

Moretti, Laura

Working Paper

The determinants of inflation differentials in the euro area

CFS Working Paper, No. 451

Provided in Cooperation with:

Center for Financial Studies (CFS), Goethe University Frankfurt

Suggested Citation: Moretti, Laura (2014) : The determinants of inflation differentials in the euro area, CFS Working Paper, No. 451, Goethe University Frankfurt, Center for Financial Studies (CFS), Frankfurt a. M.

This Version is available at:

<http://hdl.handle.net/10419/93094>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



CFS WORKING PAPER

No. 451

The determinants of inflation differentials in the euro area

Laura Moretti





CFS Working Paper Series

The *Center for Financial Studies*, located in Goethe University's House of Finance in Frankfurt, is an independent non-profit research center, funded by the non-profit-making organisation Gesellschaft für Kapitalmarktforschung e.V. (GfK). The CFS is financed by donations and by contributions of the GfK members, as well as by national and international research grants. The GfK members comprise major players in Germany's financial industry. Established in 1967 and closely affiliated with the University of Frankfurt, it provides a strong link between the financial community and academia. CFS is also a contributor to policy debates and policy analyses, building upon relevant findings in its research areas.

The CFS Working Paper Series presents the result of scientific research on selected topics in the field of money, banking and finance. The authors were either participants in the Center's Research Fellow Program or members of one of the Center's Research Projects.

If you would like to know more about the Center for Financial Studies, please let us know of your interest.

A blue ink signature of Prof. Michalis Haliassos, written in a cursive style.

Prof. Michalis Haliassos, Ph.D.

A blue ink signature of Prof. Dr. Jan Pieter Krahen, written in a cursive style.

Prof. Dr. Jan Pieter Krahen

A blue ink signature of Prof. Dr. Uwe Walz, written in a cursive style.

Prof. Dr. Uwe Walz



The determinants of inflation differentials in the euro area

Laura Moretti*

December 2013

Abstract

Inflation differentials in the euro area have been persistent since the adoption of the single currency. This paper analyzes the impact of product and labor market regulation on inflation in a sample of 11 countries. The results show that, after the adoption of the euro, product market deregulation has a relevant and significant effect on the level of inflation, while higher labor market regulation increases the responsiveness of inflation to the output gap.

JEL: E31, E58, E65, L51.

Keywords: Labor Market Deregulation, Product Market Deregulation, EMU, Inflation Rate.

*I would like to thank Alessandro Barattieri, Stefan Gerlach and Silvana Tenreyro for helpful comments. All errors are mine. Correspondence address: Center for Financial Studies, Goethe University Frankfurt, House of Finance, Grüneburgplatz 1, 60323 Frankfurt, Germany. Email address: moretti@ifk-cfs.de.

1 Introduction

After the adoption of the single currency, inflation differentials in the euro zone countries have remained persistent. This phenomenon has increasingly become a cause of concern and it has contributed, to some extent, to the building up of the imbalances within the monetary union. In fact, common policy rates are set based on aggregate inflation and output gap, and countries with inflation persistently higher than average have experienced lower real interest rates for a protracted period of time. This has led to divergent developments in competitiveness and, in some countries, to a stronger credit growth and housing booms. Moreover, lower real interest rates allowed governments to borrow easily, slowing-down fiscal consolidation.¹

It is not uncommon for inflation to temporarily diverge in a monetary union, due to differences in business cycles, processes of real convergence, the so called “Balassa-Samuelson effect”, or to a different impact of the exchange rate due to countries’ exposure to extra-union trade. However, if inflation differences are persistent, they might signal different institutions and asymmetries in the implementation of structural reforms. In fact, the adoption of the single currency led to a substantial convergence in inflation expectations², but affected less inflation persistence³, suggesting that inflation dynamics remain partly determined by country specific institutions and by their ability to absorb heteroskedastic shocks. Moreover, structural reforms, which reduce mark-ups and the price level, have also a temporary effect on inflation.

The literature presents contrasting results on the role of product versus labor market regulation on inflation. In fact, Correa-López et al. (2013) find that lower product market regulation reduced the persistence of inflation and increased its responsiveness to changes

¹See Praet (2012).

²As documented in Ehrmann et al. (2011).

³The ECB and the national Central Banks set up the Inflation Persistence Network with the aim of analyzing the change in inflation dynamics after the adoption of the single currency. The results, summarized in Altissimo et al. (2006) and Angeloni et al. (2006), show that inflation persistence is moderate in the euro area and it declined after the mid-1990s, but there was no evidence of changes after the establishment of the monetary union.

in productivity growth, while Jaumotte and Morsy (2012) find mixed evidence on the effect of product market regulation on inflation and, instead, that more regulated labor markets contributed significantly to the high and persistent inflation differentials.

The aim of this paper is to take a further look at the impact of product and labor market regulation on inflation for a sample of 11 euro area countries after the adoption of the single currency (1999-2007). In particular, the objective is to disentangle their effects and evaluate the impact of product market deregulation not only on inflation persistence, but also on the level of inflation, while controlling for the same monetary policy institution.⁴ As a robustness check, I repeat the analysis also for the period after the establishment of the common market (1994-2007).

I estimate a traditional backward-looking Phillips curve⁵ augmented for product and labor market regulation. Given the autocorrelated nature of inflation, the dynamic panel is estimated with Feasible Generalized Least Squares (FGLS) allowing for a different error variance for each country. In fact, since the time series is relative long, the use of the Arellano-Bond estimator is not optimal because the number of instruments increases with the time dimension. However, the sample is not sufficiently long for the bias in the estimated standard errors to disappear and for using a fixed effect estimator.⁶

First, I estimate the panel data model assuming that product and labor market regulation are exogenously and independently determined. The results show that, after the adoption of the euro, labor market regulation increases the persistence of inflation and dampens the responsiveness of inflation to the output gap, while product market regulation has no statistically significant effects on these variables, confirming Jaumotte and Morsy's (2012) findings. However, product market deregulation has a relevant and statistically significant impact on the level of inflation. Moreover, in order to investigate further the impact of labor market

⁴Moretti (2012) shows that product market deregulation significantly reduces inflation rate in inflation targeting countries.

⁵See Bowdler and Nunziata (2007), Biroli et al. (2010), Correa-López et al. (2013) and Jaumotte and Morsy (2012).

⁶See Judson and Owen (1999).

deregulation, I analyze separately the effect of regulation in regular versus temporary contracts, showing that the former only marginally increases the persistence of inflation, while the latter reduces the responsiveness of inflation to the output gap.

Then, I take into account the interdependence between the reforms and their potential endogeneity by carrying out the estimates using a control function approach. The importance of this issue has been pointed out by Fiori et al. (2012), which builds on Blanchard and Giavazzi's (2003) model, analyzing the effects of regulation on employment, but it has never been considered when analyzing the impact on inflation. Previous results are confirmed when controlling for policy interdependence and for political economy determinants.⁷

To capture the state of product market regulation I use the Indicators of Regulation in Energy, Transport and Communication (ETCR) coded by Conway and Nicoletti (2006). They provide, to my knowledge, the longest time series currently available (1975-2007) to compare product market regulation across countries in the non-manufacturing sectors, which constitute two-thirds of economic activity and are only affected by import penetration to a limited extent. ETCR takes into account market characteristics such as barriers to entry, public ownership, excessive vertical integration and the presence of price controls. It is a 0-6 index, where 0 denotes the lowest level of regulation and 6 the highest.

The Employment Protection Legislation (EPL) index, also coded by the OECD, captures labor market regulation. EPL, which is available annually for the period 1985-2008, measures the procedures and costs involved in the dismissals of individuals or groups of workers for both regular and temporary contracts. I use also the two subcategories: the index for labor market regulation for regular contracts (EPR) and for temporary contracts (EPT). It is important to note that employment protection refers to only one dimension of the complex set of factors that influence labor market flexibility. In this paper I focus on country specific policies rather than structural characteristics of the labor market. Nevertheless, I verify the robustness of the results using also trade union density.

⁷See Høj et al. (2006) and Alesina et al. (2011).

Deregulation in product and labor markets reduces unemployment⁸, boosts growth and increases productivity⁹ and it is usually advocated, especially in the euro area peripheral countries, to regain competitiveness. From a policy point of view, it is important to analyze the impact of regulation on inflation and inflation persistence, paying particular attention to the interactions between reforms and to the reforms that created segmented labor markets. In fact, country specific institutions are particularly important for the reduction and absorption of asymmetric shocks, because a common currency precludes the use of monetary policy to offset asymmetric shocks, and the use of competitive devaluation to regain competitiveness. Moreover, deregulation reforms have a relevant impact on the inflation dynamics which should be taken into account also by monetary policy.¹⁰

The rest of the paper is organized as follows: Section 2 briefly summarizes the related literature. Section 3 describes the sample. Section 4 presents the empirical strategy and the results. Section 5 tackles the endogeneity issues. Section 6 concludes.

2 Related Literature

The divergence in the inflation rates among the euro area members has received considerable attention in the literature.

Honohan and Lane (2003) emphasize that, at the beginning of the monetary union, the main driving force of the inflation divergence was the differential impact of the euro weakness depending on the country's exposure to extra-union trade. They run static multivariate panel regressions for the period 1999-2001. However, when a longer sample period is analyzed and when the persistence of inflation is taken into account, the results are less clear and the nominal effective exchange rate is not statistically significant, as shown in Angeloni and

⁸On the effect of the interaction between product and labor market policies on employment see Nicoletti and Scarpetta (2005), Berger and Danninger (2006), Bassanini and Duval (2006), Griffith et al. (2007), Amable et al. (2007) and Fiori et al. (2012).

⁹See Nicoletti and Scarpetta (2003)

¹⁰See Cacciatore and Fiori (2012), Cacciatore, Fiori and Ghironi (2012) and Eggertsson et al. (2013) for a theoretical analysis.

Ehrmann (2004).

The subsequent literature analyses institutional differences as a possible cause. Andersson et al. (2009), using a dynamic panel data model for the period 1999-2006, show that the main determinants of inflation differentials are developments in per capita GDP, productivity levels, cyclical positions, and, to some extent, wage growth and changes in product market regulation. Unfortunately, the inclusion of product market regulation further reduces the sample to the period 1999-2003 and labor market regulation is not included in the analysis.

Bowdler and Nunziata (2007) analyze, instead, the impact of labor market structures (degree of union coordination and unionization rate) on the response of inflation to economic shocks. They find that high level of coordination in the labor market dampens the response of inflation to movements in unemployment, productivity and import prices, both on impact and dynamically, while unionization rate has the opposite effect. They argue, in fact, that in highly coordinated labor markets, unions are able to assess the impact of their demands on the macroeconomic outcomes leading to wage moderation and low inflation, instead, when unionization rate is high, workers are able to extract higher compensations following economic shocks contributing to a higher inflation.

Correa-López et al. (2013), building on Bowdler and Nunziata (2007), estimate a backward-looking Phillips curve augmented for product market regulation and labor market structure. Using a panel of 20 OECD countries for the period 1960-2006, they confirm previous results that product market regulation is the main driving force of inflation differentials. They show that lower product market regulation reduces the persistence of inflation and increases its responsiveness to changes in productivity growth. In fact, as shown in Guerrieri et al. (2010), an increase in market competition reduces firms' mark-ups and puts a downward pressure on inflation. However, as measures of labor market regulation they use only the level of coordination in wage bargaining and the percentage of unionization, but not the labor market regulation index *EPL*. Moreover, since the product market regulation index *ETCR* is available only from 1975, they assume it constant at the initial value for the period

1960-1974. Additionally, they analyze a long sample period that encompasses very different monetary policy regimes. To tackle this issue, they introduce dummies for the different monetary policy regimes interacting them with macroeconomic variables. However, this does not control for the direct impact of different monetary policy regimes on inflation, potentially biasing the results.¹¹

Biroli et al. (2010) also analyze the effects of product and labor market institutions on inflation differentials for 12 euro area countries for the period 1970-2006. They find that tighter product market regulation, higher minimum wage and union density increase inflation persistence. However, they only analyze the impact of one variable at the time and they do not control for the different monetary policy regimes.

Jaumotte and Morsy (2012), whose work is closely related to this, extend previous studies and analyze the determinants of inflation for a panel of 10 euro area countries for the period 1983-2007. They also use a traditional backward-looking Phillips curve augmented to explore the role of a broad set of labor and product market indicators in affecting inflation persistence and the responsiveness of inflation to the output gap. Contrary to previous studies, their results show mixed evidence on the effect of product market deregulation on inflation persistence, and that more regulated labor markets contribute significantly to the persistence of inflation differentials. However, they do not control for the different monetary policy regimes, which also contributed to the different inflation dynamics before the adoption of the euro.

Besides not fully taking into account the effect of monetary policy institutions, another potential issue overlooked in this strand of literature is the interdependence of policy reforms. In fact, Fiori et al. (2012), who build on Blanchard and Giavazzi (2003), show that product and labor market reforms are economic substitutes, in the sense that product market deregulation has a greater effect on employment when labor markets are more regulated

¹¹See Moretti (2012) for an analysis of the effect of inflation targeting and of product market deregulation on inflation; and see Hansen (2007) and Bertrand et al. (2004) for the econometric issues raised by introducing dummy variables in a dynamic panel.

and workers have more bargaining power. However, they can be considered also political complements since reforms in product markets led, over time, to an easing of labor market policies. Berger and Danninger (2005) also point out the important interaction effects between product and labor market reforms on the employment rate. For these reasons, I also take into consideration the sequentiality and endogeneity of the reforms in the estimations. Following Fiori et al. (2012), that builds on Høj et al. (2006) and Alesina et al. (2011), I use a control function approach to account for the interdependence of policies and political economy determinants of product and labor market regulation.

Most of the literature has focused on the effect of structural reforms on employment¹², but it is important to consider also their impact on inflation and inflation persistence. In fact, product market deregulation, by lowering the entry barriers, leads to a reduction in mark-ups, price level and temporarily in inflation, with important implications also for monetary policy. In fact, Andrés et al. (2008) show, using a two-country monetary union general equilibrium model, how inflation differentials can emerge when there is cross-country heterogeneity in the degree of competition in goods markets. Cacciatore and Fiori (2012) develop a dynamic stochastic general equilibrium model with endogenous producer entry and labor market frictions. They show that lower product and labor market regulation amplify the impact response to shocks, but reduce their persistence. Cacciatore et al. (2012) propose an extension to analyze the interaction between deregulation in product and labor markets and monetary policy. They conclude that deregulation reduces distortions in good and labor markets and make price stability less costly over the cycle. In particular, Eggertsson et al. (2013) analyze the effect of structural reforms in an open economy with two sectors and two countries that form a monetary union. They show that, in normal times, lower mark-ups in the non-tradable sector temporarily reduce inflation in the country that implements the reforms (e.g. euro periphery) but increase output in the long run. However, during a crisis, when the nominal interest rate hits its lower bound, the effects of the reforms can be coun-

¹²See for example Nicoletti and Scarpetta (2005), Griffith et al. (2007), Amable et al. (2007), Berger and Danninger (2006), Bassanini and Duval (2006) and Fiori et al. (2012) among others.

terproductive because they induce a worsening of the deflationary pressures and a decline in output.

Nevertheless, also wage rigidities, might affect inflation dynamics. Krause and Lubik (2007) develop a New Keynesian model with search and matching frictions and find that real wage rigidities have only a limited effect on inflation dynamics. However, Campolmi and Faia (2009) extend the model to a two-country currency area and find that differences in labor market institutions can generate significant differentials in the volatility of real wages, marginal costs for firms and inflation when the model is subject to a variety of realistic shocks. Nevertheless, Galí (2012) shows that it is not generally true that wage flexibility is welfare improving.

3 Data and Preliminary Evidence

In this section I present the sample, review the behavior of the inflation rate and present the variables used in the empirical work.

The analysis focuses on the first 12 countries that adopted the euro¹³, for the period 1999-2007, but results using the sample 1994-2007, after the implementation of the European Economic Area¹⁴, are also presented. In the econometric work Luxembourg is dropped due to lack of data on product and labor market regulation.

As shown in Figure 1 the inflation rates in the euro zone countries converged before the adoption of the common currency, but they started diverging again afterwards. Even though variations in cross-country inflation within a monetary union are not uncommon¹⁵ due to differences in business cycles, productivity growth or real convergence, they become a

¹³Greece qualified in 2000 and joined in 2001, while the first 11 qualified in 1998 and joined in 1999.

¹⁴The EEA Agreement was signed in Porto on May 2nd 1992 by then seven states of the European Freedom Trade Association (Austria, Denmark, Norway, Portugal, Sweden, Switzerland and the United Kingdom) and the then 12 members of the European Community (Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain and United Kingdom. Austria, Finland and Sweden acceded to the European Union, which superseded the European Community upon the entry into force of the Maastricht Treaty on November 1st 1993). It was officially established on January 1st 1994).

¹⁵See Praet (2012) for a comparison between US and eurozone.

matter of concern when they are highly persistent. Figure 2 presents the inflation differentials cumulated starting from 1999 and shows the considerable divergence between Greece and Ireland, the countries with the highest cumulated inflation, and Germany, the one with the lowest. As it is well summarized in Praet's (2012) speech, these differences led to divergent developments in competitiveness, contributing to the building up of imbalances and denoting the existence of structural differences between eurozone countries.

As a preliminary evidence of the role of product market regulation (measured by ETCR), Figure 3 presents the scatter plot of the average inflation and the average product market regulation index over the period 1999-2007. There is a clear positive relationship between the variables. However, further analysis is required to distinguish the impact of regulation on the persistence or on the level of inflation.

As in previous studies, I use the Indicators of Regulation in Energy, Transport and Communications (ETCR), coded by Conway and Nicoletti (2006), to proxy for product market regulation. They provide the longest time-series (1975-2007) currently available, to my knowledge, to compare product market regulation across countries in the non-manufacturing sectors that generate two-thirds of economic activity and are affected by import penetration only to a limited extent. They take into account market characteristics such as barriers to entry, public ownership, vertical integration, monopolies and the presence of legally imposed price controls, which distort the market and contribute to keep prices high. I use the summary of sectoral indicators that captures the level of regulation in seven non-manufacturing industries: air passenger transport, telecommunication, electricity, gas, postal services, rail transport and road freight. ETCR is a 0-6 index, with 6 representing the highest level of regulation and 0 the lowest. The index, which is annual and starts in 1975, was initially computed for a sample of 21 OECD countries until 2003, but was recently updated to 2007. The new index has missing data points that I linearly interpolate.¹⁶ Figure 4 shows the paths of

¹⁶In particular, there are missing data for Austria for the period 1976-1989, for Germany for the years 1991-1997, Norway 1999-2002, Portugal 1999-2002 and Spain 1988-1997, for a total of 39 missing value out of 693 (5.63%).

ETCR for the 11 countries in the sample for the period 1985-2007 plotted with their annual inflation rate. All countries in the sample started with a high level of regulation, underwent the bulk of the reforms in the 1990s and reduced by half their level of regulation by the end of the sample. In the analysis I will employ both the variable in level, in the interaction terms, and its absolute change ($\Delta ETCR$), as a measure of deregulation.

As a proxy for labor market regulation I use the index of Employment Protection Legislation (EPL), available annually for the period 1985-2008. EPL is a measure of the procedures and costs involved in the dismissal of individuals and groups of workers, computed as the average between the sub-indicator of dismissal of employees in regular contracts (EPR) and the one on strictness of regulation in temporary contracts (EPT). EPL is also a 0-6 index, from the lowest to the highest level of regulation. However, the average index EPL does not provide a clear picture of the deregulation process in the labor market because most of the countries implemented reforms only on employment protection legislation of temporary contracts. Figure 5 reports the evolution of EPR and EPT in the countries of the sample. Very few countries (e.g. Belgium, Finland, Portugal, and Spain) implemented deregulation reforms in the employment protection legislation of regular contracts, while most of the deregulation was implemented in the temporary contracts. Hence, it is important to disentangle the effects of these reforms and not to use only the aggregate index EPL.

In the literature, other proxies for labor market regulation have been proposed. Fiori et al. (2012) use also the gross replacement rates, which express gross unemployment benefit levels as a percentage of previous gross earnings, to proxy for the generosity of the unemployment insurance system. However, these rates are collected only for odd years for the periods 1961-2005 or 2001-2011, reducing considerably the sample. Additional measures for labor market institutions are trade union density¹⁷, the percentage of union members, and the degree of coordination in the wage bargaining process, a 1-3 index measuring the level of coordination.

¹⁷Trade union density corresponds to the ratio of wage and salary earners that are trade union members, divided by the total number of wage and salary earners (OECD Labour Force Statistics). Density is calculated using survey data, wherever possible, and administrative data adjusted for non-active and self-employed members otherwise. source OECD.

However, these are proxies of structural characteristics of the labor market not of country-specific policies, which are the focus of the paper. Nevertheless, I verify the robustness of the results using union density in lieu of EPL.

Furthermore, I control for the output gap, and for the (lagged) change in nominal effective exchange rate (NEER), as in Honohan and Lane (2003), to take into account the effect of imported inflation due to different exposure to extra-union trade. Finally, I use current account balance as a percentage of GDP to control for the capital inflows that financed investment and consumption in some peripheral countries after the adoption of the single currency, and contributed to the raise in real estate prices and to the fueling of inflation.

Following Høj et al. (2006), I also take into account the endogeneity of the adoption of reforms in the analysis by further controlling for *BIGCRISIS*, a dummy variable that it is equal to 1 when the output gap is larger than -4% , *LEFT*, a dummy variable equal to 1 whenever the government is left-leaning and a dummy for mature governments, *OGOV*, which is equal to 1 whenever the government has been in office for more than two years. The last two measures are derived using the World Bank Database of Political Institutions.

4 Empirical Analysis

The focus of this paper is to analyze further the role of regulation in product and labor markets in determining the inflation divergence after the adoption of the euro (1999-2007).

The analysis uses a backward looking Phillips curve augmented for product and labor market regulation. Furthermore, the (lagged) change of the NEER is included to proxy the differentiated impact of euro fluctuations depending on different exposure to extra-union trade, as in Honohan and Lane (2003), and the (lagged) change of the ETCR index to proxy the direct impact of product market deregulation on inflation.

The following dynamic equation is estimated:

$$\pi_{it} = b_t + \beta_1\pi_{it-1} + \beta_2ETCR * \pi_{it-1} + \beta_3EPL * \pi_{it-1} + \gamma\Delta ETCR_{it-1} + \delta_1gap_{it} + \delta_2ETCR * gap_{it} + \delta_3EPL * gap_{it} + \phi\Delta NEER_{it-1} + \varepsilon_{it} \quad (1)$$

Where b_t are the time fixed effects, $ETCR$ is the index of product market regulation, $\Delta ETCR$ is product market deregulation, EPL is the index for labor market regulation, gap is the output gap and $\Delta NEER$ the change in nominal effective exchange rate.

Given the relatively long time series, compared with the cross-country dimension, I use a Feasible Generalized Least Squares (FGLS) estimator allowing for a different error variance for each country and autocorrelation of order 1 in the residuals with country specific rho. In fact, the Arellano-Bond estimator is not optimal because the number of instrument increases with the time dimension. However, the time series is not long enough to use a fixed effect estimator.¹⁸

Table 1 shows the result for the sample 1999-2007. Column 1 presents the estimates of basic regression presented in equation (1). In column 2 the current account as a percentage of GDP is included as further control, while in column 3 the (lagged) interaction between product and labor market deregulation, $\Delta ETCR * \Delta EPL(-1)$, is added instead. Then, only the effects of product market (column 4) and labor market reforms (column 5) are tested. Finally, in column 6 only the significant variables are included in the regression.

For the sample 1999-2007, a one point increase in labor market regulation (EPL) increases the persistence of inflation only slightly (about 0.07 percentage points, see columns 1, 3, 5 and 6) and dampens the response of inflation to the output gap of more than 0.2 percentage points (see columns 1, 2, 3, 5 and 6). However, when controlling for current account balance (column 2) the effect of EPL on inflation persistence is small and not statistically significant. Product market regulation, on the other hand, has no significant effect

¹⁸See Judson and Owen (1999).

on inflation persistence (columns 1, 3 and 4) and it significantly dampens the response of inflation to the output gap only when interacted alone (see column 4). However, product market deregulation ($\Delta ETCR$) has a relevant and statistically significant effect on inflation (columns 1, 2, 3, 4 and 6). In particular, a one point reduction in the ETCR index reduces inflation by about 0.7 percentage points.¹⁹ Nevertheless, the interaction term between product and labor market deregulation, $\Delta ETCR * \Delta EPL(-1)$, is positive but not statistically significant (see column 3), not presenting evidence of complementarity between policies. Finally, $\Delta NEER$ is statistically significant, at the 10% level, only in the full regressions (see columns 1, 3 and 6), but it has a positive sign contrary to the findings in Honohan and Lane (2003).

The regressions show that higher labor market regulation dampens the response of inflation to shocks to the output gap and it increases inflation persistence, to a small extent, even though the last result is not robust to the inclusion of current account balance. This partly confirms Jaumotte and Morsi's (2012) results, even though the effect on inflation persistence is not robust. However, there is evidence that product market deregulation, while not affecting significantly inflation persistence, has a relevant and significant direct impact on the inflation level.

The analysis focuses on the years after the monetary union in order to estimate the effect of regulation on inflation controlling for the same monetary policy. However, since in the literature many studies use longer samples, I repeat the same analysis also for the period 1994-2007, after the establishment of the European Economic Area (EEA). While the issue of different monetary policies remains, this sample controls for the existence of the common market, during the converging period towards the euro.

Table 2 reports the results for the sample 1994-2007. In column 1 the basic regression 1 is

¹⁹ECTR is a 0-6 index and it is the average of the indicators of restriction to competition in seven industries (air passenger transport, telecommunication, electricity, gas, postal services, rail transport and road freight). As an illustrative example, a one point decrease in the overall index is equivalent to a complete privatization (from completely public to completely private) of the electricity, gas, rail transport and passenger air transport industries. For more detailed information see the Appendix of Conway and Nicoletti (2006).

presented, in column 2 the interaction term between product and labor market deregulation, $\Delta ETCR * \Delta EPL(-1)$, is also added, then only the effects of product market (column 3) and labor market reforms (column 4) are tested. First, in this sample, product market regulation increases slightly (about 0.04 percentage points) the persistence of inflation and it dampens the response of inflation to the output gap (about 0.06 percentage points, see columns 1, 2 and 3). Second, labor market regulation has not a significant effect on inflation persistence (see columns 1, 2 and 4), and it significantly dampens the reaction of inflation to the output gap only when considered alone (see column 4). Third, product market deregulation ($\Delta ETCR$) has a positive, but statistically not significant effect on inflation. Finally, despite considering a longer period of time, which includes the convergence process to the euro, the (lagged) rate of growth of NEER has a negative and statistically significant, at the 10% level, impact on inflation (all columns), confirming Honohan and Lane's (2003) results.

The results highlight the relevant impact of product market deregulation ($\Delta ETCR$) on inflation when controlling for the same monetary policy (sample 1999-2007), but the negligible effect of $ETCR$ on inflation persistence. Moreover, the analysis shows that higher labor market regulation reduces the responsiveness of inflation to the output gap.

Before taking into account the sequential nature of the reforms in the estimation, I analyze whether there is a differentiated effect of labor market regulation in regular versus temporary contracts. Table 3 presents, for the sample 1999-2007, the estimates of equation (1) when using separately the indexes of employment regulation for regular contracts (EPR) and temporary contracts (EPT), instead of their average (EPL), while Table 4 for the sample 1994-2007. Column 1 presents the estimates of the basic regression, then only regulation in regular (columns 2) and in temporary contracts (column 3) are included, and the interaction terms with $ETCR$ are excluded in column 4.

In the sample 1999-2007 (Table 3), higher regulation in regular contracts (EPR) slightly increases the persistence of inflation (about 0.04 percentage points, see columns 1, 2 and 4), and it has a statistically significant effect on the responsiveness of inflation to the output

gap only when interacted alone (see column 2). On the other hand, higher regulation in temporary contracts (*EPT*) has a significant impact on inflation persistence only when interacted alone (see column 3), and it significantly dampens, by more than 0.14 percentage points, the responsiveness of inflation to output gap (see columns 1, 3 and 4). This highlights the reduction in shock-absorption capacity of a higher labor market regulation in temporary contracts.

In the sample 1994-2007 (Table 4), *EPR* slightly increases the inflation persistence (significant only at 10%, see columns 1 and 4), while the effects of *EPR* and *EPT* on the responsiveness of inflation to the output gap are contrasting: higher regulation in temporary contracts dampens the responsiveness of inflation to output gap, while regular contracts increases it (see columns 1 and 4). However, when analyzing the effects of regulation in the two subcategories separately (columns 2 and 3), the impacts have still opposite signs, but they are not statistically significant. The results are less clear in the longer sample, but they suggest how a lower labor market regulation in temporary contracts has a larger effect in absorbing shocks.

An alternative proxy for labor market regulation used in the literature²⁰ is union density. While *EPL* measures the level of regulation in the labor market from a legal point of view, union density provides the percentage of union members and a measure of the monopoly power in the labor supply. Tables 5 and 6 present the estimates of equation (1) when using union density instead of *EPL* for the samples 1999-2007 and 1994-2007 respectively. In column 1 the full regression is presented, while in column 2 only the interaction terms with union density are included, and in column 3 also $\Delta ETCR$ is added. The results confirm the impact of product market deregulation ($\Delta ETCR$) on inflation and the absence of an effect of product market regulation on inflation persistence. However, a higher percentage of union density decreases the persistence of inflation and increases the responsiveness of inflation to the output gap. It is important to note that the correlation between *EPL* and union density

²⁰See Bowdler and Nunziata (2007) and Correa-López (2013).

is negative²¹, as a consequence previous results are confirmed, but with opposite signs for the variables including union density.

5 Control Function Approach

The previous analysis assumes that the deregulation reforms in product and labor market are exogenous and set independently from one another. In this section, I analyze the potential issue of endogeneity of product and labor market regulation and, following Fiori et al. (2012), I use a control function approach to tackle the issue.

First, I estimate a Granger causality tests using FGLS²², in which each market reform variable is regressed on its own three lags and on the three lags of the other, controlling for potential political economy factors that might have influenced the adoption of the reforms. As in Høj et al. (2006) and Alesina et al. (2011), I control for the (lagged) dummy variable *LEFT*, which is equal to 1 if the government is controlled by center-left parties, for *OGOV*, which is the length of the government in power, and the (lagged) dummy variable *BIGCRISIS*, which is equal to 1 if the economy experienced a drop in the output by more than 4%.²³

Second, I verify the presence of Granger causality, if the first three lags of the individual variables are jointly significant and if their sum is different from zero, and the endogeneity of the regulation policies, if the residuals of the previous regression are correlated with those of the backward looking Phillips Curve.

Finally, to tackle these issues, I use a control function approach, controlling for the endogeneity by including the estimated innovations from the first step equation interacted with the other variables in the inflation equation.²⁴

²¹The correlation between *EPL* and union density is -0.47 in the 1999-2007 sample and -0.41 in the 1994-2007 sample.

²²I assume heteroskedastic variance and a country-specific autocorrelation coefficient as in the main regression.

²³*BIGCRISIS* is not included in the sample 1999-2007 since there are not significant crisis episodes.

²⁴The regulation policies appear in levels only in the interaction terms.

Table 7 reports the results of the first step estimations for the sample 1999-2007. Even though there is no evidence that *ETCR* Granger causes *EPL*²⁵, I find evidence of endogeneity of *ETCR*, since the residuals of the first step estimate are correlated with those in the inflation equation. Table 8 shows the results for the sample 1994-2007. In this longer sample, I do not find a clear direction of Granger causality, but that each variable Granger cause the other.²⁶ Moreover, there is evidence that both *ETCR* and *EPL* are endogenous.

Table 9 reproduces the specifications presented in Table 1 for the sample 1999-2007. Since there is evidence of endogeneity only of *ETCR*, I exclude the specifications that contain only the interactions with *EPL* with lagged inflation and output gap (i.e. columns 5 and 6 of Table 1) because only the results of the specifications including *ETCR* might be affected. The basic results of Table 1 are confirmed. In particular, the results show a large (0.8 percentage points) and statistically significant effect of product market deregulation $\Delta ETCR$ (see columns 1, 2 and 3), a relevant impact of *EPL* in dampening the response of inflation to the output gap and a moderate effect of *EPL* on inflation persistence (see columns 1 and 3). However, the coefficients of the interaction between output gap and *ETCR* are surprising positive and statistically significant (columns 1, 2 and 3). The reported endogeneity test verify the joint significance of the interactions of the estimated innovations from the first stage equations and lagged inflation and output gap depending on the specification.²⁷

Table 8 presents the first step estimates for the sample 1994-2007 where there is evidence of endogeneity of both *ETCR* and *EPL*²⁸, and Table 10 shows the main regression. The results are less clear cut. In particular, product market regulation has no statistically

²⁵Fiori et al. (2012) find that *ETCR* Granger-causes the unemployment benefit replacement rate (*BEN*), but not *EPL*. *BEN* is available biennially for the sample 1961-2005. However, even using *BEN* I do not find evidence of Granger causality in the sample 1999-2005. Results not reported.

²⁶The sum of the coefficients on both the three lags of *ETCR* and *EPL* are both positive and significant.

²⁷For the sample 1999-2007, there is evidence of endogeneity of only *ETCR*. Hence only the residuals of the Granger causality test for *ETCR* (Table 7 are interacted with lagged inflation and output gap and ΔEPL in column 2 due to the interaction effect $\Delta ETCR * \Delta EPL$).

²⁸For the sample 1994-2007, both the interactions of the residuals of the first step regressions (labeled u^{ETCR} and u^{EPL} respectively) and output gap and lagged inflation are included, depending on the specification. Moreover, the interaction terms $u^{ETCR} * \Delta EPL$ and $u^{EPL} * \Delta ETCR$ are included in the specification with the interaction term between the reforms (column 2).

significant effect on inflation persistence and on the response of inflation to the output gap (the latter is statistically significant when only the effects of product market regulation are tested, see column 3). Nevertheless, the interaction effect between the reforms has a large and statistically significant effect (column 2).

The analysis highlights the endogeneity of policies, but the main results are confirmed when using a control function approach.

6 Conclusions

This paper takes a further look at inflation differentials in a sample of 11 euro area countries after the adoption of the single currency (1999-2007) and in the longer sample (1994-2007) after the establishment of the single market.

The results show that higher labor market regulation slightly increases the persistence of inflation and dampens the responsiveness of inflation to the output gap, while product market regulation has no statistically significant effect on these variables. However, product market deregulation has a relevant and statistically significant effect on the level of inflation, reducing it by 0.6 percentage points. Moreover, I analyzed the impact of labor market regulation in regular versus temporary contracts and I show how the former slightly increases inflation persistence, while the latter significantly dampens the response of inflation to the output gap. I verify the robustness of the results by controlling for the potential endogeneity of the reforms, using a control function approach.

The results suggest that labor market regulation is one important factor in determining the slower adjustments of inflation to real shocks and that product market deregulation considerably reduces the level of inflation. These results are relevant in the light of the deregulation processes implemented in the euro area peripheral countries with the aim of regaining competitiveness.

References

- Alesina, Alberto, Silvia Ardagna and Vincenzo Galasso**, 2011, “The Euro and Structural Reforms”, *Review of Economics and Institutions*, 2(1), Article 2.
- Amable, Bruno, Lilas Demmou and Donatella Gatti**, 2007, “Employment performance and institutions: new answers to an old question”, Discussion Paper No. 2731, IZA.
- Andersson, Malin, Klaus Masuch and Marc Schiffbauer**, 2009, “Determinants of Inflation and Price Level Differentials Across the Euro Area Countries”, ECB Working Paper Series No. 1129.
- Angeloni, Ignazio and Michael Ehrmann**, 2004, “Euro area Inflation Differentials”, ECB Working Paper Series No. 388.
- Andrés, Javier, Eva Ortega and Javier Vallés**, “Competition and inflation differentials in EMU”, *Journal of Economic Dynamics & Control*, 32(3): 848874.
- Bassanini, Andrea and Romain Duval**, “Employment patterns in OECD countries: reassessing the role of policies and institutions”, Working Papers No. 486, OECD Economics Department.
- Berger, Helge and Stephan Danninger**, 2005, “Labor and Product Market Deregulation: Partial, Sequential, or Simultaneous Reform?”, IMF Working Paper No. 227.
- Berger, Helge and Stephan Danninger**, 2006, “The employment effects of labor and product markets deregulation and their implications for structural reforms”, CESifo Working Paper No. 1709, CESifo.
- Bertrand, Marianne, Esther Dufo and Sendhil Mullainathan**, 2004, “How much should we trust Differences-in-Differences estimates?” *Quarterly Journal of Economics*, 119(1): 249-275.
- Biroli, Pietro, Gilles Mourre and Alessandro Turrini**, 2010, “Adjustment in the euro area and regulation of product labour markets: An empirical assessment”, CEPR Discussion Paper Series No. 8010.
- Blanchard, Olivier and Francesco Giavazzi**, 2003, “Macroeconomic Effects of Regulation and Deregulation in Goods and Labor Markets”, *Quarterly Journal of Economics*, 118(3): 879-907.
- Bowdler, Christopher and Luca Nunziata**, 2007, “Inflation Adjustment and Labour Market Structures: Evidence from a Multi-country Study”, *Scandinavian Journal of Economics*, 109(3): 619-642.
- Cacciatore, Matteo and Giuseppe Fiori**, 2012, “The Macroeconomic Effects of Goods and Labor Markets Deregulation,” mimeo.

Cacciatore, Matteo, Giuseppe Fiori and Fabio Ghironi, 2012, “Market Deregulation and Optimal Monetary Policy in a Monetary Union”, mimeo.

Campolmi, Alessia and Ester Faia, 2009, “Labor Market Institutions and Inflation Volatility in the Euro Area”, *Journal of Economic Dynamics and Control*, 35(5): 793-812.

Conway, Paul and Giuseppe Nicoletti, 2006, “Product market regulation in non-manufacturing sectors in OECD countries: measurement and highlights.” OECD Economics Department Working Paper.

Correa-López, Mónica, Agustín García-Serrador and Cristina Mingorance-Arnáiz, 2013, “Product Market Competition, Monetary Policy Regimes and Inflation Dynamics: Evidence from a Panel of OECD Countries”, *Oxford Bulletin of Economics and Statistics*, doi: 10.1111/obes.12031.

Eggertsson, Gauti, Andrea Ferrero and Andrea Raffo, 2013, “Can Structural Reforms Help Europe?” mimeo.

Fiori, Giuseppe, Giuseppe Nicoletti, Stefano Scarpetta and Fabio Schiantarelli, 2012, “Employment Effects of Product and Labor Market Reforms: Are There Synergies?” *Economic Journal*, 122(558): F79-F104.

Galí, Jordi, 2012, “Notes for a New Guide to Keynes (I): Wages, Aggregate Demand, and Employment, Delivered as the Presidential Address to the 27th Annual Congress of the European Economic Association, Málaga, August 27-31.

Griffith, Rachel, Rupert Harrison and Gareth Macartney, 2007, “Product Market Reforms, Labour Market Institutions and Unemployment”, *Economic Journal*, 117(519): 142-166.

Guerrieri, Luca, Christopher Gust and J. David López-Salido, 2010, “International Competition and Inflation: A New Keynesian Perspective”, *American Economic Journal: Macroeconomics*, 2(4): 247-280.

Hansen, Christian B., 2007, “Generalized Least Squares Inference in Panel and Multi-level Models with Serial Correlation and Fixed Effects.” *Journal of Econometrics*, 140(2): 670-694.

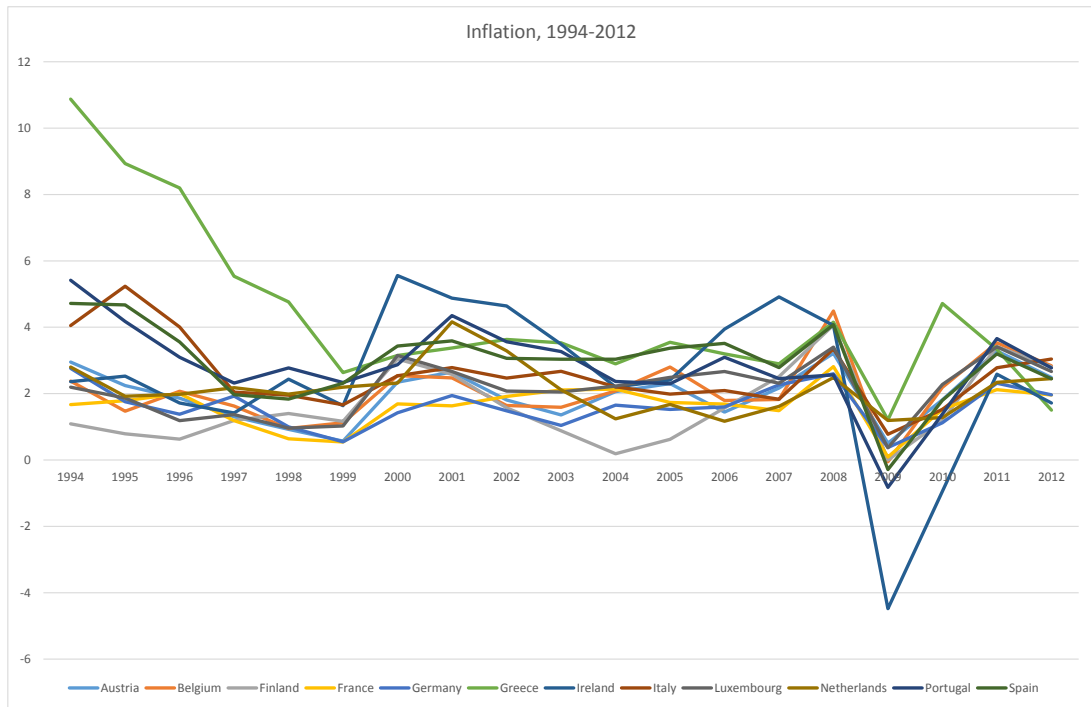
Høj, Jens, Vincenzo Galasso, Giuseppe Nicoletti and Thai-Thanh Dang, 2006, “The political economy of structural reforms: empirical evidence from OECD countries”, OECD Working Paper No. 29.

Honohan, Patrick and Philip R. Lane, 2003, “Divergent inflation rates in EMU,” *Economic Policy*, 18(37): 357-394.

Jaumotte, Florence and Hanan Morsy, 2012, “Determinants of Inflation in the Euro Area: The Role of Labor and Product Market Institutions”, IMF Working Paper No. 12/37.

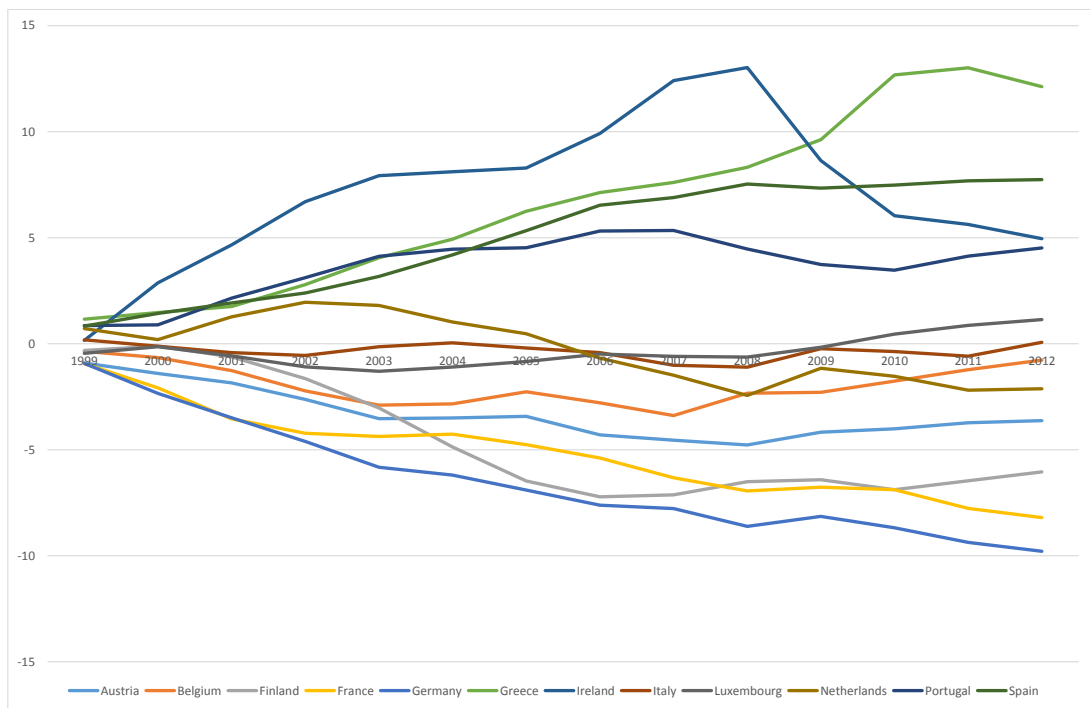
- Judson, Ruth A. and Ann L. Owen**, 1999, "Estimating dynamic panel data models: a guide for macroeconomists." *Economics Letters*, 65(1): 9-15.
- Krause, Michael U. and Thomas A. Lubik**, 2007, "The (ir)relevance of real wage rigidity in the New Keynesian model with search frictions", *Journal of Monetary Economics*, 54(3): 706-727.
- Lane, Philip R.**, 2006, "The Real Effects of European Monetary Union," *Journal of Economic Perspectives*, 20(4): 47-66.
- Moretti, Laura**, 2012, "Inflation Targeting and Product Market Deregulation," CFS WP 2012/01.
- Nicoletti, Giuseppe and Stefano Scarpetta**, 2003, "Regulation, productivity and growth: OECD evidence." *Economic Policy*, 18(36): 972.
- Nicoletti, Giuseppe, Stefano Scarpetta and Olivier Boylaud**, 1999, "Summary Indicators of Product Market Regulation with an Extension to Employment Protection Legislation." OECD Economics Department Working Paper, No. 226.
- Nicoletti, Giuseppe and Stefano Scarpetta**, 2005, "Product Market Reforms and Employment in OECD Countries", OECD Economics Department Working Papers No. 472, OECD, Paris.
- Praet, Peter**, 2012, "Heterogeneity in a monetary union: What have we learned?", Speech delivered at the ECB and Its Watchers XIV, Frankfurt June 15, 2012.
- Schiantarelli, Fabio**, 2008, "Product Market Regulation and Macroeconomic Performance: A Review of Cross-Country Evidence." mimeo.

Figure 1: Inflation Rate, 1994-2012



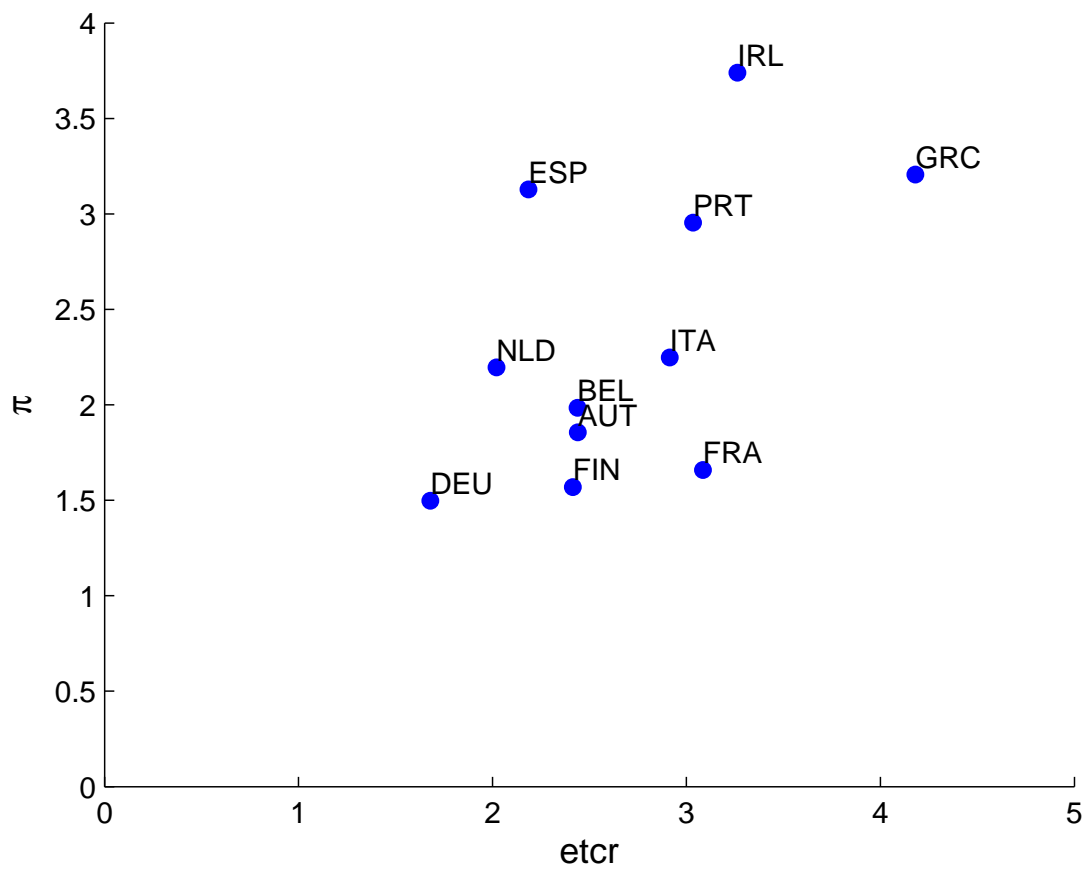
Notes: Annual (average) inflation rate for the 12 euro area countries. Source OECD.

Figure 2: Cumulated Inflation Differentials, 1999-2012



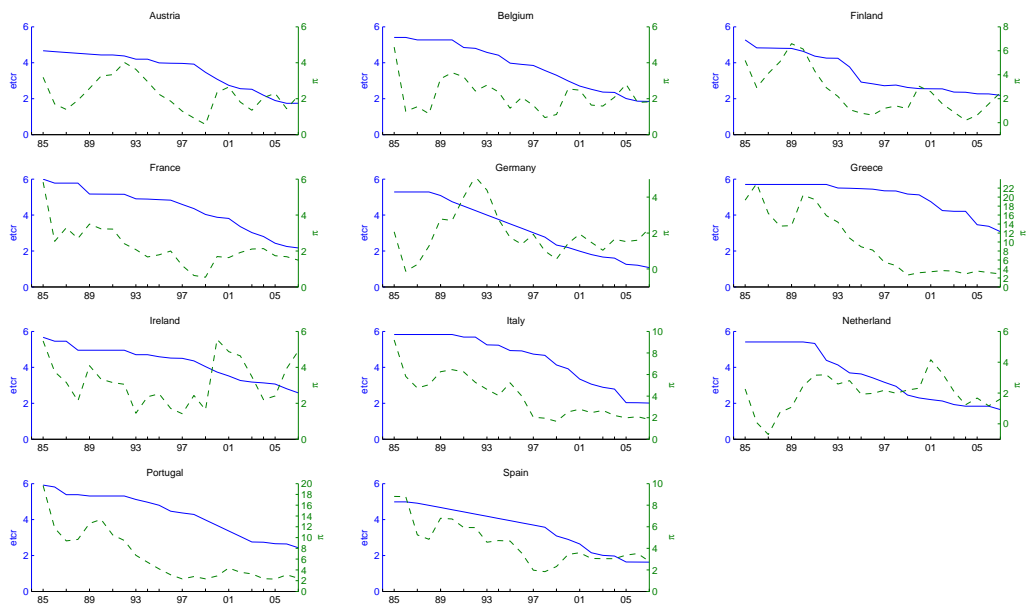
Notes: Cumulated inflation differentials for the 12 euro area countries. Inflation differentials are computed as a difference from the average inflation of the 12 euro area countries. Source OECD.

Figure 3: Inflation and product market regulation, 1999-2007



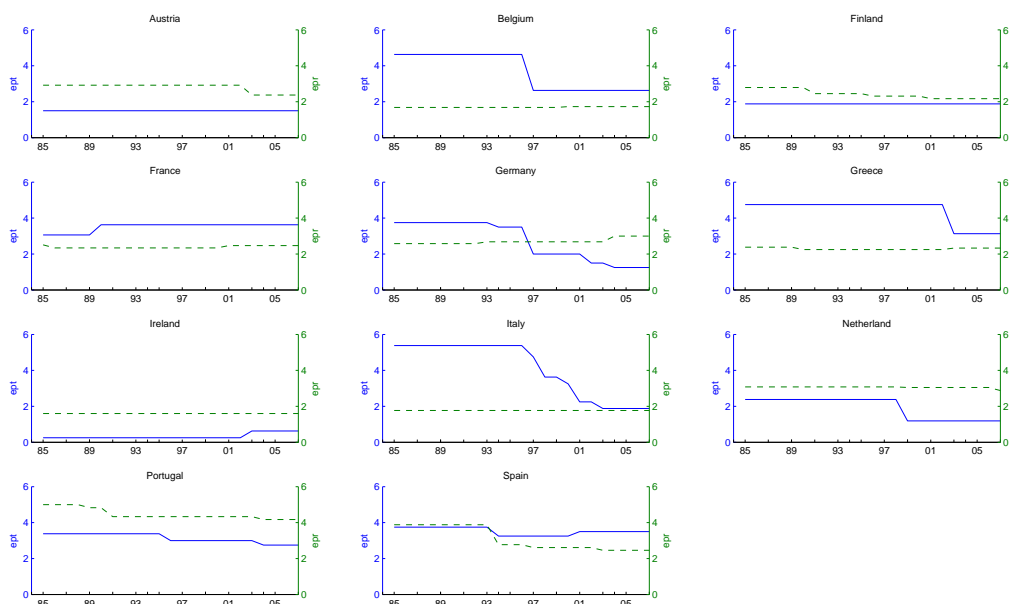
Notes: Average inflation rate and average product market regulation (ETCR) for the period 1999-2007. The index ETCR is obtained as the average of indicators in seven main industries (air passenger transport, telecommunication, electricity, gas, postal services, rail transport and road freight). The index goes from 0 to 6, with 0 indicating the lowest level of regulation and 6 the highest level of regulation in the market. Source OECD.

Figure 4: ETCR, 1985-2007



Notes: The dashed line is the annual (average) inflation rate (right scale) and the solid line the average level of regulation measured by the ETCR index (left scale). ETCR is the aggregate indicator of regulation obtained as the average of indicators in seven main industries (air passenger transport, telecommunication, electricity, gas, postal services, rail transport and road freight). The index goes from 0 to 6, with 0 indicating the lowest and 6 the highest level of regulation in the market. Source OECD.

Figure 5: EPT and EPR, 1985-2007



Notes: The solid line is the level of employment protection regulation for temporary contracts (EPT), the dashed line the level of regulation for regular contracts (EPR). Both indexes go from 0 to 6, with 0 indicating the lowest and 6 the highest level of regulation in labor market. Source OECD.

Table 1: Estimates of equation (1) using FGLS, annual data, sample 1999-2007.

	FGLS					
	(1)	(2)	(3)	(4)	(5)	(6)
π_{-1}	0.545*** (0.122)	0.639*** (0.115)	0.544*** (0.124)	0.581*** (0.124)	0.518*** (0.090)	0.479*** (0.912)
$ETCR * \pi_{-1}$	-0.025 (0.029)	-0.049* (0.028)	-0.023 (0.029)	0.023 (0.033)		
$EPL * \pi_{-1}$	0.076*** (0.029)	0.023 (0.033)	0.068** (0.029)		0.049* (0.027)	0.065** (0.027)
$\Delta ETCR_{-1}$	0.735** (0.328)	0.701** (0.319)	0.647* (0.341)	0.550* (0.339)		0.706** (0.324)
$\Delta ETCR * \Delta EPL(-1)$			1.461 1.081			
$\Delta NEER_{-1}$	0.079* (0.046)	0.064 (0.046)	0.080* (0.046)	0.039 (0.051)	0.076 (0.048)	0.076* (0.046)
gap	0.770*** (0.147)	0.745*** (0.140)	0.809*** (0.149)	0.446*** (0.138)	0.717*** (0.114)	0.743*** (0.113)
$gap * ETCR$	-0.001 (0.040)	-0.010 (0.038)	-0.011 (0.041)	-0.084** (0.042)		
$gap * EPL$	-0.227*** (0.046)	-0.224*** (0.043)	-0.226*** (0.045)		-0.217*** (0.040)	-0.217*** (0.040)
CA/GDP		-0.040*** (0.015)				
<i>OBS</i>	99	99	99	99	99	99

Notes: Dependent variable (π): annual average inflation. Source: OECD. $ETCR * \pi_{-1}$ is the interaction between the product market regulation index ETCR and lagged annual inflation rate. ETCR is the aggregate indicator of regulation obtained as the average of indicators in seven main industries (air passenger transport, telecommunication, electricity, gas, postal services, rail transport and road freight). The index goes from 0 to 6, with 0 indicating the lowest level of regulation and 6 the highest level of regulation in the market. Source OECD. $EPL * \pi_{-1}$ is the interaction between the labor market regulation index EPL and lagged annual inflation rate. EPL is a measure of the procedures and costs involved in the dismissal of individuals and groups of workers, computed as an average of the sub-indicators of the dismissal of employees on regular and temporary contracts. It is a 0-6 index from the lowest to the highest level of regulation. Source OECD. $\Delta ETCR_{-1}$ is the lagged absolute change in the product market regulation index. $\Delta ETCR * \Delta EPL(-1)$ is the lagged interaction between the absolute change in the product market regulation index and the absolute change in the labor market regulation index. $\Delta NEER_{-1}$ is the lagged absolute change in the nominal effective exchange rates. Source OECD. gap is the estimated output gap. Source World Economic Outlook. $gap * ETCR$ and $gap * EPL$ are the interaction effect between output gap and product market regulation and labor market regulation index respectively. CA/GDP is the current account balance as a percentage of GDP. Source OECD. The regressions are carried out using Feasible Generalized Least Squares estimator allowing for a different error variance for each country and AR(1) with country specific ρ and including country fixed effects. ***=significant at the 1% level; **=significant at the 5% level; *=significant at the 10% level.

Table 2: Estimates of equation (1) using FGLS, annual data, sample 1994-2007.

	FGLS			
	(1)	(2)	(3)	(4)
π_{-1}	0.459*** (0.119)	0.464*** (0.120)	0.477*** (0.107)	0.608*** (0.091)
$ETCR * \pi_{-1}$	0.038* (0.022)	0.039* (0.022)	0.043** (0.020)	
$EPL * \pi_{-1}$	0.009 (0.026)	0.004 (0.025)		0.031 (0.024)
$\Delta ETCR_{-1}$	0.195 (0.307)	0.116 (0.313)	0.173 (0.305)	
$\Delta ETCR * \Delta EPL(-1)$		1.774 (1.110)		
$\Delta NEER_{-1}$	-0.026* (0.014)	-0.026* (0.014)	-0.027* (0.014)	-0.028** (0.014)
gap	0.492*** (0.138)	0.526*** (0.139)	0.371*** (0.122)	0.315*** (0.096)
$gap * ETCR$	-0.061* (0.035)	-0.068** (0.036)	-0.068** (0.033)	
$gap * EPL$	-0.056 (0.038)	-0.057 (0.037)		-0.075** (0.035)
<i>OBS</i>	154	154	154	154

Notes: Dependent variable (π): annual average inflation. Source: OECD. $ETCR * \pi_{-1}$ is the interaction between the product market regulation index ETCR and lagged annual inflation rate. ETCR is the aggregate indicator of regulation obtained as the average of indicators in seven main industries (air passenger transport, telecommunication, electricity, gas, postal services, rail transport and road freight). The index goes from 0 to 6, with 0 indicating the lowest level of regulation and 6 the highest level of regulation in the market. Source OECD. $EPL * \pi_{-1}$ is the interaction between the labor market regulation index EPL and lagged annual inflation rate. EPL is a measure of the procedures and costs involved in the dismissal of individuals and groups of workers, computed as an average of the sub-indicators of the dismissal of employees on regular and temporary contracts. It is a 0-6 index from the lowest to the highest level of regulation. Source OECD. $\Delta ETCR_{-1}$ is the lagged absolute change in the product market regulation index. $\Delta ETCR * \Delta EPL(-1)$ is the lagged interaction between the absolute change in the product market regulation index and the absolute change in the labor market regulation index. $\Delta NEER_{-1}$ is the lagged absolute change in the nominal effective exchange rates. Source OECD. gap is the estimated output gap. Source World Economic Outlook. $gap * ETCR$ and $gap * EPL$ are the interaction effect between output gap and product market regulation and labor market regulation index respectively. The regressions are carried out using Feasible Generalized Least Squares estimator allowing for a different error variance for each country and AR(1) with country specific ρ and including country fixed effects. ***=significant at the 1% level; **=significant at the 5% level; *=significant at the 10% level.

Table 3: Estimates of equation (1) using FGLS, annual data, sample 1999-2007.

	FGLS			
	(1)	(2)	(3)	(4)
π_{-1}	0.559*** (0.154)	0.322** (0.164)	0.741*** (0.114)	0.466*** (0.089)
$ETCR * \pi_{-1}$	-0.021 (0.036)	0.039 (0.034)	-0.047 (0.032)	
$EPR * \pi_{-1}$	0.039* (0.024)	0.063** (0.031)		0.052** (0.022)
$EPT * \pi_{-1}$	0.028 (0.022)		0.043** (0.019)	0.011 (0.017)
$\Delta ETCR_{-1}$	0.611** (0.309)	0.638* (0.349)	0.716** (0.312)	0.577* (0.307)
$\Delta NEER_{-1}$	0.101** (0.043)	0.058 (0.050)	0.078* (0.043)	0.096** (0.044)
gap	0.412*** (0.167)	0.831*** (0.217)	0.366*** (0.119)	0.597*** (0.119)
$gap * ETCR$	0.065 (0.046)	-0.116*** (0.044)	0.086** (0.042)	
$gap * EPR$	0.008 (0.041)	-0.105** (0.054)		-0.013 (0.042)
$gap * EPT$	-0.173*** (0.031)		-0.173*** (0.029)	-0.143*** (0.024)
<i>OBS</i>	99	99	99	99

Notes: Dependent variable (π): annual average inflation. Source: OECD. $ETCR * \pi_{-1}$ is the interaction between the product market regulation index ETCR and lagged annual inflation rate. ETCR is the aggregate indicator of regulation obtained as the average of indicators in seven main industries (air passenger transport, telecommunication, electricity, gas, postal services, rail transport and road freight). The index goes from 0 to 6, with 0 indicating the lowest level of regulation and 6 the highest level of regulation in the market. Source OECD. $EPR * \pi_{-1}$ and $EPT * \pi_{-1}$ are the interaction effects between lagged inflation and the labor market regulation index for regular contracts EPR, and and the labor market regulation index for temporary contracts EPT, respectively. EPR (EPT) is a measure of the procedures and costs involved in the dismissal of individuals and groups of employees on regular (temporary) contracts. EPL and EPT are 0-6 indexes from the lowest to the highest level of regulation. Source OECD. $\Delta ETCR_{-1}$ is the lagged absolute change in the product market regulation index. $\Delta NEER_{-1}$ is the lagged absolute change in the nominal effective exchange rates. Source OECD. gap is the estimated output gap. Source World Economic Outlook. $gap * ETCR$ is the interaction effect between output gap and product market regulation index. $gap * EPR$ and $gap * EPT$ are the interaction effect between output gap and product market regulation for regular and temporary contracts respectively.

The regressions are carried out using Feasible Generalized Least Squares estimator allowing for a different error variance for each country and AR(1) with country specific ρ and including country fixed effects. ***=significant at the 1% level; **=significant at the 5% level; *=significant at the 10% level.

Table 4: Estimates of equation (1) using FGLS, annual data, sample 1994-2007.

	FGLS			
	(1)	(2)	(3)	(4)
π_{-1}	0.396*** (0.129)	0.386*** (0.130)	0.493*** (0.110)	0.596*** (0.086)
$ETCR * \pi_{-1}$	0.054** (0.026)	0.049** (0.021)	0.045* (0.025)	
$EPR * \pi_{-1}$	0.025* (0.015)	0.021 (0.017)		0.023* (0.013)
$EPT * \pi_{-1}$	-0.011 (0.016)		-0.009 (0.016)	0.011 (0.014)
$\Delta ECTR_{-1}$	0.143 (0.305)	0.138 (0.306)	0.172 (0.306)	0.234 (0.296)
$\Delta NEER_{-1}$	-0.027** (0.014)	-0.027* (0.014)	-0.027* (0.014)	-0.026* (0.014)
gap	0.279** (0.137)	0.321** (0.145)	0.409*** (0.124)	0.201** (0.094)
$gap * ETCR$	-0.034 (0.035)	-0.074** (0.033)	-0.042 (0.036)	
$gap * EPR$	0.053* (0.031)	0.031 (0.034)		0.051* (0.029)
$gap * EPT$	-0.056** (0.024)		-0.047 (0.024)	-0.073*** (0.022)
<i>OBS</i>	154	154	154	154

Notes: Dependent variable (π): annual average inflation. Source: OECD. $ETCR * \pi_{-1}$ is the interaction between the product market regulation index ETCR and lagged annual inflation rate. ETCR is the aggregate indicator of regulation obtained as the average of indicators in seven main industries (air passenger transport, telecommunication, electricity, gas, postal services, rail transport and road freight). The index goes from 0 to 6, with 0 indicating the lowest level of regulation and 6 the highest level of regulation in the market. Source OECD. $EPR * \pi_{-1}$ and $EPT * \pi_{-1}$ are the interaction effects between lagged inflation and the labor market regulation index for regular contracts EPR, and and the labor market regulation index for temporary contracts EPT, respectively. EPR (EPT) is a measure of the procedures and costs involved in the dismissal of individuals and groups of employees on regular (temporary) contracts. EPL and EPT are 0-6 indexes from the lowest to the highest level of regulation. Source OECD. $\Delta ECTR_{-1}$ is the lagged absolute change in the product market regulation index. $\Delta NEER_{-1}$ is the lagged absolute change in the nominal effective exchange rates. Source OECD. gap is the estimated output gap. Source World Economic Outlook. $gap * ETCR$ is the interaction effect between output gap and product market regulation index. $gap * EPR$ and $gap * EPT$ are the interaction effect between output gap and product market regulation for regular and temporary contracts respectively.

The regressions are carried out using Feasible Generalized Least Squares estimator allowing for a different error variance for each country and AR(1) with country specific ρ and including country fixed effects. ***=significant at the 1% level; **=significant at the 5% level; *=significant at the 10% level.

Table 5: Estimates of equation (1) using FGLS, annual data, sample 1999-2007.

	FGLS		
	(1)	(2)	(3)
π_{-1}	0.710*** (0.117)	0.751*** (0.066)	0.777*** (0.065)
$ETCR * \pi_{-1}$	0.008 (0.029)		
$UD * \pi_{-1}$	-0.229* (0.134)	-0.157 (0.135)	-0.228* (0.130)
$\Delta ETCR_{-1}$	0.695** (0.332)		0.740** (0.334)
$\Delta NEER_{-1}$	0.045 (0.049)	0.043 (0.050)	0.040 (0.047)
gap	0.227 (0.144)	-0.020 (0.063)	-0.004 (0.062)
$gap * ETCR$	-0.066* (0.039)		
$gap * UD$	0.478*** (0.151)	0.504*** (0.150)	0.525*** (0.142)
<i>OBS</i>	99	99	99

Notes: Dependent variable (π): annual average inflation. Source: OECD. $ETCR * \pi_{-1}$ is the interaction between the product market regulation index ETCR and lagged annual inflation rate. ETCR is the aggregate indicator of regulation obtained as the average of indicators in seven main industries (air passenger transport, telecommunication, electricity, gas, postal services, rail transport and road freight). The index goes from 0 to 6, with 0 indicating the lowest level of regulation and 6 the highest level of regulation in the market. Source OECD. $UD * \pi_{-1}$ is the interaction between union density (UD) and lagged annual inflation rate. UD is the ratio of wage and salary earners that are trade union members, divided by the total number of wage and salary earners. Density is calculated using survey data, wherever possible, and administrative data adjusted for non-active and self-employed members otherwise. Source OECD. $\Delta ETCR_{-1}$ is the lagged absolute change in the product market regulation index. $\Delta NEER_{-1}$ is the lagged absolute change in the nominal effective exchange rates. Source OECD. gap is the estimated output gap. Source World Economic Outlook. $gap * ETCR$ and $gap * UD$ are the interaction effect between output gap and product market regulation, and union density respectively. The regressions are carried out using Feasible Generalized Least Squares estimator allowing for a different error variance for each country and AR(1) with country specific ρ and including country fixed effects. ***=significant at the 1% level; **=significant at the 5% level; *=significant at the 10% level.

Table 6: Estimates of equation (1) using FGLS, annual data, sample 1994-2007.

	FGLS		
	(1)	(2)	(3)
π_{-1}	0.492*** (0.104)	0.773*** (0.043)	0.778*** (0.043)
$ETCR*\pi_{-1}$	0.053*** (0.020)		
$UD*\pi_{-1}$	-0.262** (0.125)	-0.161 (0.120)	-0.176 (0.121)
$\Delta ECTR_{-1}$	0.160 (0.300)		0.210 0.299
$\Delta NEER_{-1}$	-0.030** (0.014)	-0.031** (0.014)	-0.028** (0.014)
gap	0.270** (0.131)	0.053 (0.051)	0.061 (0.052)
$gap*ETCR$	-0.054* (0.032)		
$gap*UD$	0.144 (0.110)	0.167* (0.102)	0.161 (0.106)
<i>OBS</i>	154	154	154

Notes: Dependent variable (π): annual average inflation. Source: OECD. $ETCR * \pi_{-1}$ is the interaction between the product market regulation index ETCR and lagged annual inflation rate. ETCR is the aggregate indicator of regulation obtained as the average of indicators in seven main industries (air passenger transport, telecommunication, electricity, gas, postal services, rail transport and road freight). The index goes from 0 to 6, with 0 indicating the lowest level of regulation and 6 the highest level of regulation in the market. Source OECD. $UD * \pi_{-1}$ is the interaction between union density (UD) and lagged annual inflation rate. UD is the ratio of wage and salary earners that are trade union members, divided by the total number of wage and salary earners. Density is calculated using survey data, wherever possible, and administrative data adjusted for non-active and self-employed members otherwise. Source OECD. $\Delta ECTR_{-1}$ is the lagged absolute change in the product market regulation index. $\Delta NEER_{-1}$ is the lagged absolute change in the nominal effective exchange rates. Source OECD. gap is the estimated output gap. Source World Economic Outlook. $gap*ETCR$ and $gap*UD$ are the interaction effect between output gap and product market regulation, and union density respectively. The regressions are carried out using Feasible Generalized Least Squares estimator allowing for a different error variance for each country and AR(1) with country specific ρ and including country fixed effects. ***=significant at the 1% level; **=significant at the 5% level; *=significant at the 10% level.

Table 7: Determinants of Product and Labor Market Policies, annual data, sample 1999-2007.

	(1)	(2)
	ETCR	EPL
<i>ETCR(-1)</i>	0.852*** (0.098)	0.091 (0.070)
<i>ETCR(-2)</i>	-0.276** (0.132)	-0.013 (0.084)
<i>ETCR(-3)</i>	0.195* (0.108)	-0.065 (0.079)
<i>EPL(-1)</i>	-0.044 (0.115)	0.511*** (0.106)
<i>EPL(-2)</i>	0.199* (0.116)	0.128 (0.096)
<i>EPL(-3)</i>	-0.042 (0.060)	0.009 (0.040)
<i>LEFT(-1)</i>	0.016 (0.029)	-0.007 (0.024)
<i>OGOV</i>	-0.000 (0.019)	0.004 (0.015)
<i>OBS</i>	99	99
<i>JOINT EPL</i>	0.165	
<i>SUM EPL</i>	0.111	
<i>JOINT ETCR</i>		0.507
<i>SUM ETCR</i>		0.783

Notes: Estimation method feasible GLS allowing for heteroskedasticity and AR(1) errors with country-specific ρ and including year fixed effects. *ETCR* is the aggregate indicator of regulation obtained as the average of indicators in seven main industries (air passenger transport, telecommunication, electricity, gas, postal services, rail transport and road freight). The index goes from 0 to 6, with 0 indicating the lowest level of regulation and 6 the highest level of regulation in the market. *EPL* is a measure of the procedures and costs involved in the dismissal of individuals and groups of workers, computed as an average of the sub-indicators of the dismissal of employees on regular and temporary contracts. It is a 0-6 index from the lowest to the highest level of regulation. Source OECD. *LEFT(-1)* is the lagged dummy variable equal to 1 whenever the government is left-leaning and *OGOV* is a dummy equal to 1 whenever the government has been in office for more than 2 years. Both source World Bank Database of Political Institutions. ***=significant at the 1% level, **=significant at the 5% level and *=significant at 10% level.

Table 8: **Determinants of Product and Labor Market Policies, annual data, sample 1994-2007.**

	(1)	(2)
	ETCR	EPL
<i>ETCR(-1)</i>	0.282*** (0.089)	0.041 (0.056)
<i>ETCR(-2)</i>	0.001 (0.087)	0.039 (0.078)
<i>ETCR(-3)</i>	-0.125* (0.076)	-0.003 (0.053)
<i>EPL(-1)</i>	0.123** (0.062)	0.827*** (0.085)
<i>EPL(-2)</i>	0.051 (0.066)	-0.080 (0.111)
<i>EPL(-3)</i>	0.047 (0.062)	0.033 (0.084)
<i>LEFT(-1)</i>	0.055* (0.031)	0.051*** (0.020)
<i>OGOV</i>	-0.010 (0.018)	-0.013 (0.016)
<i>BIGCRISIS(-1)</i>	-0.611*** (0.191)	0.036 (0.040)
<i>OBS</i>	154	154
<i>JOINT EPL</i>	0.020	
<i>SUM EPL</i>	0.003	
<i>JOINT ETCR</i>		0.176
<i>SUM ETCR</i>		0.054

Notes: Estimation method feasible GLS allowing for heteroskedasticity and AR(1) errors with country-specific ρ and including year fixed effects. *ETCR* is the aggregate indicator of regulation obtained as the average of indicators in seven main industries (air passenger transport, telecommunication, electricity, gas, postal services, rail transport and road freight). The index goes from 0 to 6, with 0 indicating the lowest level of regulation and 6 the highest level of regulation in the market. *EPL* is a measure of the procedures and costs involved in the dismissal of individuals and groups of workers, computed as an average of the sub-indicators of the dismissal of employees on regular and temporary contracts. It is a 0-6 index from the lowest to the highest level of regulation. Source OECD. *LEFT(-1)* is the lagged dummy variable equal to 1 whenever the government is left-leaning and *OGOV* is a dummy equal to 1 whenever the government has been in office for more than 2 years. Both source World Bank Database of Political Institutions. *BIGCRISIS(-1)* is a dummy variable equal to 1 when the output gap is larger than -4% ***=significant at the 1% level, **=significant at the 5% level and *=significant at 10% level.

Table 9: Control Function Approach, 1999-2007.

	FGLS			
	(1)	(2)	(3)	(4)
π_1	0.524*** (0.112)	0.600*** (0.105)	0.487*** (0.114)	0.551*** (0.120)
$ETCR * \pi_{-1}$	-0.277 (0.174)	-0.252 (0.164)	-0.297* (0.171)	-0.321* (0.187)
$EPL * \pi_{-1}$	0.065** (0.029)	0.017 (0.032)	0.061** (0.028)	
$\Delta ETCR_{-1}$	0.874*** (0.354)	0.871*** (0.345)	1.020*** (0.384)	0.594 (0.193)
$\Delta ETCR * \Delta EPL(-1)$			0.170 (1.427)	
$\Delta NEER_{-1}$	0.072 (0.046)	0.061 (0.045)	0.084* (0.044)	0.044 (0.050)
gap	0.806*** (0.147)	0.777*** (0.141)	0.835*** (0.148)	0.461*** (0.136)
$gap * ETCR$	0.362** (0.157)	0.357** (0.147)	0.389*** (0.150)	0.145 (0.183)
$gap * EPL$	-0.224*** (0.046)	-0.221*** (0.043)	-0.227*** (0.044)	
CA/GDP		-0.038*** (0.015)		
<i>OBS</i>	99	99	99	99
<i>Endogeneity Test</i>	0.046	0.038	0.029	0.155

Notes: Dependent variable (π): annual average inflation. Source: OECD. $ETCR * \pi_{-1}$ is the interaction between the product market regulation index ETCR and lagged annual inflation rate. ETCR is the aggregate indicator of regulation obtained as the average of indicators in seven main industries (air passenger transport, telecommunication, electricity, gas, postal services, rail transport and road freight). The index goes from 0 to 6, with 0 indicating the lowest level of regulation and 6 the highest level of regulation in the market. Source OECD. $EPL * \pi_{-1}$ is the interaction between the labor market regulation index EPL and lagged annual inflation rate. EPL is a measure of the procedures and costs involved in the dismissal of individuals and groups of workers, computed as an average of the sub-indicators of the dismissal of employees on regular and temporary contracts. It is a 0-6 index from the lowest to the highest level of regulation. Source OECD. $\Delta ETCR_{-1}$ is the lagged absolute change in the product market regulation index. $\Delta ETCR * \Delta EPL(-1)$ is the lagged interaction between the absolute change in the product market regulation index and the absolute change in the labor market regulation index. $\Delta NEER_{-1}$ is the lagged absolute change in the nominal effective exchange rates. Source OECD. gap is the estimated output gap. Source World Economic Outlook. $gap * ETCR$ and $gap * EPL$ are the interaction effect between output gap and product market regulation and labor market regulation index respectively. CA/GDP is the current account balance as a percentage of GDP. Source World Bank. The regressions are carried out using Feasible Generalized Least Squares estimator allowing for a different error variance for each country and AR(1) with country specific ρ and including country fixed effects. ***=significant at the 1% level; **=significant at the 5% level; *=significant at the 10% level.

Table 10: Control Function Approach, 1994-2007.

	FGLS			
	(1)	(2)	(3)	(4)
π_{-1}	0.437*** (0.112)	0.449*** (0.123)	0.468*** (0.101)	0.614*** (0.091)
$ETCR * \pi_{-1}$	-0.115 (0.090)	-0.149 (0.092)	-0.108 (0.086)	
$EPL * \pi_{-1}$	-0.109 (0.086)	-0.122 (0.089)		-0.045 (0.096)
$\Delta ECTR_{-1}$	0.416 (0.301)	0.101 (1.105)	0.419 (0.297)	
$\Delta ECTR * \Delta EPL(-1)$		2.437* (1.458)		
$\Delta NEER_{-1}$	-0.031** (0.014)	-0.030** (0.015)	-0.038*** (0.014)	-0.025* (0.014)
gap	0.606*** (0.129)	0.647*** (0.130)	0.484*** (0.119)	0.326*** (0.097)
$gap * ETCR$	0.161 (0.100)	0.148 (0.102)	0.218** (0.094)	
$gap * EPL$	0.196 (0.242)	0.193 (0.254)		0.247 (0.230)
<i>OBS</i>	154	154	154	154
<i>Endogeneity Test</i>	0.000	0.001	0.000	0.120

Notes: Dependent variable (π): annual average inflation. Source: OECD. $ETCR * \pi_{-1}$ is the interaction between the product market regulation index ETCR and lagged annual inflation rate. ETCR is the aggregate indicator of regulation obtained as the average of indicators in seven main industries (air passenger transport, telecommunication, electricity, gas, postal services, rail transport and road freight). The index goes from 0 to 6, with 0 indicating the lowest level of regulation and 6 the highest level of regulation in the market. Source OECD. $EPL * \pi_{-1}$ is the interaction between the labor market regulation index EPL and lagged annual inflation rate. EPL is a measure of the procedures and costs involved in the dismissal of individuals and groups of workers, computed as an average of the sub-indicators of the dismissal of employees on regular and temporary contracts. It is a 0-6 index from the lowest to the highest level of regulation. Source OECD. $\Delta ETCR_{-1}$ is the lagged absolute change in the product market regulation index. $\Delta ETCR * \Delta EPL(-1)$ is the lagged interaction between the absolute change in the product market regulation index and the absolute change in the labor market regulation index. $\Delta NEER_{-1}$ is the lagged absolute change in the nominal effective exchange rates. Source OECD. gap is the estimated output gap. Source World Economic Outlook. $gap * ETCR$ and $gap * EPL$ are the interaction effect between output gap and product market regulation and labor market regulation index respectively. CA/GDP is the current account balance as a percentage of GDP. Source OECD. The regressions are carried out using Feasible Generalized Least Squares estimator allowing for a different error variance for each country and AR(1) with country specific ρ and including country fixed effects. ***=significant at the 1% level; **=significant at the 5% level; *=significant at the 10% level.

CFS WORKING PAPER SERIES

No.	Author(s)	Title
450	Nikolaus Hautsch, Ostap Okhrin, Alexander Ristig	Efficient Iterative Maximum Likelihood Estimation of High-Parameterized Time Series Models
449	Engelbert J. Dockner Manuel Mayer Josef Zechner	Sovereign Bond Risk Premiums
448	Johann Reindl Neal Stoughton Josef Zechner	Market Implied Costs of Bankruptcy
447	Jaewon Choi Dirk Hackbarth Josef Zechner	Granularity of Corporate Debt
446	Giuseppe Bertola Winfried Koeniger	Hidden Insurance in a Moral Hazard Economy
445	Rong Hai Dirk Krueger Andrew Postlewaite	On the Welfare Cost of Consumption Fluctuations in the Presence of Memorable Goods
444	Jill E. Fisch Tess Wilkinson-Ryan	Why Do Retail Investors Make Costly Mistakes? An Experiment on Mutual Fund Choice
443	Christiane Baumeister Pierre Guérin Lutz Kilian	Do High-Frequency Financial Data Help Forecast Oil Prices? The MIDAS Touch at Work