

Determinants of inflation differentials in the euro area

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Abstract

In this paper I analyze the determinants of inflation differentials in the euro zone. Using a sample of 11 countries for different samples in period 1990-2007, I estimate the effect of product and labor market regulation on inflation and inflation persistence. I find that, after the adoption of the euro, product market deregulation has a significant effect in reducing the inflation rate, while higher labor market regulation increases inflation persistence and it reduces the responsiveness of inflation to the output gap.

JEL: E31, E58, E65, L51.

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

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1 Introduction

The divergence in the inflation rate in the euro zone countries has increasingly become a cause of concern mainly because it contributed to the building up of the imbalances within the union and has prompted the need for a careful analysis of its determinants.¹ While inflation differentials in a monetary union can be justified by differences in the business cycles or, in the convergence period, by the “Balassa-Samuelson effect”, its persistence points instead to “cross-country differences [...] in the implementation of structural reforms” (Praet, 2012).

Figure 1 shows the cumulated inflation differentials in the euro zone since the adoption of the euro. In a monetary union these differences become a major concern if they are mainly driven by dissimilar economic structures. In fact, given the convergence in inflation expectations as a consequence of a common monetary policy and of the sovereign bond spreads (before the crisis), the real interest rates also diverged across the euro zone countries. The countries with persistent lower real interest rates experienced stronger credit growth and housing booms which contributed to a further pressure on prices and wages.

The literature presents contrasting results of the role of different economic structural on the divergence of inflation and the aim of this study is to investigate the effect of product and labor market deregulation on inflation rate and inflation persistence.

Honohan and Lane (2003) point out that at the beginning of the monetary union (1999-2001), the main driving force of the inflation divergence was not the Balassa-Samuelson effect, but the differential impact of the common external exchange rates (nominal effective exchange rate or NEER). Subsequent studies analyze also the impact of labor and product market regulation reaching contrasting results. Correa-Lopez et al. (2010) find that lower product market regulation reduces the persistence of inflation and increases its responsiveness to changes in productivity growth, while Jaumotte and Morsy (2012) find mixed evidence of the effect of product market regulation on inflation but they find that more regulated labor market contributed significantly to the high and persistent inflation differential. Moreover, they conclude that the decline in the inflation rate does not seem to reflect structural reforms but rather the anchoring of inflation expectations.

In this paper I use a sample of 11 euro zone countries and I find that, after the adoption of the euro for the sample 1999-2007, product market deregulation (the change in the product market regulation index) has a large and significant effect on the inflation rate, but not on the inflation persistence, while labor market regulation contributes to the inflation persistence and reduces the responsiveness of inflation to the output gap. The change of nominal exchange rate does not have any impact on the inflation rate, while private credit

¹See Praet (2012).

flows have a positive and statistically significant effect.

To proxy for product market regulation I use the Indicators of Regulation in Energy, Transport and Communication (ETCR) coded by Conway and Nicoletti (2006). They provide the longest time series currently available (1975-2007), to my knowledge, to compare product market regulation across countries in the non-manufacturing sectors which constitutes two-thirds of economic activities and are affected by import penetration only to a limited extent. They take into account market characteristics such as barriers to entry, public ownership, excessive vertical integration and the presence of price controls. I use both the whole index ETCR and the subindex barriers to entry. To proxy for labor market regulation I use the Employment Protection Legislation (EPL) index also coded by the OECD. The EPL, available annually for the period 1985-2008, “measures the procedures and costs involved in dismissing individuals or groups of workers and the procedures involved in hiring workers on fixed-term or temporary work agency contracts. It is important to note that employment protection refers to only one dimension of the complex set of factors that influence labour market flexibility.” (I plan to verify the robustness of the results using also the trade union density as a different measure of labor market flexibility.)

Given the relative long time series, the use of Arellano-Bond estimator is not optimal because the number of instruments increases with the time dimension, but not long enough to use a fixed effect estimator (see Judson and Owen (1999)). I estimate the dynamic panel with Feasible GLS allowing for a different error variance for each country. In the first step I estimate the panel data model assuming product and labor market regulation are exogenously and independently determined, on a second step [to be implemented] I plan to take into account the sequential nature of these reforms, as pointed out in Blanchard and Giavazzi (2004) and in Fiori et al. (2012), and estimate the panel using a control function approach.

In the 1999-2007 sample I find that product market deregulation (proxied by the change in the ETCR or entry barrier index) has a large and statistically significant effect on the inflation rate. However, product market regulation does not affect the persistence of the inflation rate, while labor market regulation affects it only marginally. On the other hand, a higher labor market regulation dampens the response of inflation to output gap. Moreover, private credit flows have a positive and statistically significant effect on the inflation rate.

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 e presents the results. Section 5 concludes.

2 Related Literature

The divergence in the inflation rates among the euro country members has received increasing attention. Honohan and Lane (2003) emphasize that, at the beginning of the monetary union (1999-2001), the main driving force of the inflation divergence was not the Balassa-Samuelson effect, but the differential impact of the common external exchange rates (nominal effective exchange rate). They run static multivariate panel regression for the period 1999-2001. However, when the persistence of inflation is taken into account, the nominal effective exchange rate is not statistically significant [add references] Anderson et al. (2009) confirm this result and, using a dynamic panel data model for the period 1999-2006, show that the main determinants of inflation differentials are developments in the per capita GDP, productivity levels, cyclical positions, and, to some extent, wage growth and changes in product market regulation. However, their dataset for product market deregulation ends in 2003 and they do not include data on labor market regulation.

Correa-Lopez et al. (2010) analyze the impact of product and labor market regulation on the responsiveness of inflation to macroeconomic shocks. Using a panel of 20 OECD countries for the period 1961-2006 they find that a lower product market regulation reduces the persistence of inflation and increases its responsiveness to changes in productivity growth. They also confirm the results of Bowdler and Nunziata (2007) that the presence of “high coordination in the labor market reduces the effect on inflation of movements in unemployment, productivity and import prices, both on impact and dynamically.” However, analyzing a sample of OECD countries, they do not control for different monetary policy institutions and the possible different effect on the inflation expectations.

Biroli et al. (2010) analyze the effects of product and labor market institutions on the 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 the inflation persistence. However, they only analyze the impact of one variable at the time.

Jaumotte and Morsy (2012) extend previous studies and analyze the determinants of inflation for a panel of 10 euro area countries for the period 1983-2007. They use a traditional backward-looking Phillips curve augmented to explore the role of a broad set of labor and product market indicators on inflation persistence and the responsiveness of inflation to the output gap and macroeconomic shocks. Contrary to previous studies, the evidence of the role of product market deregulation on the persistence is mixed. However, they find that the more regulated labor market contributed significantly to the high and persistent inflation differential in the countries characterized by higher inflation. Moreover, they find that the decline in the inflation rate does not seem to reflect structural reforms but rather

the anchoring of inflation expectations.

Another important related strand of literature analyzes the effect of product and labor market reforms on unemployment. Fiori et al. (2012) building on Blanchard and Giavazzi (2003) analyze also the political economy dimension of the reforms concluding that they are “economic substitute”, but that they can be considered also “political complement” since reforms in product markets lead, 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 employment rate. This sequentiality aspect of the reforms should be taken into consideration also in the estimation in order to fully account for the effect of product market deregulation.

From a theoretical point of view, Blanchard and Giavazzi (2003) are the first to introduce regulation in good and labor markets in order to analyze the macroeconomic consequences of regulation. They use a partial equilibrium model in which product market regulation is summarized by two parameters: a firm entry cost, which determines the number of products in the long run, and a taste parameter that determines the elasticity of substitution between goods in the short run. Labor market regulation is instead determined by the parameter summarizing the workers’ bargaining power.

A short cut used in Steinsson (2003), for the purpose of introducing cost push shocks, and in Moretti (2012), for representing product market regulation in a New Keynesian model, is to assume time-varying elasticity of substitution between goods. In this case product market deregulation has an impact on the inflation rate on the same period.

Gali (2012) analyzes the impact of wage flexibility on employment in a New Keynesian model and shows, instead, that wage adjustments do not play a direct role in the determination of employment and that their impact on employment is only indirect, through the change in aggregate demand resulting from the endogenous monetary policy response to the variations in inflation caused by wage adjustments.

Krause and Lubik (2007) develop a New Keynesian model with search and matching frictions and find that real wage rigidities only weakly affect inflation dynamics. However, Campolmi and Faia (2009) extending the model for a two-country currency area, find that the differences in labor market institutions can generate significant differentials in volatility of real wages, marginal costs for firms and inflation when the model is subject to a variety of realistic shocks.

Cacciatore and Fiori (2012) develop a dynamic stochastic general equilibrium model with endogenous producer entry and labor market frictions and they show that reforms affect business cycle dynamics, amplifying the impact responses to shocks but reducing the persistence.

3 Data and Preliminary Evidence

In this section I discuss the sample and explain the variables that I use in the econometric work.

I select a sample of 11 countries that adopted the euro in 1999 (including Greece which joined only in 2001, but dropping Luxembourg due to lack of data). In this way I can study the effect of the interaction of product and labor market reforms with the adoption of a common new framework of monetary policy. Moreover, I control for other factors that might have contributed to the divergence in the inflation rates in the euro area. I select data from 1990 to 2007, due to data limitation for labor and product market regulation indexes.

In particular I focus my attention to product and labor market reforms that contributed to the decline in the inflation persistence (Correa-Lopez et al. (2010), Biroli et al. (2010) and Jaumotte and Morsy (2012)). As in previous studies I use Indicators of Regulation in Energy, Transport and Communications (ETCR) coded by Conway and Nicoletti (2006). They provide the longest time-series currently available, to my knowledge, to compare product market regulations across countries in the non-manufacturing sectors which constitute 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, excessive vertical integration and the presence of price controls. I use both the summary index ETCR and the subindex entry barriers to proxy product market regulation.

As measures of labor market regulation I use the index Employment Protection Legislation (EPL), available also annually for the same period. EPL “measures the procedures and costs involved in dismissing individuals or groups of workers and the procedures involved in hiring workers on fixed-term or temporary work agency contracts. It is important to note that employment protection refers to only one dimension of the complex set of factors that influence labour market flexibility.” [I plan to verify the robustness of the results by using also union density as a proxy for labor market regulation.]

I further control for the (growth of) nominal effective exchange rate (NEER) as in Honohan and Lane (2003) in order to take into account the effect of imported inflation due to different exposure to extra-union trade.

Moreover, among the factors that might have contributed to the inflation divergence within the eurozone is the flow of funds from the core to the periphery which I proxy with the private credit flows.²

²The private sector credit flow represents the net amount of liabilities in which the sectors Non-Financial corporations (S.11) and Households and Non-Profit institutions serving households S.14_S.15) have incurred along the year. The instruments that are taken into account to compile private sector credit flow are Securities other than shares (F.3) and Loans (F.4), that is, no other instruments are added to calculate the

I use the estimated of the outputgap from the World Economic Outlook and I control for the fiscal stance using deficit as a percentage of GDP.

4 Empirical Analysis

The empirical evidence on the effects of product and labor market deregulation on the inflation differentials and on the inflation persistence is mixed. Some studies point to product market regulation as an important determinant of inflation differentials (Andersson et al. (2009) and Correa-López et al. (2010)), while others (Jaumotte and Morsy (2012)) point to the labor market institution as a major driving force.

These studies differ in the sample and in the econometric methodology used. Andersson et al. (2009) analyze the determinants of inflation differentials in the euro zone for the period 1999-2006 using Arellano-Bond estimator, unfortunately the inclusion of product market regulation reduces the sample to 1999-2003. Correa-López et al. (2010), instead, analyze a sample of 20 OECD countries for the period 1961-2006 using OLS since the time dimension of their panel is sufficiently large. However, as measures of labor market regulation they use a 1-3 index indicating the level of coordination in wage bargaining and the percentage of unionization but not *EPL*, not available annually at the time of their study, and, since ETCR is available only from 1975, they assume it constant at the 1975 value for the period 1960-1974. Jaumotte and Morsy (2012) estimate the determinants of inflation differentials for a sample of 10 countries in the euro zone for the period 1983-2007. On top of EPL, they also use a dummy variable for the coordination of collective bargaining and union density. They estimate the dynamic panel data model, despite the long time series, with Arellano-Bond estimator.

The focus of the paper is to analyze the determinants of inflation divergence after the adoption of the euro for the sample 1999-2007, and compare the results with longer samples

Given the relatively long time series compared with the cross-country dimension and in order to make the estimates comparable across different samples, I use a Feasible GLS allowing for a different error variance for each country, but not autocorrelation on the residuals³ In fact, Arellano-Bond 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 (see Judson and Owen (1999)).

I initially estimate the dynamic panel data model with Feasible GLS assuming product private sector credit flow. Definitions regarding sectors and instruments are based on the ESA 95. Data are expressed in million euros and presented in consolidated terms, i.e. data do not take into account transactions within the same sector.

³I verified the lack of persistence in the residuals.

and labor market reforms are exogenous and independently set, then I tackle their potential endogeneity taking into consideration the sequential nature of their adoption as pointed out in Blanchard and Giavazzi (2003) and Fiori et al. (2012) and estimating the model using a control function approach [to be implemented].

I estimate the following dynamic equation:

$$\pi_{it} = b_t + \beta_1 \pi_{it-1} + \beta_2 PMR * \pi_{it-1} + \beta_3 LMR * \pi_{it-1} + \gamma \Delta PMR + \delta_1 outputgap_{it} + \delta_2 PMR * outputgap_{it} + \delta_3 LMR * outputgap_{it} + \eta z_{it} + \varepsilon_{it} \quad (1)$$

Where b_t are the time fixed effects, PMR indicates an index of product market regulation (ETCR or entry barriers), LMR indicates an index for labor market regulation and ΔPMR is product market deregulation, while z_{it} represents the other controls (rate of growth of NEER, private credit flows, deficit as a percentage of GDP).

In Table 1 I report the result for the sample 1999-2007. I proxy product market regulation with the summary index ETCR (odd columns) and with the subindex entry barriers (*entry*) (even columns). The regressions are initially carried out including all interactions terms (columns 1-4) and then including only the interaction effects with LMR (columns 5-8) and only with PMR (columns 9-12).

For the sample 1999-2007, labor market regulation (EPL) (marginally) increases the persistence of inflation (columns 1, 2, 3, 5, 7 and 8) and dampens the response of inflation to output gap (columns 1-8). Product market regulation, on the other hand, has no effect on the inflation persistence and dampens the response of inflation to the output gap only when interacted alone and only for $ETCR$ (column 9 and 11). However, product market deregulation has a large and statistically significant effect when the proxy entry barriers is used (columns 2, 4, 6, 8, 10 and 12). The rate of change of the NEER has no impact, while private credit flow has always a positive and statistically significant effect on inflation rate.

I repeat the same analysis also for the period 1994-2007, after the establishment of the European Economic Area (EEA) (January 1, 1994). The EEA Agreement was signed in Porto on 2 May 1992 by then seven states of the European Freedom Trade Association⁴ and the then 12 members of the European Community⁵. I consider only the countries that eventually joined the euro due to the eventual convergence in monetary policy.

⁴Austria, Denmark, Norway, Portugal, Sweden, Switzerland and the United Kingdom

⁵Belgium, 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 1 November 1993.

Table 2 presents the results with the same structure as before. First, considering a longer period of time, which includes the convergence process to the euro, the rate of growth of NEER has a large, negative and statistically significant impact on inflation. Product market deregulation has a negative and (marginally) statically significant impact only when proxied by entry barriers (columns 2, 4, 10 and 12), but the results are less clear cut. Moreover, there is some evidence that the level of product market regulation increases the persistence of the inflation rate (columns 3, 4, 9, 10, 11 and 12) instead of labor market regulation. The different result might point to the interaction between the two reforms and their sequential nature.

The results are confirmed when considering the sample 1990-2007. In particular, a higher level of product market regulation increases the persistence of inflation.

However, given the sequential nature of the reforms and the observation that product market deregulation creates the conditions for an easier implementation of labor market reforms, it is important to take this into account in the estimation. For these reasons in the second step I plan to implement a control function estimation as in Fiori et al. (2012).

5 Conclusions

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Fig.1: Inflation divergence

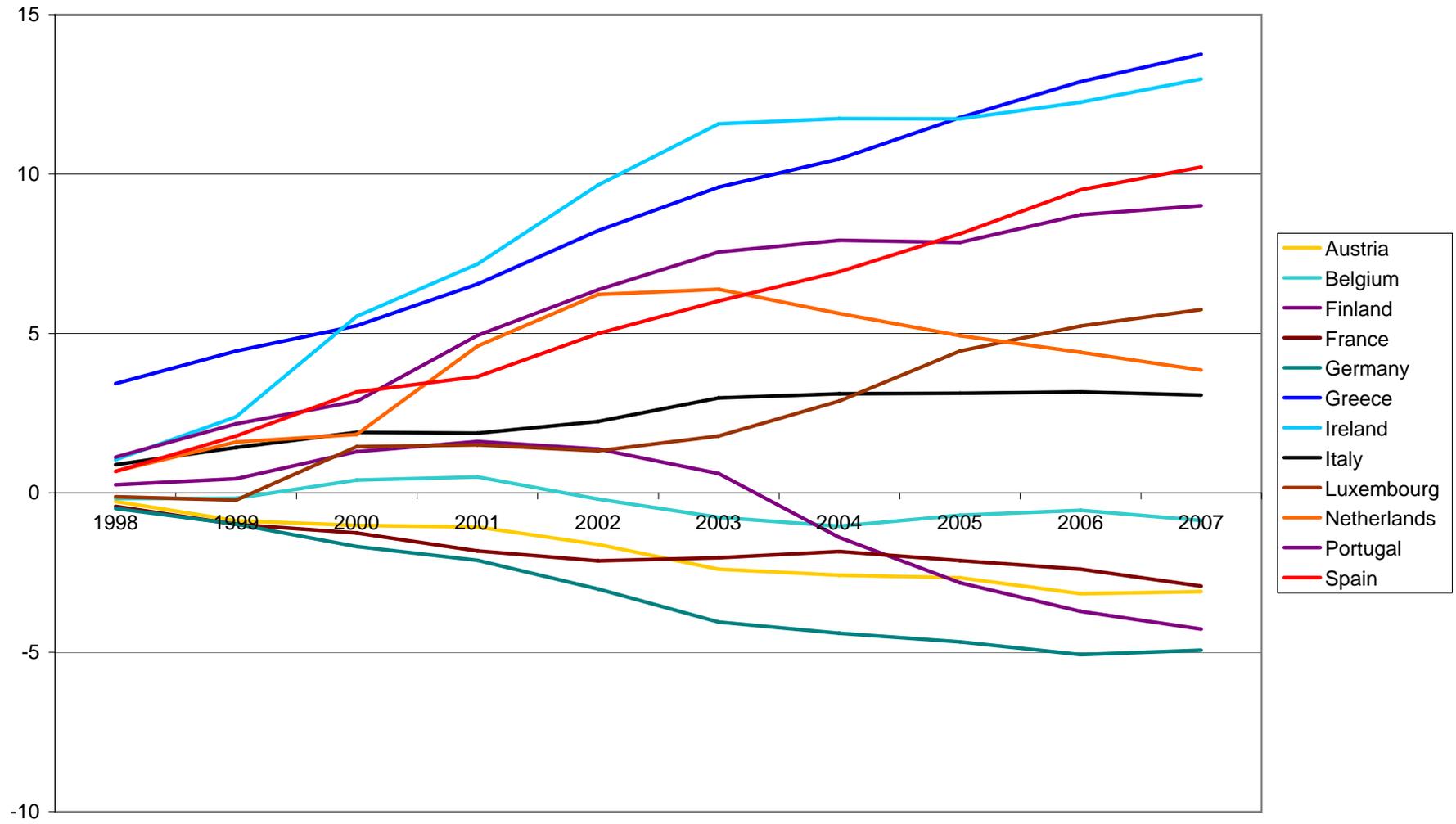


Fig. 2: ETCR

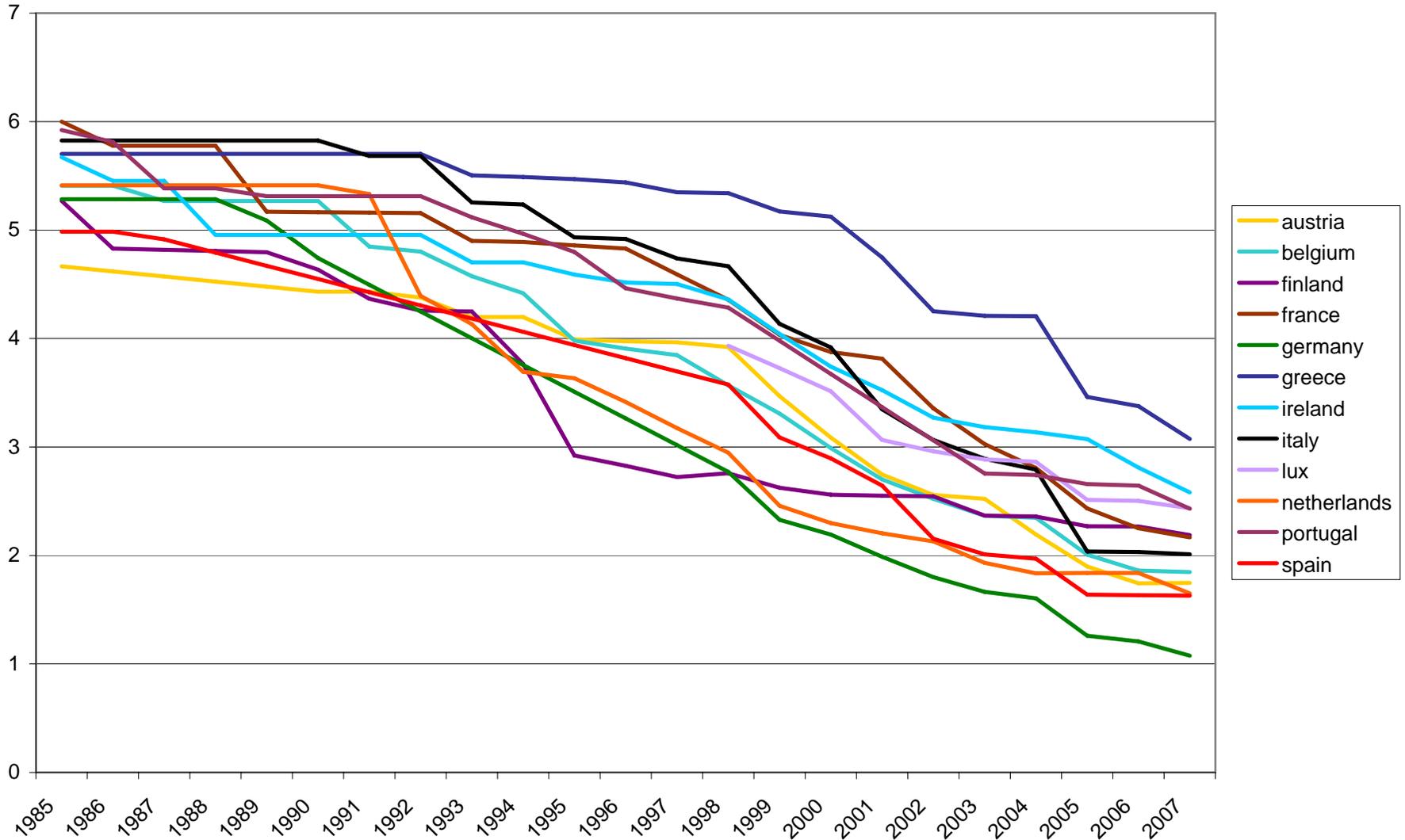


Fig.3: Employment Protection Legislation

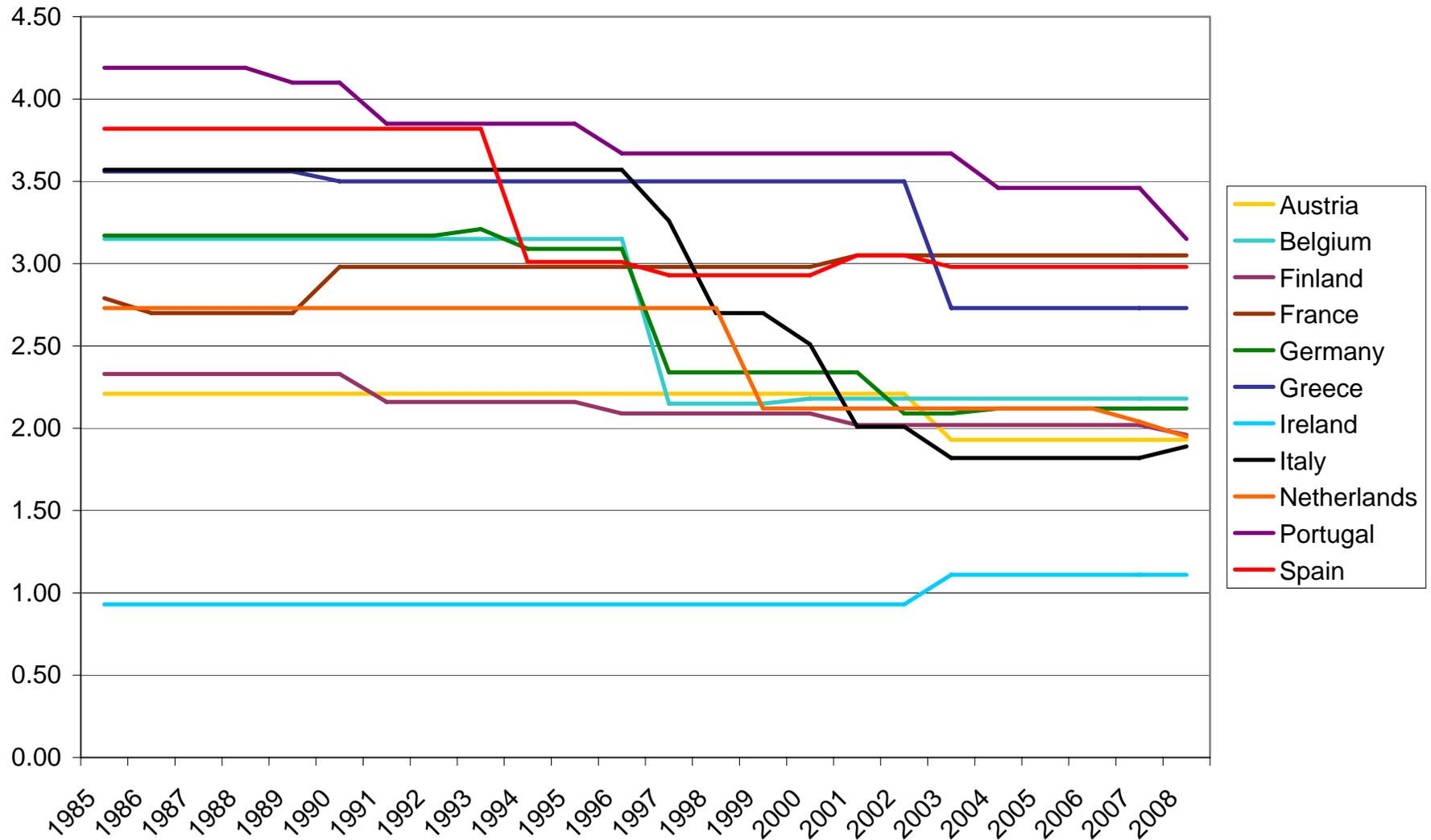


Table 1: Determinants of inflation: post euro adoption.

	1999-2007		1999-2007		1999-2007		1999-2007		1999-2007		1999-2007	
	FGLS regression Panels: heteroskedastic Correlation: no autocorrelation		FGLS regression Panels: heteroskedastic Correlation: no autocorrelation		FGLS regression Panels: heteroskedastic Correlation: no autocorrelation		FGLS regression Panels: heteroskedastic Correlation: no autocorrelation		FGLS regression Panels: heteroskedastic Correlation: no autocorrelation		FGLS regression Panels: heteroskedastic Correlation: no autocorrelation	
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
	ETCR	ENTRY	ETCR	ENTRY	ETCR	ENTRY	ETCR	ENTRY	ETCR	ENTRY	ETCR	ENTRY
infl_1	0.615 ***	0.585 ***	0.426 ***	0.434 ***	0.529 ***	0.554 ***	0.423 ***	0.434 ***	0.603 ***	0.622 ***	0.417 ***	0.423 ***
etcr_infl_1	0.119	0.105	0.120	0.108	0.097	0.097	0.094	0.095	0.110	0.102	0.120	0.112
entry_infl_1	-0.032	-0.026	-0.001	0.003					0.013		0.032	
epI_infl_1	0.027	0.027	0.024	0.025					0.027	0.023	0.024	0.041 *
dentry		0.027								0.028		0.025
dneer	0.058 *	0.068 **	0.043 *	0.043	0.051 *	0.043	0.045 *	0.041 *				
outputgap	0.032	0.032	0.026	0.027	0.028	0.028	0.024	0.024				
outputgap_etcr	-0.344	-0.355 **	-0.671 **	-0.432 ***	-0.328	-0.364 **	-0.664 **	-0.431 ***	-0.502	-0.419 **	-0.805 ***	-0.485 ***
outputgap_entry	0.349	0.164	0.310	0.149	0.348	0.172	0.308	0.149	0.350	0.189	0.319	0.164
private_credit		0.061		0.058		0.060		0.063		-0.038		0.032
		0.059		0.059		0.060		0.059		-0.036		0.061
		0.061		0.061		0.060		0.060		0.064		0.063
		0.059		0.059		0.060		0.059		0.063		0.059
		0.686 ***		0.438 ***		0.607 ***		0.475 ***		0.416 ***		0.335 ***
		0.145		0.125		0.116		0.086		0.129		0.123
		0.124		0.097		0.115		0.086		0.080		0.070
		-0.015		-0.016						-0.088 **		-0.078 **
		0.040		0.036						0.037		0.034
		0.039		0.016						-0.016		-0.021
		0.026		0.024						0.031		0.027
		-0.190 ***		-0.152 ***		-0.178 ***		-0.148 ***				
		0.048		0.034		0.040		0.029				
		0.044		0.033		0.039		0.032 ***				
				0.031 ***				0.031 ***				
				0.007				0.007				
				0.007				0.007				
Obs.	99	99	96	96	99	99	96	96	99	99	96	96

Table 2: Determinants of inflation, post establishment of the European Economic Area.

	1994-2007		1994-2007		1994-2007		1994-2007		1994-2007		1994-2007	
	FGLS regression Panels: heteroskedastic Correlation: no autocorrelation		FGLS regression Panels: heteroskedastic Correlation: no autocorrelation		FGLS regression Panels: heteroskedastic Correlation: no autocorrelation		FGLS regression Panels: heteroskedastic Correlation: no autocorrelation		FGLS regression Panels: heteroskedastic Correlation: no autocorrelation		FGLS regression Panels: heteroskedastic Correlation: no autocorrelation	
	[1] ETCR	[2] ENTRY	[3] ETCR	[4] ENTRY	[5] ETCR	[6] ENTRY	[7] ETCR	[8] ENTRY	[9] ETCR	[10] ENTRY	[11] ETCR	[12] ENTRY
infl_1	0.553 *** 0.108	0.586 *** 0.104	0.437 *** 0.112	0.503 *** 0.101	0.642 *** 0.091	0.650 *** 0.091	0.611 *** 0.084	0.619 *** 0.084	0.547 *** 0.092	0.569 *** 0.091	0.404 *** 0.108	0.416 *** 0.105
etcr_infl_1	0.027 0.019	0.026 0.022	0.049 ** 0.021						0.030 * 0.017		0.063 *** 0.020	
entry_infl_1				0.049 ** 0.023						0.033 * 0.018		0.072 *** 0.021
epl_cpi_1	0.001 0.025	0.003 0.028	0.009 0.024	0.006 0.024	0.023 0.024	0.021 0.024	0.031 0.022	0.030 0.022				
detr	-0.408 0.283		-0.383 0.286		-0.286 0.278		-0.281 0.284		-0.366 0.277		-0.390 0.282	
dentry		-0.263 * 0.155		-0.291 ** 0.151		-0.236 0.150		-0.224 0.149		-0.250 * 0.154		-0.286 * 0.153
dneer	-0.095 *** 0.018	-0.093 *** 0.017	-0.090 *** 0.018	-0.091 *** 0.018	-0.091 *** 0.018	-0.092 *** 0.017	-0.087 *** 0.018	-0.088 *** 0.018	-0.096 *** 0.017	-0.095 *** 0.017	-0.093 *** 0.018	-0.093 *** 0.017
outputgap	0.415 *** 0.125	0.225 ** 0.102	0.408 *** 0.121	0.325 *** 0.092	0.231 *** 0.093	0.239 *** 0.093	0.443 *** 0.088	0.440 *** 0.089	0.370 *** 0.109	0.151 ** 0.067	0.267 ** 0.113	0.081 0.066
outputgap_etcr	-0.076 ** 0.032		-0.018 0.034						-0.076 *** 0.030		-0.051 * 0.031	
outputgap_entry		-0.012 0.023		0.037 0.024						-0.016 0.023		0.008 0.023
outputgap_epl	-0.019 0.036	-0.036 0.038	-0.095 *** 0.036	-0.119 *** 0.034	-0.052 0.034	-0.056 * 0.034	-0.132 *** 0.031	-0.132 *** 0.031				
private_credit			0.022 *** 0.007	0.021 *** 0.007			0.016 ** 0.007	0.016 ** 0.007			0.021 *** 0.008	0.021 *** 0.008
Obs	154	154	139	139	154	154	139	139	154	154	139	139

