Impact of euro-area membership on structural reforms in product market and business regulation

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Abstract:

This paper investigates whether membership in the euro area enhances or hampers structural reforms in the regulation of product markets and business environment. It updates the empirical results of the early literature and adds to it by applying new indicators for structural reforms. By estimating a dynamic panel data model with system GMM, I find that euro-area countries deregulate significantly more than other OECD countries in product markets. This result is confirmed applying the longer panel for network sector regulation. However, I do not find any evidence for reforms in business regulation that would ease doing business in a cross-section analysis.

Keywords: Product market regulation, network sector regulation, euro area, ease of doing business, structural reforms, deregulation

JEL: F33, F36, L50

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1 Introduction

Prior to the creation of the euro area, there was a lively debate among scholars whether the euro would hamper or speed up structural reforms in the regulation of product and labour markets. In that debate, the TINA (There Is No Alternative) argument was predominant. However, the conclusions of theoretical models concerning this question are rather ambiguous or contradictory. Hence, right after the introduction of the euro, several studies were conducted to test the hypotheses empirically.

In my view, it is time to reassess the empirical relationship between the introduction of the euro and structural reforms with the substantial larger sample period now available, more than a decade after the creation of the euro area. Moreover, I apply indicators that were not available or usable for the early literature. In this paper, I do not assess the impact of the euro on labour markets. Rather, I focus on the effect on product market and business regulation. We will look at whether euro-area membership reduces product market regulation and improves the ease of doing business.

To begin with, I use the OECD's economy-wide product market regulation (PMR) indicator to estimate a dynamic panel data model with system GMM, where a dummy variable for the euro-area membership of a country is the variable of interest. Then, I use a difference-in-differences framework to estimate the euro's impact on network sector regulation in a long panel of OECD countries—with indicators already applied by the early literature on structural reforms. This enables me to address the issues of identification and country fixed effects. Finally, I perform a simple OLS cross-sectional analysis with the World Bank's Doing Business distance to frontier indicator. To summarize the results, I find a significant and robust effect of euro-area membership on the deregulation of product markets and, more specific, of network sectors. However, the analysis does not permit to say that the introduction of the euro facilitates or complicates doing business.

This paper contributes to the early literature on structural reforms. Alesina, Ardagna and Galasso (2010) investigate whether or not the introduction of the euro has accelerated structural reforms. They call the deregulation in product markets, and the liberalization and deregulation in the labour markets structural reforms. They disentangle the effect of the euro and the European Single Market, and find significant correlations between the speed of deregulation in product markets and the adoption of the euro. Moreover, the effect of the euro on product market regulation was larger the larger the initial level of regulation. The results are less clear with respect to the labour markets. They find evidence for wage moderation prior the adoption of the euro, and mixed results thereafter. Due to data availability at the time, their results concerning the deregulation in product markets are predominantly based upon indicators on regulation of seven network industries (electricity and gas supply, road freight, air passenger transport, rail transport, post, and telecommunications). This set of indicators is to some extent a forerunner of the OECD Product Market Regulation (PMR) indicator that I use in my first regression analysis (Section 3). The main difference between these sets of indicators is the area of regulation: the first measure regulation in specific sectors, the latter measures economy-wide regulation. Their second limitation is the observable period after the introduction of the euro. The latest data on regulation they use is from 2003.

Duval and Elmeskov (2005) conduct a similar empirical analysis, where they explore the role of the monetary regime for structural reforms. They estimate the likelihood that countries undertake reforms in either product market regulation or in one of four specific areas of labour market policies, depending on whether the country is engaged in a fixed exchange rate arrangement or not. The dataset is basically the same as in Alesina, Ardagna and Galasso (2010): the OECD dataset on labour market reform and the OECD indicators of product market regulation in network sectors for 21 OECD countries for the period 1985–2003. Based on a panel probit regression, there is weak evidence that countries with a fixed exchange rate regime undertake less structural reforms. Duval and Elmeskov (2005) restrict

their analysis to major reforms as opposed to small ones. By this, they empirically prove the theoretical conclusion of Saint-Paul and Bentolila (2001) (see Section 2) that the participation in the euro area makes big reforms more unlikely. However, Duval's and Elmeskov's (2005) analysis cannot identify the effect of the euro area on rather small, but gradual reforms, which should be encouraged (Saint-Paul and Bentolila 2001).

Belke, Herz and Vogel (2007) and Belke and Vogel (2015) also contribute to this strand of literature by focusing on monetary commitment rather than on the introduction of the euro. In a sample of 23 OECD countries from 1970 to 2000, Belke, Herz and Vogel (2007) find evidence in favour of the TINA argument for reforms in labour and product markets. Belke and Vogel (2015) gain mixed evidence on the relationship between market-oriented structural reforms as economic liberalization and monetary commitment in transition countries.

In a recent paper, Schönfelder and Wagner (2016) test whether the European monetary integration has had an impact on institutional development, measured by the Worldwide Governance Indicators.[1] These indicators encompass political, legal, and economic institutions, and are composed of several hundred variables obtained from surveys of firms and households and subjective expert assessments. The OECD's PMR indicator and the Doing Business indicator of the World Bank choose a very different approach. These are indicators for the regulation of product markets and business environment. Both are based on raw information about existing laws and regulations. For the Doing Business indicators a second type of data is used: cost estimates, for example, from official fee schedules and time estimates, which often involve an element of judgment by practitioners in each country (World Bank 2013, pp. 21–22). The PMR indicator measures the degree to which policies promote or inhibit competition. The Doing Business indicator complements this by measuring

[1] Schönfelder and Wagner (2016) find a significant and negative effect of euro-area membership on control of corruption.

the strength of legal institutions relevant to business regulation and the complexity and cost of regulatory process. A more detailed description of the selected data is given in the respective sections.

The paper is organized as follows. Section 2 discusses how euro-area membership could influence structural reforms. The empirical analyses of the three regulation indicators are divided in separate sections—each explaining the data, the estimation approach and the results. Section 3 studies the impact of euro-area membership on economy-wide product market regulation. Network sector regulation is evaluated in Section 4. In Section 5, I assess the euro's impact of the ease of doing business. Section 6 concludes.

2 Theoretical arguments of why euro-area membership could influence structural reforms

Alesina, Ardagna and Galasso (2010, p. 2) lay down some economic arguments why the membership in the euro area could accelerate and facilitate deregulation and liberalization in product and labour markets. In this discussion, I focus on their arguments concerning product market deregulation. They describe two channels by which the euro could foster reforms: the competition channel and the adjustment channel. The former establishes a relationship between more competition due to the single market and the cost of regulation in product markets. A single currency likely increases price transparency, and may expose the cost of structural rigidities more obviously. Combining greater price transparency with more competition within the European single market could make it more difficult for domestic monopolist to protect their rents. The resulting difficulties of local monopolist to dominate regional markets could create pressure for deregulation of product markets.

One recent example of widespread domestic regulatory protection is the German legislation restricting internet sales of medical products for human use by pharmacies. In the version of 1998, the Arzneimittelgesetz (Law on Medicinal Products) prohibited the sale by mail order of

medicinal products that may be sold only in pharmacies. The Dutch mail-order pharmacy DocMorris N.V.—aspire to sell medicinal products to German households—partially won proceedings against the Deutscher Apothekenverband (Federal Union of German Association of Pharmacists) before the Court of Justice of the European Union (CJEU) (Court of Justice of the European Union 2003). As an (anticipated) reaction, the German legislation was deregulated to allow the sales by mail order for medicinal products. The subsequent market pressures increased competition in prices for medicinal products again resulting in a CJEU judgment that German legislation ruling fixed prices is violating EU law (Court of Justice of the European Union 2016). Since 2016, pharmacies from other EU member states can grant price reduction on medicinal products subject to prescription in Germany. The euro clearly promoted competitive pressures in this market. The common currency makes it much easier for private consumers to compare prices in internet shops and pay by bank transfer etc. To conclude, if one agrees upon that a common currency is a necessary condition for having a truly common market, then, the protection of insider firms and workers by anti-competitive regulation would become more costly and visible to consumers and voters.[2]

The second channel becomes relevant whenever a country is losing competitiveness. The common currency eliminates the possibility of strategic devaluations. Domestic firms that are producing tradeable goods and their special interest groups could demand deregulation of the markets for non-tradeable input goods, e.g. services and transportation, to contain costs. Hence, the tradeable sector reacts directly to competition and translates this pressure to the intermediate goods producers (Alesina, Ardagna and Galasso 2010, pp. 2–7; Duval and Elmeskov 2005, p. 10). This argument is related to the TINA (There Is No Alternative) argument. By introducing the euro, the member countries become unable to use monetary policy to accommodate asymmetric shocks. Instead, adjustment has to come via a boom or

[2] However, the conspicuousness of protectionism could be desirable for populist politicians. As they claim to protect domestic industry in order to save local jobs, they could even attract voters.

recession. Therefore, euro-area members have to develop market-based adjustment channels to adjust to shocks through changes in prices (Alesina, Ardagna and Galasso 2010, p. 6; Bean 1998, p. 368).

In a case study, Fernández-Villaverde, Garicano and Santos (2013) show that economic reforms were abandoned and institutions deteriorated after the introduction of the euro in Spain, Ireland, Greece, and Portugal. They argue that as the euro facilitated large inflows of capital, which enabled the emergence of the financial bubble in peripheral countries, economic reforms were abandoned, institutions deteriorated, and the response to the credit bubble was delayed. This hampered the growth prospects of these countries. Fernández-Villaverde, Garicano and Santos (2013) analyse two channels to explain this development. They appear in stark contrast with the German case. First, capital flows relaxed the economic constraints under which agents (e.g., a government or bank manager) were acting, which reduced the pressure for reforms. Second, capital inflows hindered the principal (e.g., voters, shareholders, investors) in extracting signals about the performance of the agent. Germany did not experience a loosening of its financing conditions because of the introduction of the euro, and it was faced with a stagnant economy. Hence, Germany implemented far-reaching structural reforms, so that the divergence in economic policies and institutions between Germany and the other peripheral countries increased after the introduction of the euro (Fernández-Villaverde, Garicano and Santos 2013, pp. 146–147).

Other factors than the euro may influence reforms on regulation in product markets and business environment. As far as these factors are correlated with the membership in the euro area, they have to be included in the regression to avoid the omitted variable bias. Moreover, they are interesting on their own right. Alesina, Ardagna and Galasso (2010) and Duval and Elmeskov (2005) summarize some factors that could create incentives for governments to adopt regulatory reforms. Firstly, according to the TINA argument, regulatory reforms are required to regain international competitiveness when the devaluation channel is not

available. Secondly, countries that devaluated more often in the past could be more in need of regulatory reforms. Thirdly, it has been frequently observed that governments implement reforms in response to a macroeconomic or fiscal crisis. This is because governments can overcome a “status quo” bias in crisis situations. In normal times the “status quo” bias tends to prevent growth-enhancing deregulation from being implemented. On the other hand, a sound fiscal position enables governments to compensate losers from regulatory reforms, hence facilitating reforms. Fourthly, high unemployment could facilitate deregulation because there are fewer employees that oppose to bear the short-run costs of deregulation. Moreover, when unemployment benefits are high, the short-run costs of deregulation are lower for those that could be dismissed. Fifthly, there could be some effect of employment protection legislation on regulation in product markets and business environment, as implementing reforms in one field may pave the way for reforms in others. Finally, the government party-orientation could play a role in the propensity to deregulate.

3 Economy-wide product market regulation

3.1 The data set and some statistics

The OECD product market regulation database comprises indicators for economy-wide regulation, sector regulation, regulatory impact, internet regulation, sector regulators (regulatory management practice), and competition law and policy. The indicator for economy-wide regulation (Koske et al. 2015) is particularly interesting as it summarizes a wide array of different regulatory provisions across countries in areas of the product markets where competition is viable. It measures the degree to which policies promote or inhibit competition. The literature has shown that intensive competition in product markets spurs economic growth through increasing productivity and employment.[3] The economy-wide product market regulation (PMR) indicator also integrates data on sectoral regulation (as regards the energy, transportation, communication, retail distribution, and professional

services sector) into a comprehensive measure of product market regulation to assess the overall regulatory stance (Wölfl et al. 2009, p. 9). The data on sectoral regulation for networks (energy, transport and communications regulation – ETCR) will be used in a subsequent analysis as a robustness check. The construction of the PMR indicator follows a bottom-up approach. Based on raw information about existing laws and regulations, which is mainly derived from surveys of member countries. These qualitative data is turned into quantitative indicators by coding and aggregation. These sub-level indicators are aggregated to higher-level composite indicators by simple averaging. In contrast to other indicators on product market and business regulation,[4] the PMR indicator is not based on opinion or perception surveys. The economy-wide PMR indicator is available for the years 1998, 2003, 2008, and 2013. It is consistent across time and countries. The indicator is on a scale from zero to six, where higher values correspond to increasing restrictiveness of regulatory provisions for competition.[5] My sample of the PMR indicator is composed of 28 OECD countries.[6] The analysis is restricted to OECD countries that are not transition countries. The PMR indicator is not available for the USA in 2013, Luxembourg in 1998, and for Chile and Israel in 1998 and 2003.

First, I present some descriptive statistics and perform a graphical analysis. The summary statistics of the sample are reported in Table 1. Largely, the OECD countries are on the path to abandon policies that inhibit competition. The PMR indicator is smaller for all displayed quartiles and the mean in 2013 compared to 1998. The mean of the PMR indicator decreased by about 30 percent.

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[3] See Wölfl et al. (2009, p. 7) for a literature overview.

[4] Both the Fraser Institute's Economic Freedom of the World (EFW) index and the Heritage Foundation Index of Economic Freedom asses to which degree economies are free. The four cornerstones of economic freedom are personal choice, freedom of exchange, freedom to enter and compete in markets, and protection of private property Ochel and Röhn (2006, pp. 49–50). Focusing on institutional environment for business, the World Bank conducts the Business Environment and Enterprise Performance Survey every four years. It provides firm-level data on issues like business-government relations, firm financing, and so on. All of the above data sets rely on surveys or expert interviews for indices on institutional aspects.

[5] For a detailed description of the PMR indicator, see Koske et al. (2015).

[6] These are Australia, Austria, Belgium, Canada, Chile, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Portugal, Spain,

Table 1 Summary statistics of the economy-wide OECD product market indicator

	Product market regulation (PMR)	
	in 1998	**in 2013**
Minimum value	1.319	0.915
1st quartile	1.857	1.292
Median	2.113	1.442
Mean	2.131	1.473
3rd quartile	2.391	1.507
Maximum value	3.282	2.460

Data source: Koske et al. (2015)

Table 2 presents the changes of the indicator between 1998 and 2013 depending on whether a country participates in the euro area. Euro-area members experienced a pronounced reduction of policies that inhibit competition. The reduction is about twice as large as for the control group (with respect to the median, the mean, and the third quartile). Three-quarters of the euro-area countries improved regulation by at least 0.9 units on a scale from zero to six.

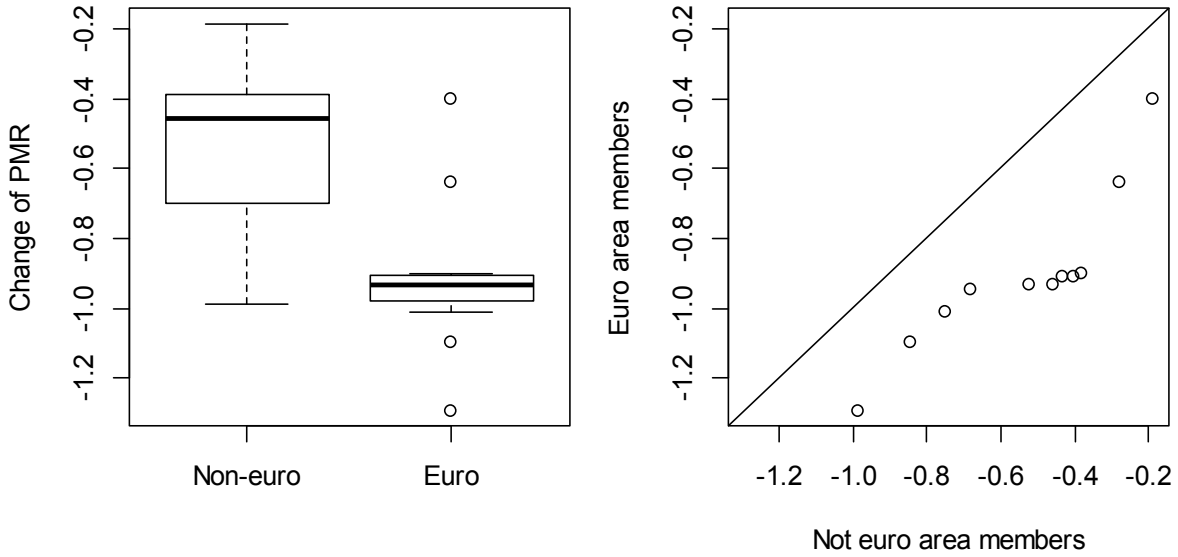
Table 2 Summary statistics of product market regulation changes

	Product market regulation (PMR change 1998–2013)	
	Non-euro	**Euro**
Minimum value	−0.9868	−1.2940
1st quartile	−0.6960	−0.9791
Median	−0.4588	−0.9315
Mean	−0.5373	−0.9070
3rd quartile	−0.3945	−0.9052
Maximum value	−0.1875	−0.4030

Data source: Koske et al. (2015)
Notes:
(i) Due to the lack of data, the change of the PMR indicator refers to the change between 1998 and 2008 for the USA.
(ii) PMR: economy-wide OECD product market regulation indicator

Sweden, Switzerland, Turkey, United Kingdom, and the United States. Hence, the sample includes twelve euro

Figure 1 Boxplot and quantile-quantile plot of product market regulation changes



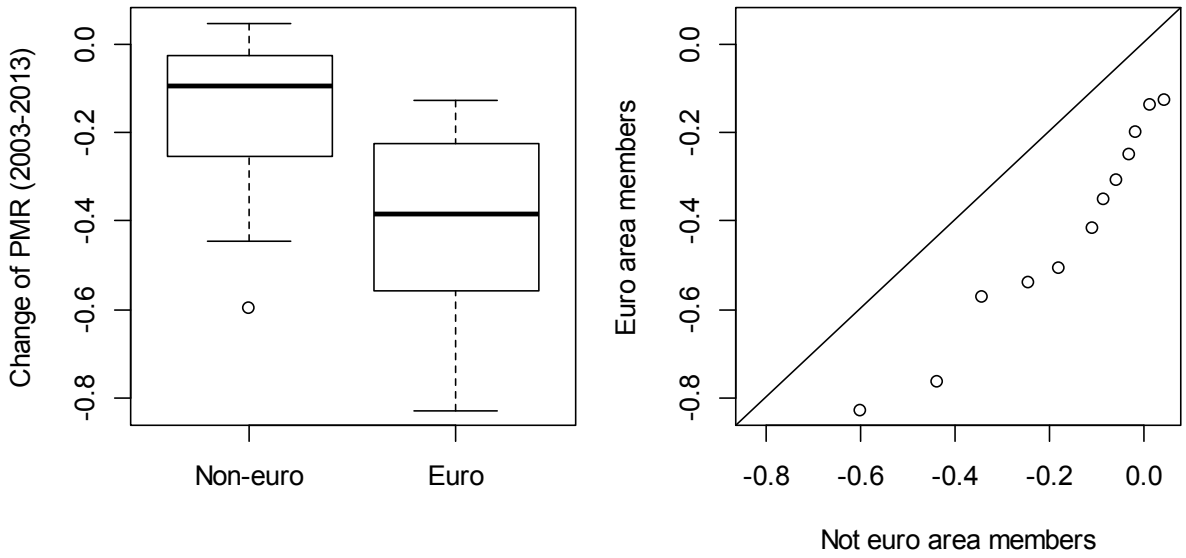
Note: The figures present the distribution of the changes of the product market regulation (PMR) indicator between 1998 and 2013. Due to the lack of data, the change of the PMR indicator refers to the change between 1998 and 2008 for the USA.
Data source: Koske et al. (2015)

Figure 1 displays boxplots and a quantile-quantile plot of the PMR indicator's changes. They plot the distributions for euro-area members against the control group. The figure visualizes and affirms the results of the descriptive analysis. One can see a remarkable difference for the change in product market regulation in euro-area countries in comparison with the control group. For the sake of comparability with the ease of doing business indicator in Section 5, Figure 2 presents the PMR changes, i.e. the deregulation in product markets, from 2003 to 2013. As one can see, there is still a remarkable difference between euro-area members and the control group for the PMR indicator, but the change between 2003 and 2013 is less than half as between 1998 and 2013. Hence, reforms to improve competition affected the PMR indicator most in the first years after its launch.[7]

countries and sixteen non-euro countries.

[7] Indeed, over the past 15 years, OECD countries have considerably liberalized their product markets, with the reforms being typically larger at the beginning of the sample period. However, the average changes hide important cross-country differences. Some countries that were in economic crisis deregulated their product market considerably during the last five years, whereas some other countries have moderately introduced regulation that might inhibit competition Koske et al. (2015, pp. 26–27).

Figure 2 Boxplot and quantile-quantile plot of the product market regulation changes between 2003 and 2013



Note: The figures present the distribution of the changes of the economy-wide OECD product market regulation (PMR) indicator between 2003 and 2013. Due to the lack of data, the change of the PMR indicator refers to the change between 2003 and 2008 for the USA.
Data source: Koske et al. (2015)

3.2 The control variables

I introduce several control variables to assure that the estimated coefficients of interest are not affected by some omitted variables that are correlated with both the euro-area membership and the regulation indicator. The selection of the control variables is loosely based on Alesina, Ardagna and Galasso (2010), and Duval and Elmeskov (2005). To use them in the PMR analysis, I calculate the average values for the five-year periods 1993–97, 1998–2002, 2003–07, and 2008–12. If nothing else is mentioned below, the values for the five-year periods are simple arithmetic averages.

I test two competitiveness indicators. The first competitiveness indicator (*CPIDR*) displays the competitiveness-weighted relative consumer prices. The second one (*ULCDR*) indicates the competitiveness-weighted relative unit labour costs for the overall economy. The indicator is generally used to analyse trends in international trade. An increase in the index indicates a real appreciation and a corresponding deterioration of the competitiveness position (OECD 2014a, 2014c, pp. 302–303). The variable *n.deval* is the number of

devaluations that a country that belonged to the European Monetary System (EMS) experienced from 1979 to 1993. These are five for France, one for Belgium, seven for Italy, and three for Ireland (Alesina, Ardagna and Galasso 2010, p. 18).

The variable *GAP* indicates the output gap, which is the deviation of the actual output from the potential output of the economy in percent of potential GDP (OECD 2014a). Additionally, I use this variable to construct a dummy variable *crisis05* that equals one when the output gap is below the 95th percentile of the empirical density of the output gap. The variable *fiscal* is the government primary balance as a percentage of GDP (OECD 2014a).

The variable *unempl* indicates the harmonized unemployment rate in percent of the total labour force (OECD 2015b). The variable *EPL* indicates the strictness of employment protection legislation (OECD 2015a), which is computed as the average on the strictness of employment protection legislation concerning regular employment and temporary employment.

The variable *GRR* is the historic OECD summary measure of benefit entitlements defined as the average of the gross unemployment benefit replacement rates for two earning levels, three family situations, and three durations of unemployment. Gross replacement rates are defined as the gross unemployment benefit levels as a percentage of previous gross earnings. *GRR*, which is compiled for odd-numbered years from 1961 to 2005, is based on the data about the Average Production Worker (APW) wage. Since 2001 the OECD constructs the gross replacement rate calibrated to the Average Worker (AW) wage, since data on the APW wage have not been collected by the OECD since 2005 (OECD 2014b). The latter series shows levels and for some countries different time trends from 2001 to 2005 compared to the first series. Hence, it would introduce a serious break if I simply extend the GRR (APW) series by the GRR (AW) series. Therefore, I use only the GRR (APW) series to

calculate averages for the five-year periods for the PMR analysis, and apply these period averages lagged once to the regression equation.

The variable *gov* is a categorical variable that indicates party orientation of the largest government party with respect to economic policy. The series is compiled by the Database of Political Institutions (DPI) (Beck et al. 2001), and is made available by the Quality of Government Institute (Teorell et al. 2013). The party orientation is coded along the following criteria: (1) *right* for parties that are defined as conservative, Christian democratic, or right-wing; (2) *center* for parties that are defined as centrist or when party position can best be described as centrist (e.g., party advocates strengthening private enterprise in a social-liberal context); and (3) *left* for parties that are defined as communist, socialist, social democratic, or left-wing. For the use in the PMR analysis, I assign the party orientation of the largest government party to the five-year period, which was in government most of the time (three of the five years).[8]

3.3 The econometric model and its estimation

In this section, I use a panel model to estimate the impact of euro-area membership on economy-wide product market regulation. The empirical approach is to compare the end-of-period levels of the indicator with the levels at the beginning of each period. The differences between both are the period changes. If the period changes are significantly different for euro-area countries in comparison to other OECD countries (when controlling for other determinants), this is evidence for the influence of the euro on regulation. For the PMR indicator, one period corresponds to five years. The estimation equation is

$$PMR_{i,t} = \beta_0 + \beta_1 PMR_{i,t-1} + \beta_2 euro_i + \boldsymbol{\beta}_3 \mathbf{X}_{i,t-1} + \alpha_i + \gamma_t + \varepsilon_{i,t} \quad (1)$$

[8] The data on government orientation is only available up to 2012. I choose periods with odd number of years to avoid cases where the largest government parties with two different party orientations were in government for equal number of years.

where $\mathbf{X}_{i,t-1}$ is a vector of time-variant and invariant control variables, and $\boldsymbol{\beta}_3$ is the corresponding vector of coefficients.[9] $PMR_{i,t}$ is the economy-wide OECD product market regulation indicator. The dummy variable $euro_i$ indicates whether a country has introduced the euro. α_i are the country-specific effects, γ_t are the time effects, and $\varepsilon_{i,t}$ is the disturbance term (independently and identically distributed over i and t). I also consider an interaction term between $PMR_{i,t-1}$ and $euro_i$. However, it turns out to be insignificant in every specification, so that I drop it from the beginning.

To select the appropriate estimator for Equation (1), one usually first discusses whether fixed effects are present or the individual effects are uncorrelated to the regressors (random effects). However, as the variable of interest, *euro,* does not change its value over the sample period (time-invariant), it is impossible to estimate the coefficient of interest with a fixed effect estimator. In the following, we assume a random effects model, although one has to bear in mind that this assumption is restrictive.

If one regressor is correlated with the error term, the least squares estimates of the coefficients are inconsistent. This is called the simultaneous equation bias (see, e.g., Baltagi 2008, pp. 121–129). By economic reasoning, one can see that the strong exogeneity assumption is not appropriate for every variable. The discussion starts with the variables, for which the strong exogeneity assumption is appropriate and ends with the variables, for which I assume endogeneity. The decision for joining the euro area is not correlated with the error terms, even with the first period errors, because it has been decided upon much earlier. Therefore, I treat the *euro* variable as strict exogenous. Strict exogeneity is also appropriate for the variable *n.deval*, as the devaluations occurred at least several years before the sample start. It is conceivable that the government's election is influenced by past product

[9] One can re-write the Equation (1) as $\Delta PMR_{i,t} = \beta_0 + (\beta_1 - 1)PMR_{i,t-1} + \beta_2 euro_i + \boldsymbol{\beta}_3 \mathbf{X}_{i,t-1} + \alpha_i + \gamma_t + \varepsilon_{i,t}$, where

market regulatory reforms, which means that the *gov* variable could be predetermined. However, I think that the influence of product market regulatory reforms on elections is marginal, which justifies treating the *gov* variable as strict exogenous as well. With respect to the labour market regulation, it is reasonable to assume strict exogeneity as the gross replacement rate and labour market legislation protection are the expression of social preferences and highly persistent. On the contrary, employment could indeed be influenced by reforms in product markets. Therefore, I assume that it is endogenous. For the remaining control variables, the analysis is complicated not only by endogeneity, but also by opposing signs of the contemporary effect and the effect of the control variables from previous periods. In Section 2, it was argued that in times of crisis, when the GDP growth is below its potential and fiscal deficits are alarming, governments can more easily change a "status quo" and implement growth-enhancing reforms. This would correspond to a positive sign of the coefficients of *fiscal* and *GAP*, and to a negative sign of the coefficient of c*risis05* in the PMR analysis. However, within the same, or even the next period, the fiscal and macroeconomic stance could be negatively influenced by increasing product market regulation. This way of argumentation is even more urgent for the competitiveness indicators *CPIDR* and *ULCDR*. On the one hand, governments could seek to implement deregulatory reforms when the loss of international competitiveness is high. On the other hand, there is probably a direct effect of product market regulation on international competitiveness. Deregulation in product markets should lead to lower consumer prices and hence higher international competitiveness than without the deregulation. Therefore, I am seriously concerned about the endogeneity of these two regressors and the identification of two opposing effects.

The inclusion of a lagged depended variable in the estimation equation leads to similar problems as the qualification of the strong exogeneity assumption of regressors. The individual specific effect is correlated with the lagged dependent variable and hence the

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$\Delta PMR_{i,t}$ is the period change.

lagged dependent variable is correlated with the composite error term. Therefore, the least squares estimates of a dynamic panel data model are inconsistent in short panels. This is the so-called Nickell bias (Nickell 1981).

In the panel data analysis of this chapter, the sample period is short (four periods). To deal with potential endogeneity of the regressors, system GMM as proposed by Blundell and Bond (1998) is employed.[10] This estimator consistently estimates dynamic panel data models in short panels. All potentially endogenous variables are instrumented by their second and third lags. Additionally, lagged differences are used as instruments for the equations in levels. However, the number of instruments is high, relative to the sample size. Hence, the finite sample at hand lacks adequate information to estimate the variance matrix of moments well. By this, the first-step and the second-step matrix become singular, which forces the use of the generalized inverse. As Roodman (2009b, p. 98) notes, this does not compromise consistency of the estimated coefficients, but does exaggerates the distance of the feasible efficient GMM estimator from the asymptotical ideal. The number of instruments (including the time dummies) is reported for every regression in Table 3. As a rule of thumb, the number of instruments should not exceed the number of countries, and the p-value of the Hansen–Sargan test should not be close to unity. Both would be symptoms of instrument proliferation (Roodman 2009a).

3.4 Econometric evidence

In this section, I estimate the impact of euro-area membership on product market regulation by two-step system GMM (Blundell and Bond 1998) in a dynamic panel-data model. Equation (1) is estimated with changing sets of control variables.[11] The first regression

[10] All the results of this paper are obtained using R version 3.1.1 with the packages plm 1.4–0, lmtest 0.9–33, car 2.0–21 and sandwich 2.3-2 (R Core Team 2014; Croissant and Millo 2008; Zeileis and Hothorn 2002; Fox and Weisberg 2011; Zeileis 2004).

[11] See Table 10 for an overview of the expected coefficient's signs.

includes the lagged dependent variable, the *euro* variable, and control variables that appeared to be significant throughout several specifications. In all specifications, the coefficient of the lagged dependent variable is highly significant and between 0.44 and 0.81. The coefficient of the variable *euro* is significantly different from zero in every specification (only at the 10 percent level in the Model 4 and 6). The coefficient has a negative sign and ranges between −0.08 and −0.15 dependent on the specification. Hence, the euro-area countries deregulated significantly more than other countries. In the first regression, the coefficient is −0.10. Hence, the short run effect of *euro* is −0.10 (β_2) and the long-run effect amounts to −0.20 ($\beta_2/(1-\beta_1)$).

Interestingly, only two control variables are (weakly) significant throughout several specifications: the gross replacement rate (*GRR*) and the employment protection legislation (*EPL*). An increase in the gross replacement rate by 10 percentage points is associated with a decrease in the PMR indicator by 0.032 (Model 1) in the short-run. That supports the hypothesis that high unemployment benefits reduce the cost of deregulation for those that could be dismissed and therefore facilitate the implementation of deregulation. The employment protection legislation affects regulatory reforms the other way around. *EPL* is positively associated with regulation that inhibits competition. Hence, there is some evidence that implementing reforms in labour markets may pave the way for reforms in product markets. From the third regression, I subsequently include additional control variables related to different areas. Loosely speaking, these are policy variables, labour market variables, competitiveness variables, and variables signalling a "crisis". All of them turn out to be insignificant.[12] I find no evidence that product market deregulation is pursued to regain international competitiveness or that governments tend to implement reforms when a

[12] To prove that the results of system GMM are robust with respect to the number of instruments, I re-estimated Table 3 with collapsed instruments. Methods for cutting down the number of instruments in panel GMM have been proposed among others by Breitung (1994), Judson and Owen (1999), and Roodman (2009a). However, they come to the expense of efficiency. The only noteworthy difference to the previous system GMM results is that the gross replacement rate (*GRR*) and employment protection legislation (*EPL*) are significant with the expected signs only in Model 2. The table is available from the author upon request.

macroeconomic or fiscal crisis occurs. I also include an interaction term between the lagged dependent variable and the *euro* dummy, and test on significance (not reported here). However, the interaction term is not significant. Hence, regulatory reforms do not depend in a different way on the level of regulation in euro-area countries than in other countries.

Table 3 System GMM estimates on product market regulation

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
lag(PMR)	0.5072***	0.5090***	0.5122***	0.8064***	0.7196***	0.7843***	0.5808***	0.4351**	0.4769***
	(0.1116)	(0.1267)	(0.1089)	(0.1848)	(0.1724)	(0.1505)	(0.1836)	(0.2107)	(0.1833)
euro	−0.0973***	−0.1474***	−0.0914***	−0.0787*	−0.1107***	−0.0899*	−0.1286***	−0.1232***	−0.1253**
	(0.0341)	(0.0405)	(0.0311)	(0.0406)	(0.0402)	(0.0483)	(0.0296)	(0.0430)	(0.0551)
lag(GRR)	−0.0032*	−0.0035*	−0.0032*	−0.0010	−0.0005	0.0000	−0.0012	−0.0047	−0.0030
	(0.0018)	(0.0021)	(0.0017)	(0.0022)	(0.0024)	(0.0027)	(0.0018)	(0.0029)	(0.0027)
EPL	0.0924*	0.1118**	0.0910**	−0.0088	0.0246	−0.0057	0.0537	0.1282	0.0998
	(0.0485)	(0.0559)	(0.0459)	(0.0718)	(0.0646)	(0.0631)	(0.0597)	(0.0868)	(0.0861)
gov_center		0.0872							
		(0.0898)							
gov_left		0.0217							
		(0.0298)							
n.deval			−0.0037						
			(0.0084)						
lag(fiscal)				0.0114					
				(0.0092)					
lag(crisis05)					0.0321				
					(0.0542)				
lag(GAP)						0.0033			
						(0.0221)			
lag(unempl)							0.0075		
							(0.0057)		
lag(CPIDR)								−0.0069	
								(0.0121)	

(Continued on next page)

Table 3 Continued

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
lag(ULCDR)									0.0015
									(0.0029)
n	28	28	28	28	28	28	28	28	28
T	4	4	4	4	4	4	4	4	4
No. of observations	112	112	112	112	112	112	112	112	112
No. of observations used	106	106	106	104	103	103	97	106	104
No. of instruments	14	18	16	19	19	19	19	19	19
Sargan Test: chi^2	6.7904	13.0152	6.7590	12.4686	10.2157	13.1235	9.9359	10.2651	8.8895
Sargan Test: df	7	9	8	11	11	11	11	11	11
Sargan Test: p-value	0.4510	0.1619	0.5628	0.3295	0.5111	0.2853	0.5362	0.5067	0.6321

Notes:

(i) The dependent variable is the economy-wide OECD product market regulation (PMR) indicator.
(ii) The sample covers 28 countries in 1998, 2003, 2008, and 2013. The panel is unbalanced because of data availability.
(iii) Two-step system GMM (Blundell and Bond 1998) estimation with Windmeijer (2005) finite-sample correction for standard errors (in parentheses) is applied. The second and third lag of all potentially endogenous variables (PMR, fiscal, unempl, GAP, crisis05, CPIDR, ULCDR) are used as instruments. Included exogenous variables (incl. time dummies) are counted in the total number of instruments as well.
(iv) The Arellano–Bond test for AR(2) in first differences cannot be performed because there are estimates of the standard error only for two periods. This is because including a lagged dependent variable and taking first-differences depletes the number of periods. Two periods are not sufficient to perform an AR(2) test.
(v) The two-step version of the Hansen–Sargan test for joint validity of the instruments does not reject the null hypothesis in all regressions.
(vi) Lag() denotes lagged one period.
(vii) euro: dummy variable for euro-area membership.
(viii) GRR: gross unemployment benefit replacement rate.
(ix) EPL: strictness of employment protection legislation.
(x) gov_center: center party orientation of the largest government party.
(xi) gov_left: left party orientation of the largest government party.
(xii) n.deval: number of devaluations during EMS from 1979 to 1993.
(xiii) fiscal: government primary balance as a percentage of GDP.
(xiv) crisis05: dummy variable indicating a crisis when the output gap is exceptionally high.
(xv) GAP: output gap.
(xvi) unempl: harmonized unemployment rate in percent of the total labour force.
(xvii) CPIDR: competitiveness indicator based on competitiveness-weighted relative consumer prices.
(xviii) ULCDR: competitiveness indicator based on competitiveness-weighted relative unit labour costs.
(xix) Df are the degrees of freedom.
(xx) *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.

4 Network sector regulation

4.1 The data set, controls and some statistics

The OECD indicator on regulation in network sectors (energy, transport and communications, ETCR) covers a much longer time span than the economy-wide product market regulation indicator. The former was used by the early empirical literature on structural reforms (Alesina, Ardagna and Galasso 2010; Duval and Elmeskov 2005) to assess the euro's impact on regulation. The ETCR indicator covers seven network sectors (telecoms, electricity, gas, post, rail, air passenger transport, and road freight). It is available for the years 1975–2013, though not all years are covered for all countries.[13] My sample effectively covers the years 1985 to 2013 because data for the most relevant control variables is not available before 1985. In fact, there are almost no changes in the ETCR indicator within the first decade (1975–84). The sample comprises 27 OECD countries at the most[14]

First, I present some descriptive statistics and perform a graphical analysis. The summary statistics of the sample at hand are reported in Table 4. The OECD countries are on the path to abandon policies that inhibit competition in network sectors. The mean of the ETCR indicator is considerably lower in 2013 than in 1999, and substantially lower than in 1975. Network sectors have been heavily deregulated during the last four decades.

[13] For a detailed description of the ETCR indicator, see Koske et al. (2015).
[14] These are Australia, Austria, Belgium, Canada, Chile (since 2008), Denmark, Finland, France, Germany (since 1991), Greece (since 1995), Iceland (since 2008), Ireland (since 1990), Israel (since 2008), Italy, Japan, Korea (since 1990), Luxembourg (since 2008), Mexico (since 1995), Netherlands, New Zealand (since 1990), Norway, Portugal, Spain, Sweden, Switzerland, Turkey, and United Kingdom. Hence, the sample includes twelve euro countries and fifteen non-euro countries.

Table 4 Summary statistics of the OECD indicator on regulation in network sectors

	Network sector regulation (ETCR)		
	in 1975	**in 1999**	**in 2013**
Minimum value	4.101	1.71	0.7886
1st quartile	5.286	2.772	1.669
Median	5.396	3.402	2.008
Mean	5.372	3.39	2.095
3rd quartile	5.699	4.135	2.489
Maximum value	5.976	5.251	3.309

Data source: Koske et al. (2015)

Table 5 presents the changes of the ETCR indicator between 1975 and 1999 and between 1999 and 2013 depending on whether a country participates in the euro area. Euro-area members experienced a stronger reduction of policies that inhibit competition in comparison to the control group after the introduction of the euro but not before.

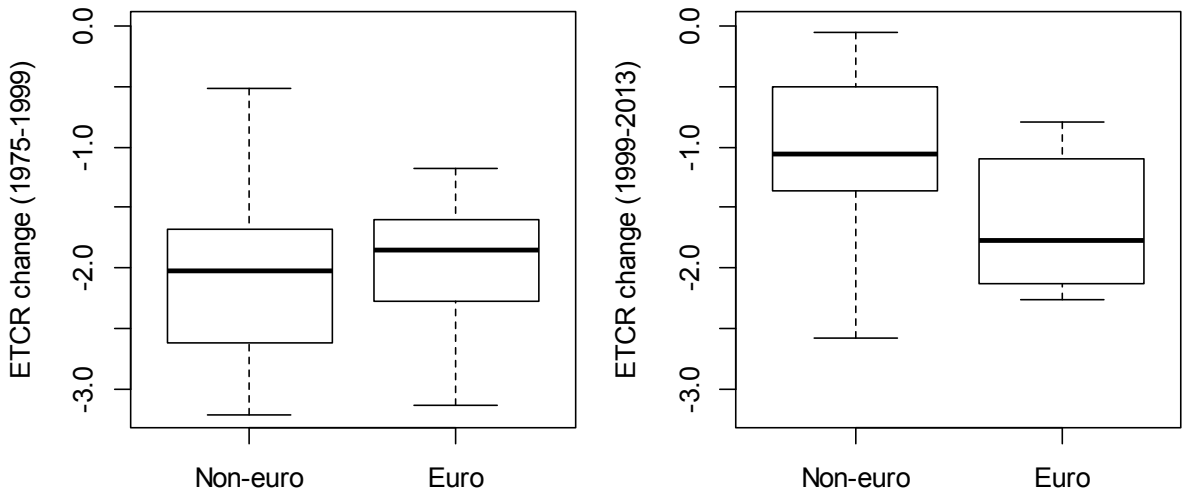
Table 5 Summary statistics of changes in network sector regulation

	Network sector regulation (ETCR change 1975–99)		Network sector regulation (ETCR change 1999–2013)	
	Non-euro	**Pre-Euro**	**Non-euro**	**Euro**
Minimum value	–3.217	–3.139	–2.582	–2.259
1st quartile	–2.62	–2.159	–1.363	–2.078
Median	–2.028	–1.853	–1.063	–1.772
Mean	–2.011	–1.971	–0.9999	–1.639
3rd quartile	–1.681	–1.633	–0.5033	–1.12
Maximum value	–0.5099	–1.176	–0.05329	–0.7911

Note: For Greece, the ETCR changes refer to changes between 1975 and 2001 and between 2001 and 2013.
Data source: Koske et al. (2015)

Figure 3 displays boxplots of the ETCR changes before and after the introduction of the euro. They plot the distributions for euro-area members against the control group. The figure confirms the results of the descriptive analysis. One can see a remarkable difference for the change in network sector regulation in euro-area countries in comparison with the control group, but not before the introduction of the euro. Hence, euro-area countries seem to deregulate more heavily than other OECD countries.

Figure 3 Changes in network sector regulation before and after the launch of the euro



Note: The boxplots present the distribution of the changes of the OECD indicator on regulation in network sectors (energy, transport and communications, ETCR) indicator between 1975 and 1999, and between 1999 and 2013. For Greece, the ETCR changes refer to changes between 1975 and 2001 and between 2001 and 2013.
Data source: Koske et al. (2015)

Largely, the control variables to be applied in the ETCR analysis are the same as in the PMR analysis but on annual basis. However, there are some qualifications. (1) The variable *n.deval*, which indicates the number of devaluation during the EMS, is not applied because it has no meaningful variation over time and coefficients of time-invariant variable cannot be estimated in a fixed-effects framework. (2) The variable *unempl* indicates the annual unemployment rate from the OECD Economic Outlook (OECD 2017a). (3) For the variable *GRR* (gross replacement rate), I calculate the missing values for the even-numbered years as simple averages of the odd-numbered years (previous and following year). (4) I introduce a new dummy variable that captures the effects of the European Single Market (ESM). The later established a legal framework to promote trade and competition within the EU. Hence, on should expect a positive influence on deregulation. *ESM* indicates whether a country belongs to the European Union from 1993 on. (5) From the Database of Political Institutions (DPI) (Beck et al. 2001), I compiled a dummy variable *elec*, which indicates whether parliamentary or presidential elections were held during that year. The conventional wisdom is that a government rather conducts painful reforms right after its appointments than before an election. By this, the short-term costs of reforms may die away before the next election.

The additional control variables *ESM* and *elec* were both found to promote deregulation by Alesina, Ardagna and Galasso (2010).

4.2 The econometric model and its estimation

In the second empirical analysis, I use a difference-in-differences framework to estimate the euro's impact on network sector regulation in a long panel of OECD countries. By this, I can address the issues of identification and country fixed effects. The empirical approach of this chapter is basically the same as in the last section: to compare the end-of-period levels of the indicator with the levels at the beginning of each period. If the period changes are significantly different for euro-area countries in comparison to other OECD countries, this is evidence for the euro's influence on network sector regulation. The estimation equation is

$$ETCR_{i,t} = \beta_0 + \beta_1 ETCR_{i,t-1} + \beta_2 euro_{i,t} + \boldsymbol{\beta}_3 \mathbf{X}_{i,t-1} + \alpha_i + \gamma_t + \varepsilon_{i,t} \quad (2)$$

where $\mathbf{X}_{i,t-1}$ is a vector of time-variant control variables, and $\boldsymbol{\beta}_3$ is the corresponding vector of coefficients. $ETCR_{i,t}$ is the OECD indicator on regulation in network sectors (energy, transport and communications). The dummy variable $euro_{i,t}$ indicates whether a country is in the euro area. α_i are the country-specific effects, γ_t are the time effects, and $\varepsilon_{i,t}$ is the disturbance term.

Because of the sample's long time dimension, the estimator of the previous section should not be applied in this section. The generalized method of moments (GMM) procedures, such as the Arellano–Bond estimator, the Arellano–Bover estimator, and the Blundell–Bond estimator are suited to short panels with T fixed and $N \to \infty$ (Cameron and Trivedi 2007, p. 744). However, they are not appropriate for long panels that comprise many periods with relatively few individuals. The sample of this section comprises 29 years and 27 countries at the most. Therefore, inference can be based on the assumption that $T \to \infty$. The fixed-effects estimator is generally biased in dynamic models (Nickell 1981). However, as *T*

increases, the fixed-effects estimator becomes consistent (Baltagi 2008, p. 147).[15] Our sample period is sufficiently large so that the bias should be small in this estimation.[16] The long time-dimension enables us to address the issues of identification and country fixed effects. However, coefficients of time-invariant variables cannot be estimated (as the number of devaluations during EMS from 1979 to 1993).

4.3 Econometric evidence

In this section, I estimate the impact of euro-area membership on regulation in network sectors (energy, transport and communications) in a dynamic panel-data model. Equation (2) is estimated by the two-way fixed-effects OLS estimator in different specifications. The first three models include inter alia the gross replacement rate (*GRR*) in first lags. However, this greatly reduces the sample size because there is *GRR* data only until 2005. The Models 4 to 8 include the gross replacement rate but with its eighth lag to boost the sample without completely skipping the gross replacement rate. The Models 7 and 8 are specifications without the gross replacement rate due to the above-mentioned reasons.

Throughout all specifications, the lagged dependent variable, the euro variable, the crisis dummy and the labour market regulation variables *EPL* and GRR[17] are statistically significant. Hence, the euro-area countries deregulated significantly more than other countries. Moreover, the negative sign of the coefficient of c*risis05* supports the argument that in times of crisis, when the GDP growth is well below its potential, it easier for governments to overcome a "status quo" and implement growth-enhancing reforms. The

[15] As the Nickell bias, the bias of weakly exogenous or predetermined regressors is also inversely related to the size of the time dimension Breitung (2015, p. 455). Bias size decreases as the time dimension increases.
[16] Alternative estimators have been developed that are asymptotically efficient as *T* tends to infinity. These are the bias-adjustment and maximum likelihood type estimators. Corrected within-group estimators perform best in dynamic panel data models with moderate to large *T*. Maximum likelihood estimators may be superior if *T* is small and the autoregressive coefficient is close to unity. However, the attractive features of bias-adjustment and maximum likelihood-type estimators come at the expense of more restrictive model assumptions Breitung (2015). Most relevant in our context is the restrictive assumption of strictly exogenous regressors. Hence, there is not much to gain in applying these alternative estimators with respect to our coefficients of interest. Taking into account the limited gain in applying these estimators, we favour the approach of estimating Equation (2) by two-way within OLS.

employment protection legislation *EPL* is positively associated with regulation that inhibits competition. *GRR* affects regulatory reforms the other way around. That supports the hypothesis that high unemployment benefits reduce the cost of deregulation for those that could be dismissed and therefore facilitate the implementation of deregulation. The significance of other control variables is either not robust (left-wing government, competitiveness indicator based on relative unit labour costs, parliamentary or presidential elections, unemployment rate, the European Single Market membership, and the government primary balance) or the control variable is not significant at all (output gap, centrist government). However, besides the unemployment rate, the coefficients of all the above-mentioned controls have the expected sign. To summarize the results, I find a significant and robust effect of euro-area membership on the deregulation in network sectors.

[17] The gross replacement rate is not significant only in Model 4.

Table 6 Two-way fixed-effects estimates on network sector regulation

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
lag(ETCR)	0.7823***	0.7785***	0.7595***	0.8208***	0.8089***	0.8063***	0.8085***	0.8070***
	(0.0225)	(0.0244)	(0.0258)	(0.0161)	(0.0162)	(0.0183)	(0.0168)	(0.0198)
euro	−0.1677***	−0.1610***	−0.1624***	−0.1649***	−0.1455***	−0.1507***	−0.1634***	−0.1494***
	(0.0368)	(0.0358)	(0.0389)	(0.0329)	(0.0396)	(0.0346)	(0.0393)	(0.0371)
lag(EPL)	0.0995**	0.1150***	0.1154***	0.0952***	0.0782**	0.0999***	0.1014***	0.1178***
	(0.0419)	(0.0407)	(0.0426)	(0.0300)	(0.0319)	(0.0280)	(0.0328)	(0.0326)
lag(crisis05)	−0.1538***	−0.1634***	−0.1420***	−0.0822**	−0.0755***	−0.0997***	−0.0718**	−0.0852**
	(0.0374)	(0.0490)	(0.0501)	(0.0331)	(0.0272)	(0.0382)	(0.0284)	(0.0349)
lag(GRR)	−0.0029*	−0.0031**	−0.0037**					
	(0.0015)	(0.0015)	(0.0015)					
lag(GRR, 8)				−0.0016	−0.0030**	−0.0028**		
				(0.0011)	(0.0012)	(0.0011)		
lag(gov_center)		−0.0304	−0.0207	−0.0250		−0.0221		−0.0351
		(0.0241)	(0.0311)	(0.0202)		(0.0245)		(0.0277)
lag(gov_left)		0.0286**	0.0248	0.0234*		0.0196		0.0165
		(0.0143)	(0.0162)	(0.0130)		(0.0149)		(0.0146)
lag(elec)			−0.0256			−0.0189	−0.0235*	−0.0204*
			(0.0159)			(0.0122)	(0.0125)	(0.0122)
lag(unempl)		0.0057	0.0121*			0.0051		0.0037
		(0.0045)	(0.0073)			(0.0043)		(0.0044)
lag(ULCDR)			−0.0001	−0.0014**		−0.0010		−0.0009
			(0.0008)	(0.0006)		(0.0007)		(0.0007)
lag(fiscal)			0.0023		0.0033*	0.0041*		0.0033
			(0.0019)		(0.0019)	(0.0022)		(0.0023)
lag(GAP)			0.0100			0.0005		0.0007
			(0.0063)			(0.0063)		(0.0061)
ESM			−0.0443		−0.0608*	−0.0543*		−0.0479
			(0.0336)		(0.0350)	(0.0320)		(0.0341)
R^2	0.7669	0.7706	0.7559	0.8536	0.8440	0.8484	0.8396	0.8412
Adjusted R^2	0.7372	0.7388	0.7171	0.8361	0.8260	0.8280	0.8226	0.8209
No. of observations	399	396	387	534	540	524	595	547

(Notes on next page)

Notes:

(i) The dependent variable is the OECD indicator on regulation in network sectors (energy, transport and communications, ETCR). It covers seven network sectors (telecoms, electricity, gas, post, rail, air passenger transport, and road freight).
(ii) The sample covers 27 OECD countries from 1985 to 2013. The panel is unbalanced because of data availability.
(iii) The two-way within OLS estimator with country fixed effects and time effects is applied.
(iv) Lag() denotes lagged one period.
(v) euro: dummy variable for euro-area membership.
(vi) EPL: strictness of employment protection legislation.
(vii) crisis05: dummy variable indicating a crisis when the output gap is exceptionally high.
(viii) GRR: gross unemployment benefit replacement rate.
(ix) gov_center: center party orientation of the largest government party.
(x) gov_left: left party orientation of the largest government party.
(xi) elec dummy variable indicating whether parliamentary or presidential elections were held during that year.
(xii) unempl: annual unemployment rate in percent of the total labour force.
(xiii) ULCDR: competitiveness indicator based on competitiveness-weighted relative unit labour costs.
(xiv) fiscal: government primary balance as a percentage of GDP.
(xv) GAP: output gap.
(xvi) ESM dummy variable indicating whether a country belongs to the European Union from 1993 on.
(xvii) *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.

5 Ease of doing business

5.1 The data set, controls and some statistics

The Doing Business project of the World Bank compares business regulation for domestic firms in 189 economies. It measures the strength of legal institutions relevant to business regulation, and the complexity and cost of regulatory process applying to domestic small and medium sized enterprises, operating in the largest business city in each country. There are two sets of indicators, which are aggregated into a composite indicator. The first set of indicators measures the strength of the legal and regulatory framework for getting credit, protecting investors, enforcing contracts, and resolving insolvency. The second set of indicators measures the cost and efficiency of regulatory process for starting a business, dealing with construction permits, getting electricity, registering property, paying taxes, and trading across borders (World Bank 2013, p. 2). The Doing Business indicators value better regulation, not less regulation. Some indicators give higher score for better and more developed regulation, others assign the lowest score to economies that have no regulation in the respective area or do not apply their regulation. In fact, as measured by the Doing Business indicators, bigger governments tend to provide more protection and efficient rules (World Bank 2013, p. 4).

As the PMR indicator, the Doing Business indicators use the readings of laws and regulation in each country to measure the strength of legal institutions relevant to business regulation. About three-quarters of the data are of this type. To capture the complexity and cost of regulatory process, the Doing Business team collaborates with local experts to estimate time needed for a regulatory process (e.g., starting a business). Cost estimates are usually taken from official fee schedules (World Bank 2013, pp. 21–22).

The Doing Business project has two measures to compare the business regulatory efficiency: (1) the ranking of the “ease of doing business” and (2) the “distance to the frontier” (DTF) measure. The first is a relative ranking of countries according to their regulatory

efficiency. The second shows the absolute distance to the "frontier", which is the best performance a country has ever had on each of the Doing Business indicators since the year in which the indicator was first collected. The distance to frontier is scaled from zero to one-hundred, where one-hundred represents the frontier. Hence, higher scores indicate more efficient business environment and stronger legal institutions (World Bank 2013, p. 2). The distance to frontier measure is appropriate to cross-section and time-series analysis as it is an absolute measure. The data is back-calculated to adjust for changes in methodology (including the emergence of a new frontier) and revisions in data due to corrections (World Bank 2013, pp. 28–29).[18, 19] As acknowledged by Acemoglu et al. (2013, p. 8) there exist only one other data set that captures similar issues as the Doing Business indicator. That is the OECD's PMR indicator, whose correlation coefficient is 0.49 with the Doing Business rankings (World Bank 2013, p. 24). My sample comprises 28 OECD countries.[20] Transition countries are excluded from the analysis. Because the Doing Business indicator is not available for Luxembourg in 2005, I resort to data for 2006.

Largely, the control variables applied here are the same as in Section 3. However, there are some qualifications. I use both the simple arithmetic averages over the respective sample period and the initial levels from the beginning of the period. In the DTF analysis, *gov* indicates the party orientation of the largest government party, which was in government most of the time. Concerning endogeneity, the least that can be done in cross-sectional OLS analysis (without external instruments) is to use the beginning-of-the-period values of potential endogenous variables as regressors.

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[18] For a detailed description of the methodology compiling the Doing Business distance to frontier measure, see World Bank (2013, pp. 156–158).

[19] I refrain from using the latest Doing Business indicators from the Doing Business 2015 report because the methodology changed considerably for three indicators. This can seriously hamper the comparability over time.

[20] These are Australia, Austria, Belgium, Chile, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom and the United States.

The summary statistics of the sample are reported in Table 7. In the contrast to the product market regulation indicator, the mean DTF indicator grew only around 4 percent. Although its quartiles show an improvement, the changes were quite moderate considering the underlying scale.

Table 7 Summary statistics of the business regulation indicator

	Business regulation (DTF)	
	in 2005	**in 2013**
Minimum value	56.42	61.23
1st quartile	66.31	71.69
Median	75.19	77.52
Mean	73.58	76.84
3rd quartile	79.45	82.67
Maximum value	88.62	89.71

Note: DTF is the distance to frontier indicator of the Doing Business report.
Data source: World Bank (2013)

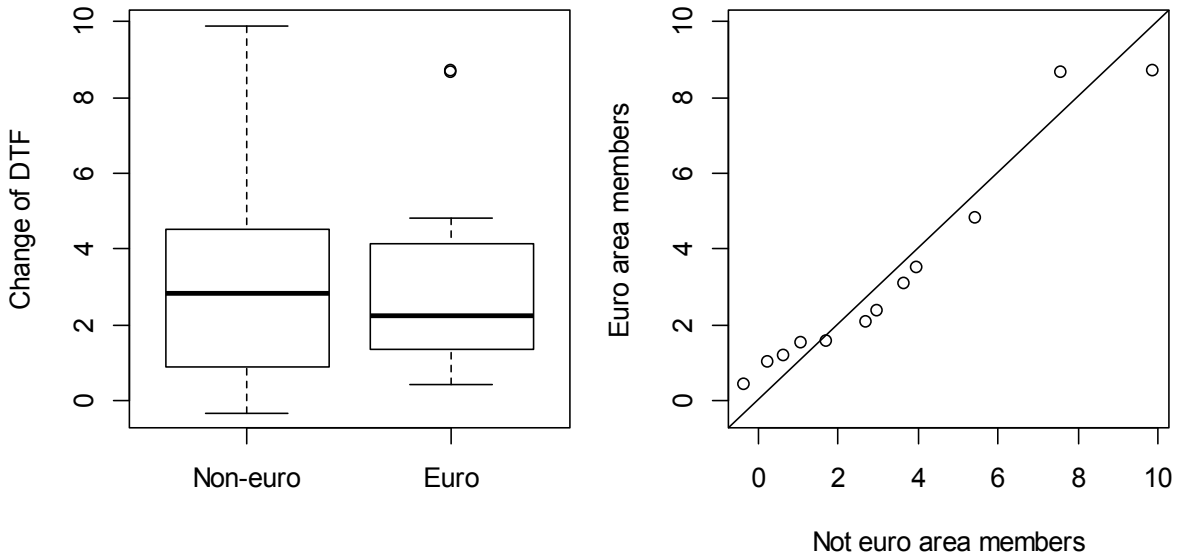
Table 8 presents the changes of the indicator between 2013 and 2005 depending on whether a country participates in the euro area. In contrast to the product market regulation, a notable improvement is not visible in the DTF indicator. The changes over time are quite small and there is no difference between euro-area members and other countries.

Table 8 Summary statistics of changes in business regulation

	Business regulation (DTF change 2005–13)	
	Non-euro	**Euro**
Minimum value	−0.3282	0.4246
1st quartile	0.8792	1.4740
Median	2.8240	2.7350
Mean	3.2320	3.4350
3rd quartile	4.5290	4.0530
Maximum value	9.8840	8.6870

Note: DTF is the distance to frontier indicator of the Doing Business report.
Data source: World Bank (2013)

Figure 4 Boxplot and quantile-quantile plot of business regulation changes



Note: The figure presents the distribution of the changes of the distance to frontier (DTF) indicator of the Doing Business report between 2005 and 2013. Due to the lack of data, the change of the DTF indicator refers to the change between 2006 and 2013 for Luxembourg.
Data source: World Bank (2013)

Figure 4 displays boxplots and a quantile-quantile plot of the changes of the DTF indicator. They plot the distributions for euro-area members against the control group. In contrast to the product market regulation, there is almost no difference in the change in business regulation in euro-area countries compared to the control group. This can be traced back either on the different sample length of the two measures or on their differences in concept and method. As shown in Figure 2, the different sample length explains the discrepancy only partially. Still there is a remarkable difference between euro-area members and the control group for the PMR indicator.

5.2 The econometric model and its estimation

The impact of euro-area membership on the ease of doing business is estimated in a cross-section analysis. The empirical approach is basically the same as in the two previous sections. The Doing Business distance to frontier indicator $DTF_{i,2013}$ is explained by its initial

level in 2005 (this is the first year for which the aggregate indicator is available)[21], a dummy variable $euro_i$, which indicates whether a country has introduced the euro, and additional controls $\mathbf{X}_i$. $\varepsilon_{i,t}$ is the disturbance term. The estimation equation is

(3) $$DTF_{i,2013} = \beta_0 + \beta_1 DTF_{i,2005} + \beta_2 euro_i + \boldsymbol{\beta}_3 \mathbf{X}_i + \varepsilon_i \,.$$

5.3 Econometric evidence

In this section, I present the OLS estimations of Equation (3) with the cross-sectional distance to frontier dataset. The estimates in Table 9 confirm the result of the descriptive analysis. There is no significant difference in business deregulation between euro-area countries and the control group. The coefficient of *euro* is insignificant in every specification. The coefficient of employment protection legislation becomes significant only in Model 9 and 10. However, this result is not robust. As soon as the insignificant control variable *fiscal* is excluded from the estimation, the coefficient of *EPL2005* becomes insignificant again. Other control variables do not either explain the change of the distance to frontier measure. Only the coefficient of the lagged dependent variable and the intercept are significantly different from zero.

I also consider period averages as control variables instead of the initial values where appropriate (tables are not reported here).[22] Although, I am concerned about endogeneity problems as there could be reverse causality, the results are very similar to Table 9. In addition, the coefficients of the two competitiveness indicators, which I cannot include in Table 9 because 2005 is the base year of the indexes, are insignificant.

[21] It could be problematic that the initial level of the DTF indicator is from 2005, as the euro was launched in 1999 in all euro area members in this sample except in Greece. However, earlier data is not available.
[22] They are available from the authors on request.

To sum up, the analysis of the DTF indicator does not confirm the hypothesis that euro-area membership induces structural reforms in business regulation. This result contrasts with the previous analysis that finds a positive impact of euro-area membership on product market deregulation. There could be several possible explanations. First, the period of observation differs between the analyses. Hence, most reforms could have been undertaken in the first years after the introduction of the euro. Unfortunately, the Doing Business indicator do not observe this important period. Indeed, as we have seen in Figure 2, the different sample length explains the discrepancy only partially. Still there is a remarkable difference between euro-area members and the control group for the PMR indicator. Therefore, some discrepancy is probably due to the differences in concept and method of the measures. I do not investigate the differences between the PMR indicator and the DTF indicator further, as this is not the focus of this paper.

Table 9 Cross-sectional OLS estimates on business regulation

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
(Intercept)	20.1387***	18.4141***	7.7162	18.9570***	22.6097***	21.0847***	24.1465***	19.8628***	−2.6952	5.9190
	(4.1989)	(3.9726)	(11.6616)	(6.4446)	(6.7031)	(4.5168)	(6.4910)	(4.2654)	(9.3117)	(8.5893)
DTF2005	0.7775***	0.7875***	0.8995***	0.7897***	0.7500***	0.7645***	0.7451***	0.7811***	1.0156***	0.9396***
	(0.0524)	(0.0508)	(0.1280)	(0.0774)	(0.0872)	(0.0564)	(0.0674)	(0.0532)	(0.1036)	(0.0937)
euro	−1.1847	−1.1976	−1.4707	−0.8858	−1.9026	−0.9549	−1.1442	−1.3629	−2.0284	−1.8134
	(0.9258)	(0.9287)	(1.1475)	(1.1609)	(1.3007)	(0.9668)	(0.9136)	(1.0430)	(1.5967)	(1.5178)
GRR2005		0.0319								
		(0.0418)								
EPL			1.9460						3.2190**	3.0520**
			(1.4126)						(1.3796)	(1.3875)
fiscal2005				0.0619					−0.2583	−0.2737
				(0.1680)					(0.2810)	(0.3237)
gov_center					0.9708					
					(2.4788)					
gov_left					−0.2237					
					(1.2174)					
GAP2005						0.0242				
						(0.1569)				
unempl2005							−0.2300			−0.3830
							(0.2574)			(0.3030)
n.deval								0.1479		
								(0.6320)		
R^2	0.9042	0.9135	0.9208	0.8983	0.9087	0.9034	0.9190	0.9052	0.9263	0.9421
Adjusted R^2	0.8965	0.9011	0.9089	0.8830	0.8913	0.8908	0.9085	0.8933	0.9089	0.9227
No. of observations	28	25	24	24	26	27	27	28	22	21

(Notes on next page)

Notes:

(i) The dependent variable is the distance to frontier (DTF) indicator of the Doing Business report.
(ii) OLS with heteroscedasticity consistent covariance matrix estimation, i.e., robust standard errors (in parentheses), is performed.
(iii) The sample covers 28 countries.
(iv) The supplement “2005” indicates that 2005 data is used.
(v) euro: dummy variable for euro-area membership.
(vi) GRR: gross unemployment benefit replacement rate.
(vii) EPL: strictness of employment protection legislation.
(viii) fiscal: government primary balance as a percentage of GDP.
(ix) gov_center: center party orientation of the largest government party.
(x) gov_left: left party orientation of the largest government party.
(xi) GAP: output gap.
(xii) unempl: harmonized unemployment rate in percent of the total labour force.
(xiii) n.deval: number of devaluations during EMS from 1979 to 1993.
(xiv) *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.

6 Conclusion

I selected three indicators of product market and business regulation: the economy-wide OECD product market regulation (PMR) indicator, the OECD indicator on regulation in network sectors (energy, transport and communications, ETCR) and the distance to frontier indicator (DTF) measuring the ease of doing business. The panel data analyses show robust evidence for a positive impact of euro-area membership on deregulation in product markets and network sectors. Euro-area countries deregulate significantly more than other OECD countries. The descriptive analysis indicates that the effect was more pronounced during the first years after the introduction of the euro.

I proceeded with a cross-sectional analysis on the effect of euro-area membership on the ease of doing business. However, I do not find any significant effects. This might be for two reasons: First, the period under observation starts several years later for the ease of doing business than for the product market regulation. As there is indication that most reforms occurred during the first years after the introduction of the euro, the distance to frontier indicator misses this important period. Second, the divergent results may be due to differences in concept and method of the measures. Indeed, the distance to frontier indicator is a much more narrow measure of the regulatory stance than the PMR indicator. Because of the weaknesses surrounding the ease of doing business analysis, I give more weight to the analyses concerning product market and network sector regulation that support a positive impact of euro-area membership.

Appendix

Table 10 Overview of variables, its sources and the expected coefficient's signs

Variable	Expected sign	Data source
PMR	–	OECD (2013)
euro	–	Own compilation
n.deval	–	Alesina, Ardagna and Galasso (2010, p. 18).
gov_center	–	Beck et al. (2001), made available by Teorell et al. (2013)
gov_left	+	Beck et al. (2001), made available by Teorell et al. (2013)
GRR	–	OECD (2014b)
EPL	+	OECD (2015a)
unempl	–	OECD (2015b)
fiscal	+	OECD (2014a)
GAP	+	OECD (2014a)
crisis05	–	Own calculation with data from OECD (2014a)
CPIDR	–	OECD (2014a)
ULCDR	–	OECD (2014a)
ETCR	–	OECD (2017b)
elec	–	Beck et al. (2001), made available by Teorell et al. (2013)
ESM	–	Own compilation
DTF	+	World Bank (2014)

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