit to Private Sec.	(5) Export Market Share
MPAI t-4:t0	1.099**	-0.787*	-2.697**	3.109**	-0.0433**
	(0.190)	(0.450)	(0.271)	(0.633)	(0.0162)
GDP growth	-0.774**	0.255**	0.0498	0.396**	0.00401*
	(0.0460)	(0.0794)	(0.0767)	(0.127)	(0.00212)
Inflation	-0.171	0.550**	2.066**	-1.867**	0.0229**
	(0.117)	(0.255)	(0.164)	(0.380)	(0.0102)
Constant	2.723**	-0.201	-4.150**	7.751**	-0.0588**
	(0.364)	(0.719)	(0.505)	(1.096)	(0.0220)
Country FE	Yes	Yes	Yes	Yes	Yes
N	408	388	415	402	415
r2_a	0.525	0.747	0.384	0.647	-0.0108

Standard errors in parentheses

More details on the Monetary Policy Adequacy Index (MPAI) in the text, positive value indicates slack monetary policy. The index measures the average deviation of interest rates from the desirable level, over the preceding 4 quarters Imbalances considered are all flow imbalances contained in the EC Macroeconomic Imbalance Procedure, with exclusion of unemployment and real estate prices.Country fixed effects included, robust standard errors

* $p < 0.10$, ** $p < 0.05$

Table 5: Imbalances and Monetary Policy In the US

	(1) Unit Labor Cost	(2) Export Market Share	(3) REER	(4) Unit Labor Cost	(5) Export Market Share	(6) REER
Policy Residuals	-0.116**	-0.00795*	-0.568**	-0.414**	-0.0337**	-0.744**
	(0.0146)	(0.00431)	(0.0258)	(0.0942)	(0.0152)	(0.225)
Inflation	-0.0393	0.00885*	0.947**	-0.104**	0.00694	0.425**
	(0.0276)	(0.00524)	(0.123)	(0.0373)	(0.00481)	(0.0822)
GDP Growth	-0.207**	-0.00158	0.0886**	-0.225**	-0.00112	-0.0850**
	(0.0273)	(0.00422)	(0.0385)	(0.0300)	(0.00387)	(0.0369)
Migration				0.107	-0.0582	7.032**
				(0.185)	(0.0515)	(0.369)
Migration X M.P.Stance				0.368**	0.0291**	0.714**
				(0.109)	(0.0132)	(0.239)
Constant	1.153**	-0.0257	-0.386	1.327**	0.0303	-4.632**
	(0.114)	(0.0276)	(0.415)	(0.168)	(0.0591)	(0.324)
Country FE	Yes	Yes	Yes	Yes	Yes	
N	1020	613	1020	867	613	867
r2_a	0.438	-0.00173	0.102	0.491	-0.00299	0.119

Standard errors in parentheses

Policy residuals are defined as deviation of the fitted from actual interest rate, positive value indicates slack monetary policy. Country fixed effects included, robust standard errors.

* $p < 0.10$, ** $p < 0.05$

Table 6: Imbalances and Monetary Policy, The Effect of Migration

	(1) ULC	(2) Current Account	(3) REER	(4) Credit to Private Sec.	(5) Export Market Share
MPAI t-4:t0	1.656***	1.280	-5.636***	5.760***	-0.119***
	(0.601)	(1.377)	(0.778)	(1.986)	(0.0519)
GDP growth	-0.785***	0.144	0.205***	0.296***	0.00671***
	(0.0577)	(0.103)	(0.0831)	(0.150)	(0.00287)
Inflation	-0.167	0.478**	2.140***	-1.906***	0.0235***
	(0.117)	(0.260)	(0.163)	(0.388)	(0.0105)
Migration	3.291***	-3.197	3.721***	5.151*	-0.174
	(1.170)	(3.575)	(1.659)	(3.155)	(0.155)
Migration X M.P.Stance	-2.680	-9.784*	14.18***	-12.62	0.363**
	(2.717)	(5.948)	(3.287)	(9.154)	(0.209)
Constant	2.091***	1.049	-5.701***	7.207***	-0.0360
	(0.401)	(1.059)	(0.608)	(1.220)	(0.0396)
Country FE	Yes	Yes	Yes	Yes	Yes
N	408	388	415	402	415
r2_a	0.528	0.750	0.427	0.648	-0.00999

Standard errors in parentheses

More details on the Monetary Policy Adequacy Index (MPAI) in the text, positive value indicates slack monetary policy. Imbalances considered are all flow imbalances contained in the EC Macroeconomic Imbalance Procedure, with exclusion of unemployment and real estate prices. Country fixed effects included, robust standard errors.

* $p < 0.15$, ** $p < 0.10$, *** $p < 0.05$

Table 7: Relative Fiscal and Monetary Policy in the Euro Area

	(1) Fiscal Balance	(2) Net Payments From EU
MPAI t-4:t0	-9.068**	3.617**
	(2.529)	(1.178)
GDP growth	2.234**	-0.445
	(0.564)	(0.267)
Constant	-11.00**	1.748
	(2.617)	(1.236)
N	414	89
r2_a	0.558	0.481

Standard errors in parentheses

Between estimator. The two dependent variables represent the national fiscal balance and the net payments from the EU as a share of GDP

* $p < 0.10$, ** $p < 0.05$

Figure 12: Internal Migration as a Share of Population, Euro Area and US

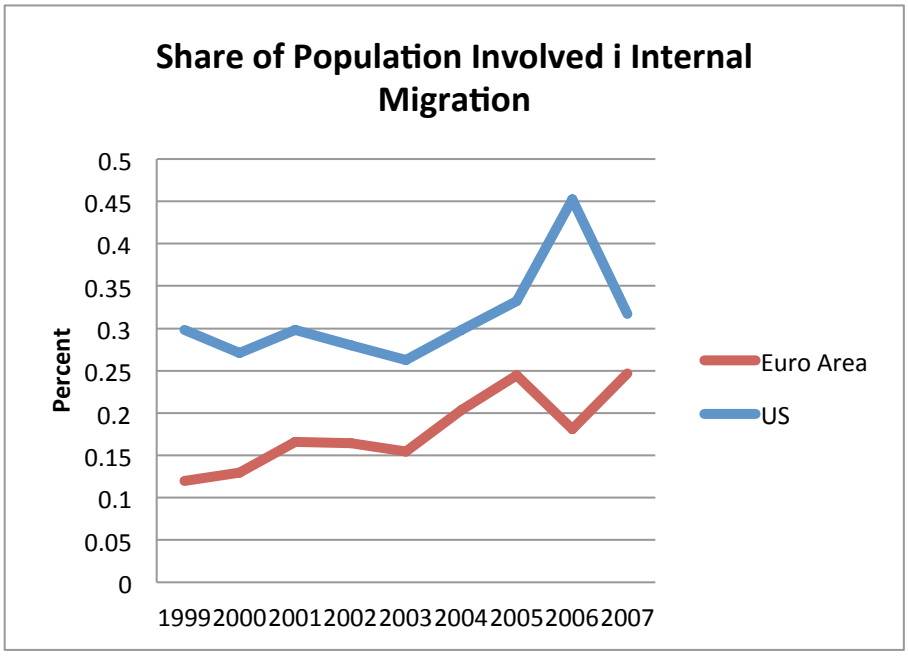


Figure 13: Central and Regional Fiscal Spending in the US and European Union