The unemployment impact of product and labour market regulation : Evidence from European countries

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by Céline Piton

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Abstract

This paper provides a robust estimation of the impact of both product and labour market regulations on unemployment using data for 24 European countries over the period 1998-2013. Controlling for country-fixed effects, endogeneity and various covariates, results show that product market deregulation overall reduces unemployment rate. This finding is robust to all specifications and in line with theoretical predictions. However, not all types of reforms have the same effect: deregulation of State controls and in particular involvement in business operations tends to push up the unemployment rate. Labour market deregulation, proxied by the employment protection legislation index, is detrimental to unemployment in the short run while a positive impact (i.e. a reduction of the unemployment rate) occurs only in the long run. Analysis by sub-indicators shows that reducing protection against collective dismissals helps in reducing the unemployment rate. The unemployment rate equation is also estimated for different categories of workers. While men and women are equally affected by product and labour market deregulations, workers distinguished by age and by educational attainment are affected differently. In terms of employment protection, young workers are almost twice as strongly affected as older workers. Regarding product market deregulation, highly-educated individuals are less impacted than low- and middle-educated workers.

JEL codes: E24, E60, J48, J64, L51
Keys words: Unemployment, Structural reform, Product market, Labour market, Regulation, Employment

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I. Introduction

With almost 20 million people[1] unemployed in 2016, unemployment is and remains at the core of economic and social debate in Europe. The financial crisis in 2008 and the sovereign debt crisis which followed in Europe in 2013 significantly raised the unemployment rate. Unemployment rates are particularly high in some countries: as much as 23.6% in Greece and 19.6% in Spain in 2016 compared to 8.4% and 8.2% respectively in 2007. Since standard macroeconomic tools such as monetary and fiscal policies are being already used and have their limits, structural reforms appear as a crucial ingredient for boosting economic growth and employment. This paper contributes to the debate by evaluating the effect of product and labour market deregulation on the unemployment rate.

The economy-wide product market regulation (PMR) index computed by the OECD is used to estimate the level of regulation in 24 European countries[2] over the period 1998-2013. The indicator covers all sectors and can be broken down by type of regulation thanks to the bottom-up approach used to compute it. State controls, barriers to entrepreneurship and barriers to trade can thus be assessed separately in order to find the most relevant deregulation policy to put in place to tackle unemployment. Labour market regulation is analysed through the OECD employment protection legislation (EPL) index, which can also be unbundled by type of contract (regular or temporary).

The timing of structural reform implementation can be directly linked to the economic environment, leading to an endogeneity issue. Standard econometric methodologies would then provide biased estimates since the change in the unemployment rate can be due to a cyclical component rather than to the implementation of product and labour market reforms. I control for the potential endogeneity of PMR and EPL by using a fixed-effect regression model where lags of the difference with respect to the country means for the endogenous variables are used as instruments. Results show that a reduction of PMR reduces the unemployment rate whereas a drop in EPL increases it. Moreover, econometric tests do not support the existence of PMR and EPL endogeneity.

The increase in unemployment does not affect all categories of workers equally. Young workers, less educated individuals and to a lesser extent women constitute vulnerable groups. Their average unemployment rates reached 18.2%, 16.2% and 8.7% respectively in 2016 in Europe[3]. These high unemployment rates encourage governments to implement targeted policies such as education improvement, reduction in childcare costs, activation policies, etc. In addition to these policies, it is interesting to assess the impact of structural reforms which are not specially designed to target vulnerable groups. I estimate the unemployment effect of PMR and EPL reforms by gender, age and education of workers. While men and women are equally affected, it appears that young workers and low- and middle-educated individuals are more affected by reforms than their counterparts.

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1 Total number of people unemployed aged from 15 to 74 years in the 24 considered European countries.

2 21 countries from the European Union (Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, United Kingdom) as well as Iceland, Norway and Switzerland.

3 Average unemployment rate among the 24 European countries considered: total number of unemployed workers aged from 15 to 74 years old as a proportion of the total corresponding labour force.

A review of the existing literature on the effect of product and labour market reforms on unemployment is presented in the next section. This review also highlights previous findings on different types of deregulations (PMR and EPL) and on different types of workers. I contribute to this literature by analysing a longer period of time than previous studies which allows me to control for endogeneity of the regulatory variable and to find significant results. This paper also goes further in the analysis by considering sub-components of product and labour markets reforms as well as by analysing different groups of workers. Section 3 presents the database and defines PMR and EPL indices. It also describes which reforms took place in the past, and analyses the bivariate relationship between each index and the unemployment rate. Empirical results of the multivariate analysis are summarised in section 4. I distinguish by type of deregulation as well as by type of workers. The last section concludes by emphasising some limits of the study and proposes further research.

II. Literature review

Unemployment movements as well as heterogeneities across countries can largely be explained by interactions between macroeconomic shocks and economic institutions (Blanchard and Wolfers, 2000). Product market regulation and employment protection legislation are part of the equation. The first section is devoted to theoretical and empirical findings regarding the labour impact of product market regulation and employment protection legislation. The second section summarises the labour market situation, and in particular the unemployment rate, of different categories of workers and presents a survey of the literature on the labour impact of PMR and EPL for vulnerable groups.

1. Theoretical and empirical findings on the impact of product and labour market (de)regulation on labour market outcomes

In the theoretical literature, product market deregulation is usually defined as a reduction in barriers to entry or an increase in competition. Ebell and Haefke (2003) have studied the dynamic relationship between product market entry regulation and equilibrium unemployment and wages. They assume matching frictions, monopolistic competition in the goods market, multi-worker firms, individual wage bargaining and barriers to entry. They find a positive impact of product market deregulation on labour market outcomes: a reduction in entry barriers in the model brings down unemployment and pushes up wages.

Blanchard and Giavazzi (2003) distinguish between short-run and long-run effects. In their model, a reduction in entry costs has no effect in the short run since the number of firms is assumed to be fixed. The positive effect of deregulation comes only in the long run when new firms enter the market, implying a higher elasticity of demand and a lower mark-up. This in turn leads to lower unemployment and higher wages. Cacciatore *et al.* (2012) study the macroeconomic effects of a reduction in barriers to entry using a dynamic stochastic general equilibrium model. They assume endogenous producer entry, equilibrium unemployment and costly job creation and destruction. In line with Blanchard and Giavazzi (2003), their results show a long-term effect but no short-term effect.

The story is different if an increase in product market competition is considered. In the Blanchard and Giavazzi model, firms are then facing more elastic demand associated with a lower mark-up in the short run. This, in turn, leads to both an increase in real wages and a fall in unemployment. In the long run, profits come back to their initial level, as do unemployment and wages. Using a general equilibrium model, Gerbach and Schniewind (2001) evaluate the final effect of promoting product market competition, without any distinction between short-run and long-run impact. They find a decline in the aggregate unemployment rate (although the unemployment rate can rise in some sectors). Amable and Gatti (2001) consider an increase in product market competition in a model of monopolistic competition with an endogenous determination of worker flows in and out of unemployment. Product market reform boosts the hiring rate as well as the separation rate, which can lead to a negative effect on unemployment depending on wage rigidities in the labour market.

The empirical findings are in line with the theory and point to a decrease in unemployment (Amable *et al.* 2011, Bassanini and Duval 2006a, De Serres *et al.* 2012, Griffith *et al.* 2007) and an increase in employment (Berger and Danninger 2007, Boeri *et al.* 2000, Fiori *et al.* 2007, Nicoletti *et al.* 2001, Nicoletti and Scarpetta 2005) if the product market is deregulated. Gal and Hijzen (2016) and Bordon *et al.* (2016) evaluate the impact over time and find a positive and increasing effect in the long run. The methodologies and results are presented in table 1.

Depending on the type of product market deregulation implemented by governments, the expected impact on labour market outcomes can differ. Papers distinguish between State controls (e.g. public ownership), barriers to entrepreneurship (e.g. administrative burdens, regulatory opacity, barriers to entry), and barriers to trade (e.g. barriers to FDI). Regarding government interventions, results are contrasted. While some papers find a negative but not statistically significant impact of State control on employment (Boeri *et al.* 2000, Berger and Danninger 2006), Fiori *et al.* (2007) find a statistically significant positive relationship. Nicoletti and Scarpetta (2005) analyse the non-agricultural business employment rate (excluding public employment) and find a negative and statistically significant effect of public ownership. This implies that employment shifts, at least partially, from business to public sector as a result of an increase in public ownership. Regarding barriers to entrepreneurship and barriers to trade, the evaluated impact is always negative: more regulation would mean less employment (Fiori *et al.* 2007, Berger and Danninger 2006) even if the effect is sometimes not statistically significant (Boeri *et al.* 2000).

Labour market factors – i.e. union density, employment protection, replacement rate, active labour market policies - are also at the core of unemployment researches. In this paper, I am particularly interested in employment protection legislation which aims to protect workers against abusive dismissals and provides (financial) compensation for the income loss associated with dismissals. Flexibility of employment protection is considered to be essential for rapid adjustments in the workforce to changing economic conditions and to reallocate labour towards more productive activities.

In theory, more stringent employment protection legislation is modelled through an increase in the cost of firing staff. *A priori*, labour demand is thus negatively affected: firms reduce their hiring

rates and unemployment increases (Cahuc and Zylberberg, 1996, Bassanini and Duval 2006b). To compensate for higher dismissal costs, firms offer lower wages. However, severance pay can be seen as an additional income for workers. If workers are risk neutral, it does not matter if the income is coming from wages or severance pay. Wages adjust and the unemployment rate is not affected (Burda 1992). On the other hand, as the hiring rate declines, the average time job-seekers spend in unemployment before finding a new job increases, and unemployment becomes more costly. Workers are more willing to accept lower wages to maintain their jobs, and labour market equilibrium is restored (Blanchard 1999). As a result, employment protection lowers labour turnover (both hiring and lay-offs) and extends the duration of unemployment. The net effect on the aggregate unemployment rate remains ambiguous.

Labour market deregulation through less stringent employment protection legislation can provide different results. In the short run, it leads to lower wages and thus higher profits for firms. It either has no effect on unemployment (Blanchard and Giavazzi 2003) or initially increases lay-offs more than it creates jobs and thus increases unemployment (Cacciatore *et al.* 2016). In the long run, higher profits attract new firms which hire new workers and thus the unemployment rate drops.

Empirical estimates on the potential impact of EPL on (un)employment vary. While some papers find a positive effect of EPL deregulation on employment (Bordon *et al.* 2016, Berger and Danninger 2007, Boeri *et al.* 2000, Fiori *et al.* 2007) and a fall in unemployment (De Serres *et al.* 2012), others find a statistically insignificant impact (Kugler and Pica 2008, Bassanini and Duval 2006a, Belot and Van Ours 2004, Amable *et al.* 2011, Nicoletti and Scarpetta 2005) or even a negative impact on employment (Malk 2013). Studying 20 OECD countries during the period 1960-1999, Baker *et al.* (2002) find that a large part of unemployment movements was mainly due to country-specific effects rather than institutional factors such as employment protection legislation. In sum, the empirics do not provide unambiguous results that could justify prescriptions for labour market deregulation. A detailed summary of the results and the estimation methods are provided in table 1.

Employment protection reforms can be implemented either on regular or on temporary contracts and thus have different impacts on labour market outcomes. Bassanini and Duval (2006a) point out that a statistically insignificant aggregate impact of EPL on unemployment may mask two opposite effects. On the one hand, regulation on permanent contracts implies upward pressure on unemployment with a positive coefficient in the unemployment equation. On the other hand, stricter rules for temporary contracts can induce downward pressure on unemployment and a negative coefficient. However, both effects disappear when Spain is removed from the sample (Spain undertook the deepest reforms on permanent contracts over the period 1982-2003) and thus the empirical findings are not particularly robust. In a study of 21 OECD countries over the period 1985-2007, De Serres *et al.* (2012) also found a positive but not statistically significant impact of permanent contract regulation on unemployment and a statistically insignificant negative effect of the share of temporary contracts on unemployment. By contrast, when analysing the change in employment, Berger and Danninger (2006) estimated a negative and statistically significant effect of regulation for

all types of EPL but with a larger impact for permanent contracts and protection against collective dismissals than for temporary contracts.

The difference between levels of regulation for both types of contracts can also be crucial in determining the potential variation of unemployment. A stricter protection for permanent contracts compared to temporary contracts could raise the share of temporary contracts. However, this conclusion also depends on the initial level of regulation. If employment protection is initially strict for both types of contract, a weakening in rules for temporary contracts would raise the share of temporary contracts (Boeri *et al.* 2000). The reform of temporary contracts in Spain in 1984 is a good illustration since the use of fixed-term contracts dramatically increased from 10% at the beginning of the 1980s to 35% in the 1990s.

Table 1: Summary of empirical findings on the impact of PMR and EPL reforms on (un)employment

Authors	Data	Dependent variable	Definition PMR and EPL	Methodology	Endogeneity tests	Results
Boeri, Nicoletti and Scarpetta (2000)	19 OECD countries 1982-1995	Non-agricultural employment rate	EPL: OECD indicator for permanent and temporary workers PMR: OECD economy-wide index	step 1: reduced-form model for EPL; step 2: country-specific effect; step 3: bivariate correlation between the unexplained country-specific effects and the PMR index	/	Countries with restrictive PMR tend to have lower employment rates in the non-agricultural business sector. EPL has a negative impact on employment rate (90% significance)
Nicoletti et al (2001)	20 OECD countries 1982-1998	Employment rate	PMR: OECD sectoral index	Reduced-form models estimated with fixed and random effects	/	Anticompetitive PMR have significant negative effects on non-agricultural employment rate. In some countries, the product market regulatory environment may account for up to 3 pp of deviations of the employment rate from the OECD average.
Baker et al (2002)	20 OECD countries 1960-1999	Unemployment rate	EPL: OECD indicator	Feasible generalized least squares	Do not consider EPL as endogenous. Control for the endogeneity of ALMPs by instrumenting it using countries' average ALMP value over the 1985-1999 period	No argument in favour of labour market deregulation since nearly all the change in structural unemployment rates was accounted for by country-specific effects not by institutional factors
Belot and Van Ours (2004)	17 OECD countries 1960-1999	Unemployment rate	EPL: index based on three sub-indexes (protection of open-ended contracts, fixed-term contracts and temporary work agencies), own computation, scale of 0 to 1	FE regressions taking interactions between labour market institutions into account.	/	No clear causal relation between employment protection and unemployment rate. Estimating the regression with fixed effect made the coefficient of employment protection statistically insignificant
Nicoletti, Scarpetta (2005)	20 OECD countries 1980-2002	Non-agricultural employment rate	EPL: OECD indicator for permanent and temporary workers PMR: OECD sectoral index	Fixed effect regression	/	Significant employment gains can be obtained by deregulating product markets in overly regulated countries EPL has a negative impact on employment rate but this impact is not significant in all specifications, particularly when they control for outliers and add country fixed effects
Bassanini and Duval (2006a)	20 OECD countries 1982-2003	Unemployment rate	EPL: OECD indicator for permanent and temporary workers PMR: OECD sectoral index	Feasible GSL with fixed and random effects	IV estimation using lagged institutional variables (2-years lag) PMR and EPL coefficients become statistically insignificant	PMR raise aggregate unemployment EPL effect on unemployment is statistically insignificant
Berger, Danninger (2007)	27 OECD countries 1980-2004	Employment growth rate	EPL: OECD indicator for permanent and temporary workers PMR: OECD economy-wide index	Time series panel techniques with fixed and random effects, IV and GMM	GMM based on Arellano and Bond (1991) with a 4-lag structure Same result as other specifications but coefficients become not statistically significant	Lower levels of product and labour market regulation foster employment growth
Fiori et al (2007)	20 OECD countries 1980-2002	Non-agricultural employment rate	EPL: OECD indicator for permanent and temporary workers PMR: OECD sectoral index	Feasible GLS	Control function approach of Rivers and Vuong (1988) Find that there is no endogeneity and thus GLS results are consistent	Anti-competitive PMR has a negative impact on employment rate Tight labor market regulation tends to reduce employment
Griffith, Harisson and Macartney (2007)	14 OECD countries 1986-2000	Unemployment rate	PMR: captures changes in the extent of competition using a measure of the average level of firm profitability + 2 indicators based on an opinion survey and 1 reported by the Fraser Institute	Fixed effect regression	Two-stage estimation approach: first the impact of PMR and LMR on profitability, then the impact of profitability on the unemployment rate	Increased competition reduces unemployment

Table 1 (continued): Summary of empirical findings on the impact of PMR and EPL reforms on (un)employment

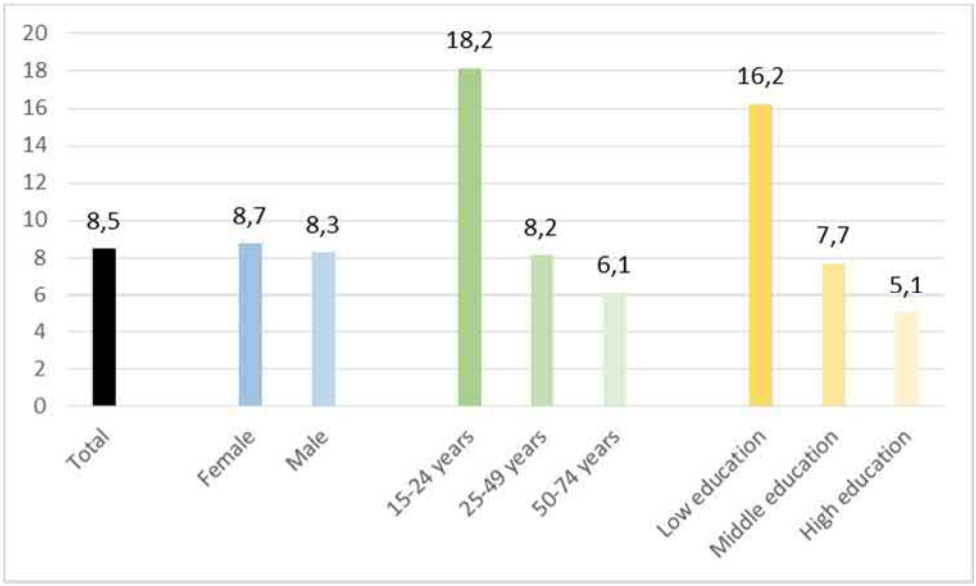
Authors	Data	Dependent variable	Definition PMR and EPL	Methodology	Endogeneity tests	Results
Kugler, Pica (2008)	Italian Social Security employer-employee panel data 1986-1995	Accession or separation between worker and firm	EPL: Dummy variable which takes the value of 1 after 1990 (after the reform) and a dummy variable which take the value of 1 if the worker is employed in a small firm	Diff-in-diff approach by comparing worker and job flows in small and large firms before and after the reform	Use the 1990 reform on workers and job flows (increasing dismissal costs for small firms) as a natural experiment.	The increase in dismissal costs decreased accession and separation rates for workers in small relative to large firms. Negligible impact on net employment.
Amable, Demmou and Gatti (2011)	18 OECD countries 1980-2004	Jobless, inactivity and unemployment	EPL: model the evolution of the OECD index using EPL index from the FRDB Social Reforms Database as well as country dummies and time trends as regressors PMR: OECD index (economy wide & sectoral)	Limited dependent variable model with country dummies + Fixed effect vector decomposition	IV estimation using lagged institutional variables Find that there is no endogeneity	Regressions on joblessness show a negative impact of PMR and a positive impact of EPL on employment. Regression using sectoral PMR index shows not statistically significant impact on joblessness Specifications for inactivity and unemployment show that the model specification fits more satisfactorily the inactivity rather than the unemployment component of joblessness. Unemployment equation: PMR always positive and statistically significant (economy-wide index) and EPL negative but not statistically significant
De Serres, Murtin, De La Maisonneuve (2012)	21 OECD countries 1985-2007	Unemployment rate	EPL: OECD indicator on regular contracts + share of workers with fixed-term contracts PMR: OECD sectoral index	Dynamic unemployment equation taking the persistence of unemployment into account estimated using FE Least-square dummy variable (LSDV) estimator + non-linear least square (NLS) estimator	Diff-GMM The impact of EPL on regular contracts remains positive and significant. However, the impact of PMR becomes negative and insignificant	Easing of employment protection legislation on regular contracts reduce persistence of unemployment (statistically significant only in half of the specifications including the one based on diff-GMM) More competition-friendly product market regulation can reduce structural unemployment but the impact is not robust to different specifications
Malk (2013)	Microdata from labour force survey for Estonia and Lithuania 2007-2011	Worker flows out from employment and into employment	EPL: Dummy variable which takes the value of 1 after the reform and a dummy variable which take the value of 1 if the worker is in Estonia	Diff-in-diff approach by comparing labour flows in Lithuania and Estonia before and after the reform	Analyse the Estonian reform in mid-2009 decreasing EPL (for all workers) and use Lithuania as a control	Labour flows out of and into employment increased in Estonia relative to Lithuania. Statistically significant only for flows out of employment
Bordon, Ebeke and Shirono (2016)	30 OECD countries 1980-2013	Variation in the employment rate (from 1 to 5 years)	EPL: OECD indicator on regular contracts PMR: OECD sectoral index	Define two reform variables (for PMR and EPL) which take the value of one when the index drop by more than 2 standard deviations of the change in the indicator over all observations Estimation using local projections techniques	Augmented inverse probability weighting (AIPW) method which estimates the treatment effects of reforms while controlling for potential selection bias The positive effect of reforms remains even after controlling for endogeneity	Structural reforms have a lagged but positive impact on employment Both labour and product market reforms increase employment rates by about a little over 1 percentage point over 5 years
Gal and Hijzen (2016)	10 regulated industries in 18 advanced economies 1998-2013	Employment based on the firm-level database Orbis	PMR OECD sectoral index	Impulse response function using the local projection method	Instrumental variables	Product market reforms have positive effects on employment and their effects increase over time

2. *Vulnerable groups of workers and the potential effect of PMR and EPL*[4]

Women, young workers, old workers and the low-educated are considered as vulnerable groups in terms of employment. A large share of those types of workers is either inactive or unemployed. The unemployment literature has widely studied the reasons behind their weaker attachment to the labour market.

Figure 1 - Unemployment rate for different types of workers

(2016, average of the 24 considered European countries,
in percentage of the corresponding labour force aged from 15 to 74)



Source: EC.

Unemployment among young people appears to be one of the most highly sensitive variables in the labour market. It is directly linked to GDP growth: the youth unemployment rate falls during booms and rises during recessions. In addition, young workers are frequently mismatched in their employment (Shimer 2001). The employment process thus implies considerable searching and job changing before settling into a more or less permanent contract. In 2016, on average across European countries, 45% of the 15-24 year-old salaried workers had a temporary contract compared to 14% of the category aged from 25 to 49. Job match improves with age and older workers are often protected against job loss by seniority rights and because they have built up skills through experience. Despite job protection and the lower average unemployment rate, the possibilities of finding a new job decline with age. The net effect is that the long-term unemployment rate is higher for older workers. In 2016, 60% of the unemployed workers over 50 years had been disconnected from the labour market for more than 12 months in Europe. This rate was 28% for the 15-24 age group and 47% for the 25 to 49 age group.

[4] All averages in this section correspond to the average for the 24 European countries considered, namely 21 countries from the EU (Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, United Kingdom) + Iceland, Norway and Switzerland.

In spite of the rise in their participation rate, from 52% in 1998 to 59% in 2016, there are still less women in the labour market than men, with a gap in the activity rate of 11 percentage points in 2016. As emphasised by Jaumotte (2004), education, the functioning of labour markets and cultural attitudes (access to childcare, parental leave, integration) remain important determinants of female participation. Analysing 18 OECD countries over the period 1980-2007, Thévenon (2013) finds that childcare services, maternity leave and tax policies remain the most important drivers of increased female participation in the labour market.

Whatever the age or gender considered, unemployment is concentrated among those with the lowest level of education. Moreover, a large part of the increase in unemployment in Europe is due to a rise in joblessness among the low-skilled. The reason is a fall in demand for low-skilled workers. Competition from countries with low labour costs and technological progress are two factors often cited to explain labour demand shrinkage. However, as emphasised by Dolado *et al.* (2000), raising the educational attainment of the labour force does not always solve the unemployment problem unless other labour market rigidities are reduced.

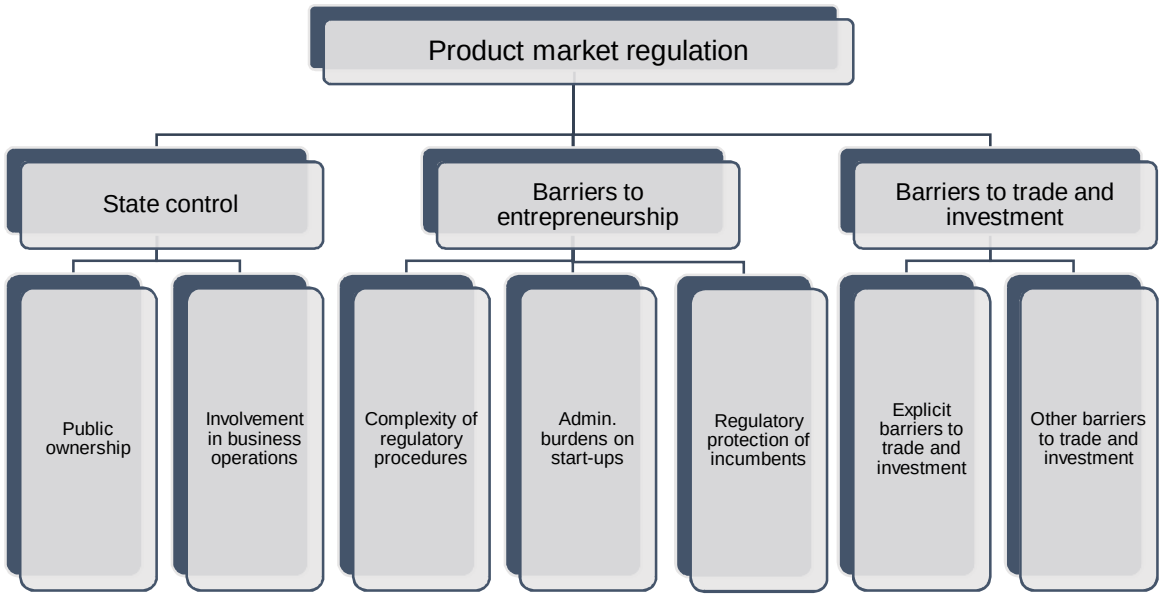
Among the wide range of literature on product and labour market regulations, only very few articles have considered their impact on the unemployment rate for different categories of individuals. Gal and Theising (2015) point out that low-educated people, the young, and the elderly tend to be more affected by structural reforms. They study employment protection legislation in particular and find a heterogeneous impact on various segments of the population. In their analysis, stricter regulation reduces employment for women and low-educated workers and pushes up employment for highly-educated individuals. Bassanini and Duval (2006b) also find contrasting results depending on the type of workers, with a decrease in employment for young workers but an increase for older workers. As emphasised in the OECD (2004) *Employment Outlook*, by reducing turnover, employment protection reduces the job prospects for those with relatively weak attachment to the labour market, such as young workers and women. Those opposing effects may explain the difficulty in finding a robust impact of EPL on aggregate unemployment since the impact depends on the composition of the working-age population in terms of skills and demographic characteristics. Product market regulation seems to affect women more than men. Studying the impact of PMR on the employment rate for 20 OECD countries over the period 1982-2003, Bassanini and Duval (2006b) estimate a statistically significant negative effect for women but no statistically significant impact for men. De Serres *et al.* (2012) provide similar results by studying the unemployment rate: a stricter regulation implies a higher unemployment rate for women but not for men. Those two articles also find that the impact depends on the age of workers: product market regulation affects older workers positively, through an increase in their employment rate (Bassanini and Duval 2006b), but affects young people negatively, through an increase in the unemployment rate (De Serres *et al.* 2012).

III. Data

Our sample includes 24 European countries[5] over the period 1998-2013[6]. The two variables of interest, i.e. product market regulation (PMR) and employment protection legislation (EPL), are OECD indicators. The PMR index is updated every five years and currently covers the years 1998, 2003, 2008 and 2013. The OECD collects information on regulatory structures and policies through a questionnaire sent to governments. Each answer is normalised over a zero to six scale, where a lower value means a low level of regulation. In a bottom-up approach, the numerical value of each question is first aggregated into 18 low-level indicators. They are then aggregated into seven mid-level indicators, which are in turn aggregated into three high-level indicators: State control, barriers to entrepreneurship, and barriers to trade and investment. An economy-wide indicator is then calculated based on the three high-level indicators. At each step of aggregation, a weighted average is used.

The indicators are insulated from context-specific assessments that are found in opinion surveys since they are based on objective data about laws and regulations. While the procedure ensures that the indicators are comparable across countries and over time, it has only limited information on how authorities implement the regulation and on informal regulatory practices.

Figure 2: Product market regulation indicator – OECD definition



Source: OECD.

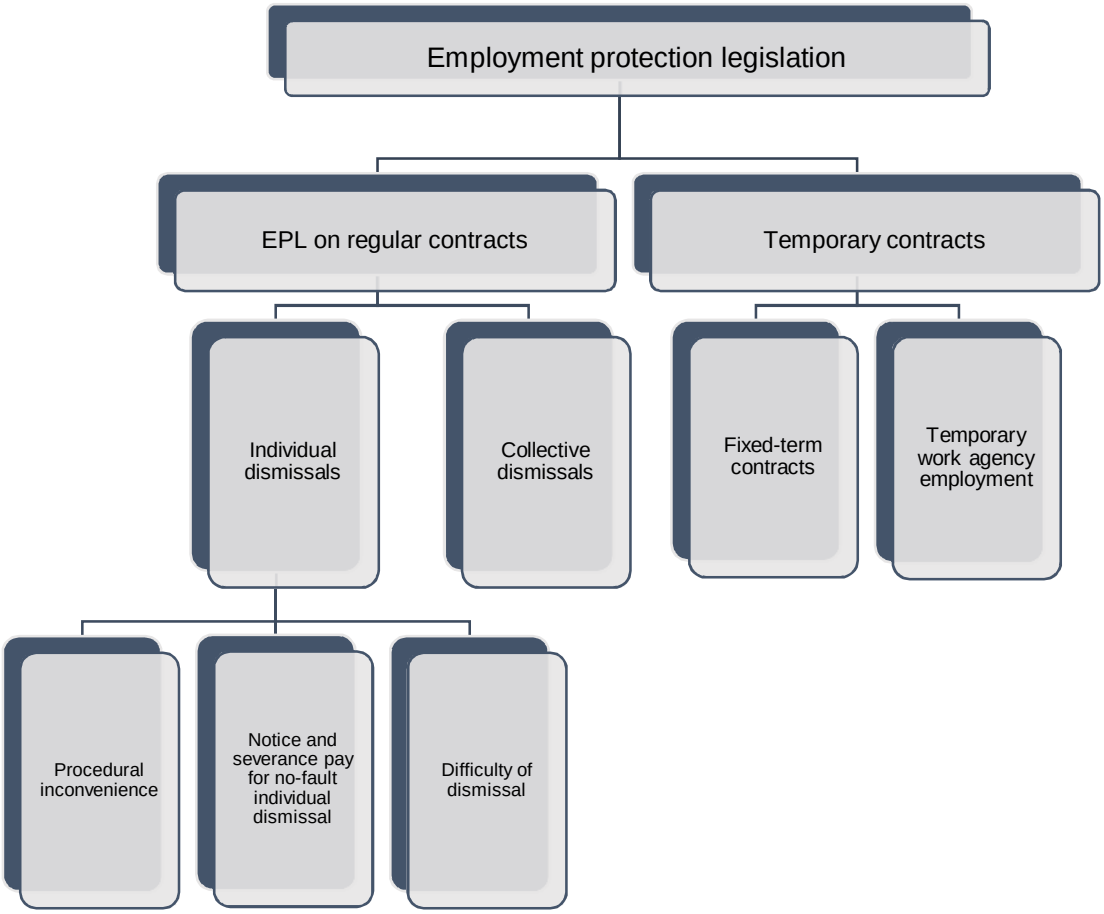
The same bottom-up approach is used in the computation of the EPL indicator. The index is available for the period 1985-2013 and is computed every year. It combines information on strictness of employment protection for regular contracts (individual and collective dismissals) and on the use of temporary contracts. The indicator is compiled on the basis of statutory laws, collective bargaining

[5] 21 countries from the EU (Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, United Kingdom) + Iceland, Norway and Switzerland.

[6] Table of descriptive statistics for all variables is in appendix.

agreements and case-law, with contributions of country experts. It is scaled from zero to six and rises with the level of strictness. Even though the complexity of employment protection legislation is difficult to summarise in an index, the EPL indicator provides a quantitative and comprehensive measure which is comparable across countries and over time.

Figure 3: Employment protection legislation indicator – OECD definition

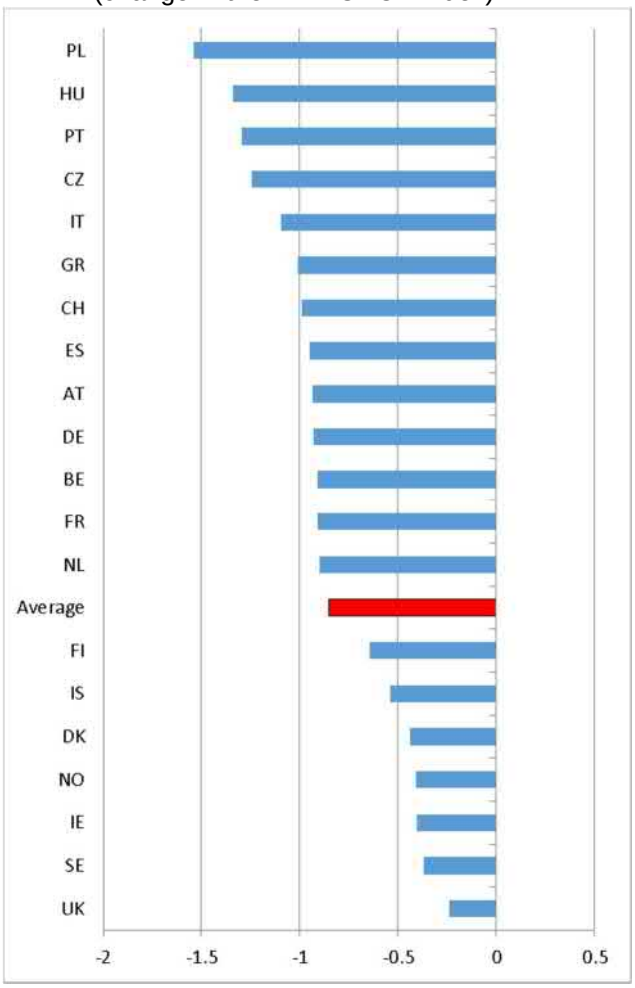


Source: OECD.

Over the past fifteen years, product markets have been substantially liberalised in European countries: the average index fell from 2.22 in 1998 to 1.38 in 2013. Reforms took place in all countries analysed, with the biggest reduction occurring in Poland (-1.54), Hungary (-1.34) and Portugal (-1.29). Despite the 1.29 drop, Poland remains one of the most regulated European countries in 2013: it ranks 22nd just ahead of Slovenia (23rd) and Greece (24th). The most competition-friendly in 2013 were the Netherlands, the United Kingdom and Austria.

Figure 4 – Product market reforms between 1998 and 2013[7]

(change in the PMR OECD index)



Source: OECD.

In recent years, liberalisation of the product market has slowed down in European countries. Between 1998 and 2003, the average PMR score fell by 0.46 compared with 0.26 between 2003 and 2008 and 0.14 between 2008 and 2013. The pace of reforms may have slowed down because most countries have already reached a low level of regulation. The potential benefits of further reforms are thus becoming smaller and liberalisation becomes harder over time. Three countries even introduced additional rules that inhibit competition: Ireland (with an increase in the PMR indicator by +0.1 over the period 2008-13), Iceland (+0.02) and Luxembourg (+0.02). On the other hand, Greece, Italy and Spain faced strong market pressure for structural reforms in 2011. While the PMR index for Greece came down by 0.47 points (the largest change over the period 2008-13), reforms have been more modest in Italy (-0.22) and Spain (-0.15).

On average across European countries, deregulation has mostly involved removing barriers to entrepreneurship (from 2.72 in 1998 to 1.62 in 2013), through simplification of the regulatory procedures and reduced protection of incumbents (e.g. lower barriers to entry). State control was limited by abolishing price controls (or at least by making them more competition-friendly). The State

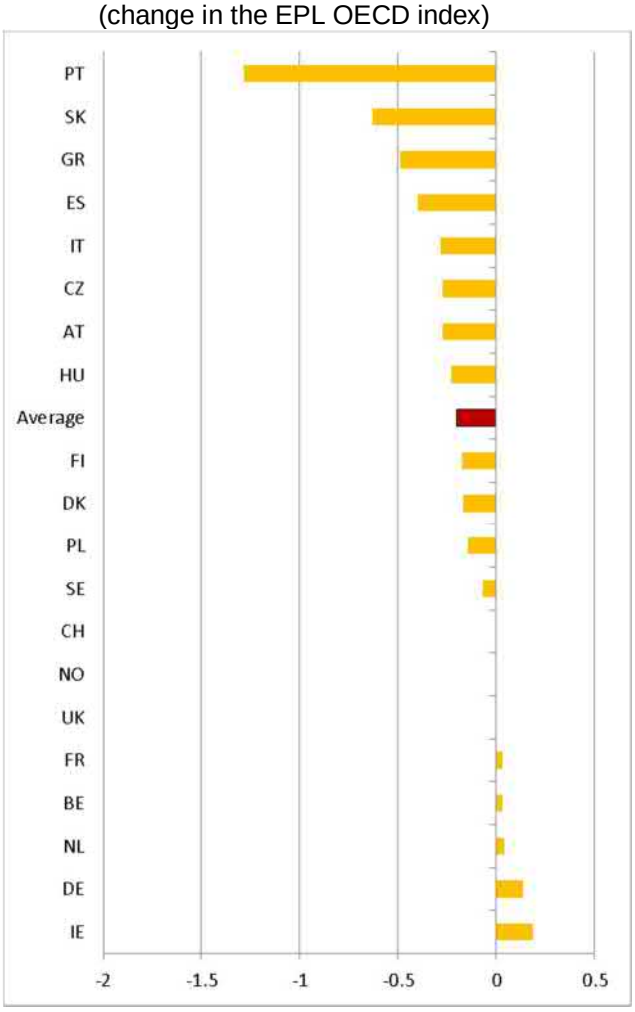
[7] Luxembourg, Slovak Republic, Estonia and Slovenia are not presented on the graph because data are not available at the beginning of the period.

control index fell by 0.93 points and reached a level of 2.13 in 2013. Public ownership remains high at an index of 2.72. Barriers to trade and investment were already low in 1998 (0.87) and continued to come down over time (0.39 in 2013), mainly because of discrimination against foreign suppliers fall.

The trend in reducing regulations is less strong in labour markets than in product markets. From an average score of 2.66 in 1998, European countries reached 2.46 in 2013. However, contrary to product market reforms, employment protection dropped back at an increasing rate over time: by -0.01 points between 1998 and 2003, by -0.05 points between 2003 and 2008 and by -0.13 points between 2008 and 2013. This trend is not evenly spread over the 24 countries. Over the period 1998-2013, five countries raised their dismissal costs, namely Ireland (+0.19), Germany (+0.14), the Netherlands (+0.04), Belgium (+0.03) and France (+0.03). On the contrary, other countries substantially reduced employment protection: the largest reform was in Portugal (-1.28), followed by the Slovak Republic (-0.63), Greece (-0.48) and Spain (-0.40).

Figure 5 – Labour market reforms between 1998 and 2013 [8]

(change in the EPL OECD index)

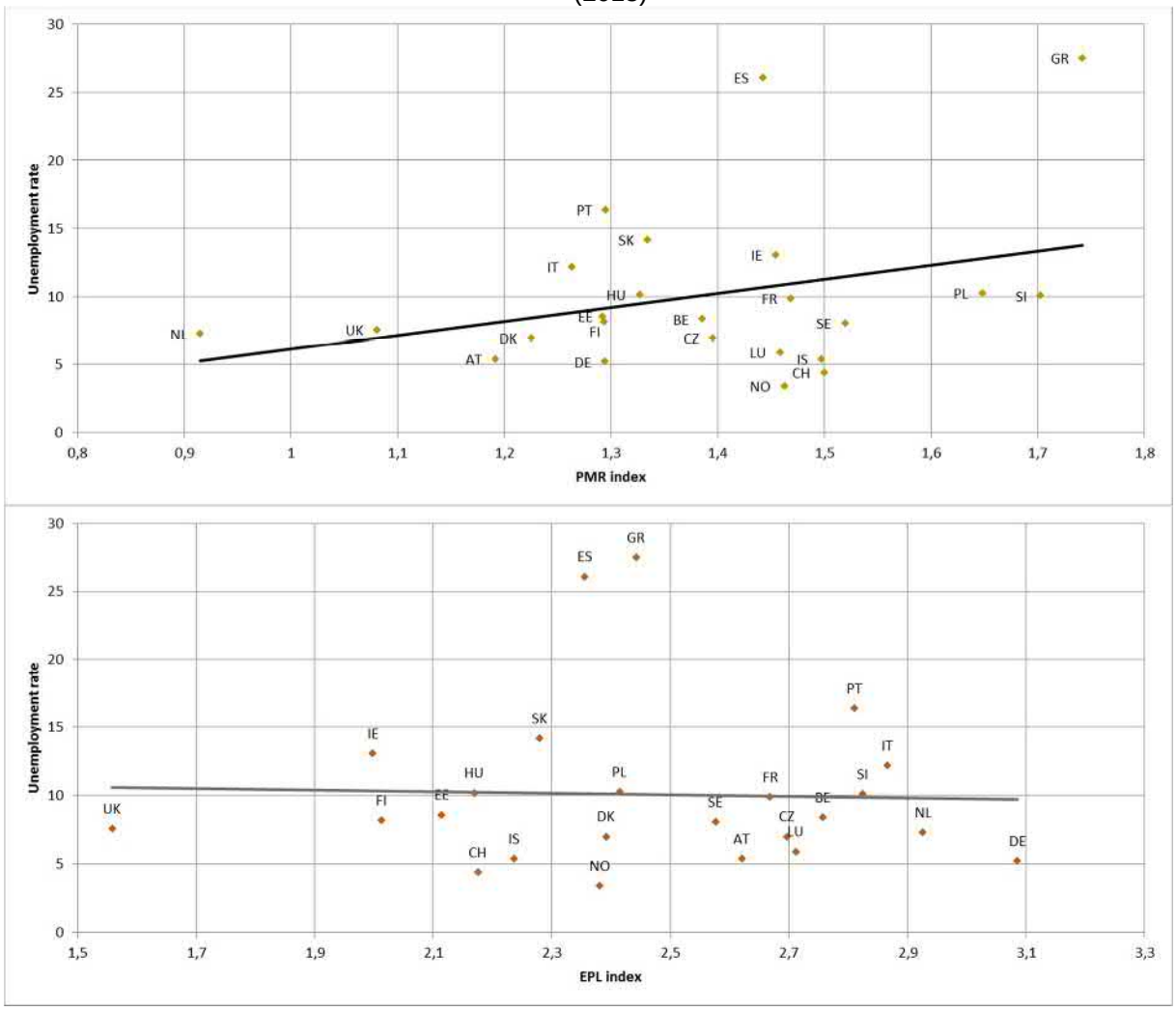


Source: OECD.

[8] Estonia, Luxembourg, Slovenia and Iceland are not presented on the graph since data on their EPL are available only over the period 2003-2013.

The indicators for three types of employment protection legislation weakened over the period. The largest reduction in the index is observed for temporary contracts, with a decrease of 0.23, and it was also the lowest indicator at 1.71 in 2013. Individual dismissals were on average less costly in 2013 than in 1998 with a reduction of the indicator by 0.22 points to reach a score of 2.18 in 2013. Employment protection in the event of collective redundancies remains high at 3.15 in 2013 (-0.15 points compared to 1998). A high degree of protection of individual dismissals is not always associated with a high protection of collective redundancies and vice versa. For example, Belgium had in 2013 the highest index of collective employment protection legislation at 5.12 but a low score (well below the European average) for individual dismissals (1.81). On the contrary, Portugal had the highest score of individual protection (3.18) but was among the lowest score for collective redundancies (1.87).

Figure 6 – Relationship between unemployment rate and regulatory indices
(2013)



Sources: EC, OECD.

A high level of regulation in product and labour markets is not always associated with a high unemployment rate. Germany, for instance, had the third lowest unemployment rate in 2013, while its level of employment protection was the highest. In terms of regulation in the product market,

Switzerland was the fifth most highly regulated country but had the second lowest unemployment rate. There are also some counter-examples. The highest unemployment rate was found in Greece, which has the most highly regulated product market. Portugal also had a high unemployment rate (third rank) together with a high level of employment protection (fifth rank). Differences in unemployment rates can thus reflect institutional and economic features, but are also impacted by macroeconomic shocks. Countries with high unemployment rates tend to be countries which were more affected by the economic crisis.

A bivariate analysis of the regulatory indices with respect to unemployment rates shows a slightly negative correlation (-0.03) between employment protection and unemployment in 2013 and a slightly positive correlation (0.03) in 1998. The relationship between product market regulation and unemployment is always positive with a correlation of 0.28 in 1998 and 0.32 in 2013.

IV. Empirical results

To explore the institutional determinants of unemployment, in particular product market regulation and employment protection legislation, I first estimate the following equation:

$$(1) \qquad u_{it} = \beta_0 + \beta_1 PMR_{it} + \beta_2 EPL_{it} + \beta_3 X_{it} + \beta_4 Z_{it} + \gamma_t + \varepsilon_{it}$$

where u is the unemployment rate in country i and in year t; PMR represents the product market regulation indicator; EPL is the employment protection legislation index; X groups control variables for other labour market policies (net replacement rate and union density); Z is a vector of control variables for macroeconomic factors (GDP gap, inflation and labour productivity); γ_t is a time fixed effect and ε_{it} is the error term.

Control variables have been chosen depending on the availability of the data and based on previous research. Together with employment protection legislation, union density and the replacement rate are important factors for the unemployment rate. Higher union density raises the bargaining power of workers, hence increases wages which in turn reduces the number of workers hired, and thus increases the unemployment rate (Nickell and Andrews, 1983). The replacement rate (unemployment benefits received when not working relative to wages earned when employed) can also directly influence unemployment. Higher unemployment benefits put upward pressure on bargained wages and hence lower the equilibrium level of employment (Cahuc and Zylberberg 1996). This finding is largely confirmed by empirical literature (Brauninger 2000, Meyer 1980, Adams and Coe 1990, Calmfors 1990, Acemoglu and Shimer 2000, Holmlund 1998) even if a high degree of uncertainty remains regarding the magnitude of the effect. Macroeconomic indicators constitute a second set of factors which can explain variation in the unemployment rate: inflation through the Phillips curve, the output gap, and a time-fixed effect to account for the impact of the business cycle and labour productivity growth.

Estimating and testing a model using OLS involve some issues related with the use of time-series cross-section data. Our data are characterised by a limited number of countries and a restricted period of estimation, which makes standard panel data estimation procedures problematic. By simply

applying pooled ordinary least squares method, the coefficient variability can be underestimated by 50% or more (Beck and Katz 1995). To deal with standard error overconfidence, they propose a new estimation method: the panel corrected standard errors. By applying OLS with modified standard errors, panel corrected standard errors take into account panel heteroscedasticity and contemporaneous correlation of the error terms. This methodology is thus applied to our standard regression.

Some heterogeneity across countries can be omitted or not fully captured by our explanatory variables. To control for this potential bias and to account for the specific characteristics of countries, all variables are estimated in difference with respect to the country mean (country-fixed-effect regression).

$$(2) \qquad (u_{it} - \bar{u}_i) = \beta_0 + \beta_1(PMR_{it} - \overline{PMR_i}) + \beta_2(EPL_{it} - \overline{EPL_i}) + \beta_3(X_{it} - \bar{X}_i) + \beta_4(Z_{it} - \bar{Z}_i) + (\varepsilon_{it} - \bar{\varepsilon}_i) + \gamma_t$$

Potential endogeneity of product market and labour market reforms constitutes another estimation issue. In fact, the effects of structural reforms may be endogenous to the economic environment in which reforms are conducted. Usually, in such cases, an instrumental variable regression is estimated, using the lagged values of the endogenous variables as instruments. In order to specify the optimal number of lags, a weak identification test (Cragg-Donald Wald F-stat) and an over-identification test (Hansen J-stat) are conducted. The tests suggest that a lag of two years can be used[9].

Depending on when the structural reform is implemented, the estimated impact can be biased. For example, the effect on the unemployment rate of a reform conducted shortly before an economic recovery is difficult to distinguish from the effect of the recovery itself. In this case, endogeneity induces an upward bias of the estimates. The contrary is true if the reform is implemented shortly before a downturn. Interestingly, the endogeneity tests contradict the assumption that effects of structural reforms are endogenous to the economic environment (the p-value is above the 0.10 bound). This finding is in line with Bassanini and Duval (2009) and Fiori *et al.* (2007) who also find no evidence of reverse causality from unemployment to institutions. This absence of endogeneity could be explained by the fact that the regression estimates the impact of EPL and PMR level in year *t* on the level of unemployment rate on year *t*. Since structural reforms can take time to be implemented, it is reasonable to assume that the unemployment rate does not influence the current level of regulation in product and labour markets. In this case, the fixed-effect regression is unbiased by the business cycle and thus constitutes the best estimation that can be made. Since specifications for different types of regulation and different types of workers do not provide different results regarding the endogeneity issue, the analysis presented in the next sections will focus on the fixed-effect regressions.

[9] Different lags, from 1 to 5 years, have been estimated for the IV regression. All specifications provide similar results. Coefficients of EPL and PMR remain statistically significant and of the same sign. Moreover, the evidence of no endogeneity remains for all estimations, even for the exactly identified model (lag of 1 year). See annexe 2 for the complete results.

1. Baseline regressions

The baseline regression using year- and country-fixed effects provides a positive coefficient for PMR equal to 3.45. Any deregulation in the product market thus implies a reduction in the unemployment rate. More precisely, a drop in the PMR index by one standard deviation (0.45) is associated with a predicted drop of 1.5 percentage points of the unemployment rate. The magnitude of the effect seems particularly high. Nevertheless, descriptive statistics[10] show that the average level of product market reforms over the period 1998-2013 corresponds to a decrease of the PMR index by 0.29. The associated impact is therefore a reduction of 1 percentage point of the unemployment rate. In the more recent period, deregulation was slowed down by a fall of just 0.14 in the PMR index between 2008 and 2013. Further deregulation of the same extent as between 2008 and 2013 will then be associated with a reduction in the unemployment rate by 0.5 percentage point.

By contrast, deregulation of the labour market measured by a reduction of the EPL index by one standard deviation (0.46), was associated with a predicted increase in the unemployment rate by 3.1 percentage points. When we consider the average level of deregulation (a decrease of 0.06 of the EPL index) the predicted unemployment rate should increase by 0.4 percentage point. Between 2008 and 2013, the EPL index fell on average by 0.13 point which is associated with a predicted increase of the unemployment rate by 0.9 percentage point. Deregulation in the labour market took place in the very last period of our sample, so that the estimated impact could be a short-run effect of deregulation. This result is in line with the findings of Cacciatore *et al.* 2016 and Bordon *et al.* 2016 who show that deregulating the labour market could be detrimental to unemployment in the short run while a positive impact (i.e. a reduction of the unemployment rate) occurs only in the long run. This result could have an incidence on the decision of policymakers to implement or not a labour market reform.

[10] See annex 1.

Table 2: Impact of EPL and PMR on the unemployment rate

	(1)	(2)	(3)	(4)	(5)	(6)
Employment Protection	0.97*	-1.37***	-6.56***	-6.36***	-5.96**	-6.68**
	(0.52)	(0.37)	(1.30)	(2.06)	(2.57)	(2.75)
Product Market Regulation	3.38***	6.05***	3.45***	3.97***	3.29***	3.89***
	(0.93)	(0.57)	(0.93)	(1.19)	(1.01)	(1.18)
Estimator	OLS	OLS	FE	IV-FE	IV-FE	IV-FE
Control Variables	yes	yes	yes	yes	yes	yes
Country Fixed effects	no	no	yes	yes	yes	yes
Year Fixed effects	no	yes	yes	yes	yes	yes
PMR endogeneity	no	no	no	yes	no	yes
EPL endogeneity	no	no	no	no	yes	yes
Adjusted R^2	0.83	0.88	0.35	0.39	0.44	0.45
Number of observations	317	317	317	281	279	277
Weak identification test	/	/	/	327.17	137.34	69.02
Overidentification test	/	/	/	0.30	0.84	0.60
Endogeneity test	/	/	/	0.19	0.95	0.42

Note: (standard errors), *significant at 90%, ** significant at 95%, ***significant at 99%.

To test this hypothesis, I excluded from the sample countries which implemented the largest labour market reforms at the end of the period, namely Portugal, Greece, Spain and Italy. While the coefficient of PMR remains the same, even if slightly lower, the effect of employment protection on the unemployment rate is reversed, i.e. deregulating the labour market is now beneficial to reduce the unemployment rate. As this specification should better capture the long run effect of labour market deregulation, results confirm the hypothesis of a negative short run effect but a positive long run effect.

Table 3: Robustness checks of the impact of EPL and PMR on the unemployment rate

	Baseline regression	Excluding PT, GR, ES, IT	Baseline regression with interaction term	Excluding PT, GR, ES, IT and adding interaction term
Employment Protection	-6.56***	4.21***	-5.91***	4.18***
	(1.30)	(1.59)	(1.34)	(1.61)
Product Market Regulation	3.45***	2.83***	3.53***	2.82***
	(0.93)	(0.78)	(0.93)	(0.78)
EPL x PMR			6.68**	-0.60
			(3.36)	(4.59)
Estimator	FE	FE	FE	FE
Country Fixed effects	yes	yes	yes	yes
Year Fixed effects	yes	yes	yes	yes
Adjusted R^2	0.35	0.28	0.36	0.28
Nb of observations	317	254	317	254

Note: (standard errors), *significant at 90%, ** significant at 95%, ***significant at 99%.

Another potential explanation of the negative relationship between EPL and the unemployment rate is interaction between labour market and product market regulation. Most countries deregulated their product markets, which led to a low PMR index, ranging from 0.91 (the Netherlands) to 1.74 (Greece) in 2013. According to Amable *et al.* (2011), with low levels of PMR, employment protection yields a positive and statistically significant effect on employment (and thus potentially a reduction in the unemployment rate). Other papers (Fiori *et al.* 2007, Nicoletti and Scarpetta 2005, Griffith *et al.* 2007) show similar results. Reducing product market regulation is more beneficial in terms of employment when the labour market is highly regulated. Adding an interaction term in my baseline regression confirm results provided by Amable *et al* (2011): deregulating the labour market is detrimental to unemployment only when product market regulation level is already low. However, as long as I exclude Portugal, Greece, Spain and Italy from the regression, there is no longer statistically significant impact for the interaction term, while the individual effects of EPL and PMR remain. The estimated interaction between both types of deregulation could then also be a short run rather than a long run effect.

2. Regressions by type of product market regulation

The positive and statistically significant coefficient of product market regulation can hide opposite effects. The regressions taking the three types of PMR into account support this statement. Government interventions through public ownership and involvement in business operations do not appear to be detrimental to the unemployment rate. A decrease in State control by the average level of reform observed during the period (-0.32) is associated with a predicted rise in the unemployment rate by 0.6 percentage point. This effect seems to come from price controls and command and controls rather than public ownership. While the literature on this topic is contradicting, some papers

also find State controls to be beneficial to employment (Fiori *et al.* 2007) or statistically insignificant (Boeri *et al.* 2000, Berger and Danninger 2006).

The other two components of product market regulation have a positive coefficient. A reduction in barriers to entrepreneurship (average level of reform of -0.36 over the period) is associated with a statistically significant reduction in the predicted unemployment rate by 1.4 percentage point. Simplifying regulatory procedures and reducing administrative burdens on start-ups have a larger effect than reducing the protection of incumbents (e.g. by removing legal barriers, anti-trust exemptions, and other barriers to entry). Barriers to trade and investment also have a positive but smaller coefficient. A drop by 0.18 (the average level of reform over the period) is associated with a decline in the predicted unemployment rate by 0.3 percentage point.

Table 4: Impact of different types of product market regulation on the unemployment rate

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Employment Protection	1.39***	-0.60	-6.16***	-5.85***	-6.30***	-7.67***	0.15	-1.98***	-6.21***	-6.12***	-7.20***	-8.32***
	(0.54)	(0.67)	(1.23)	(1.92)	(2.36)	(2.52)	(0.50)	(0.27)	(1.24)	(1.89)	(2.37)	(2.52)
Product Market Regulation												
1) State Control	-0.14	0.67	-1.74***	-2.87***	-1.48**	-2.35***						
	(0.64)	(0.46)	(0.54)	(0.76)	(0.61)	(0.75)						
a) Public ownership							0.25	-0.31	-0.14	-0.64	0.12	-0.30
							(0.25)	(0.30)	(0.39)	(0.43)	(0.38)	(0.48)
b) Price controls and C&C							0.34	0.88**	-2.20***	-2.78***	-2.06***	-2.58***
							(0.62)	(0.45)	(0.46)	(0.67)	(0.54)	(0.68)
2) Barrier to entrepreneurship	3.15***	4.64***	3.91***	4.68***	3.16***	3.97***						
	(0.40)	(0.45)	(0.72)	(1.04)	(0.83)	(0.98)						
a) Regulatory and admin opacity							1.18***	1.14***	1.43***	1.64***	1.15***	1.33***
							(0.15)	(0.15)	(0.29)	(0.46)	(0.32)	(0.43)
b) Administrative burdens on startups							2.92***	3.26***	2.24***	2.80***	1.72***	2.31***
							(0.34)	(0.31)	(0.56)	(0.66)	(0.62)	(0.67)
c) Barrier to competition							-2.80***	-0.58*	0.48	0.75	0.71	0.92
							(0.51)	(0.31)	(0.57)	(0.65)	(0.50)	(0.65)
3) Barrier to trade and investment	-0.46	0.80	1.53***	2.33**	1.75***	2.52***						
	(0.75)	(1.07)	(0.47)	(0.94)	(0.60)	(0.89)						
a) Barriers to FDI							-0.45	-0.74	1.89*	1.64	1.55	1.83
							(0.90)	(0.87)	(1.10)	(1.36)	(1.00)	(1.36)
b) Regulatory barriers							0.40	1.12**	0.29	0.84	0.44	0.85
							(0.39)	(0.47)	(0.38)	(0.58)	(0.38)	(0.54)
Estimator	OLS	OLS	FE	IV-FE	IV-FE	IV-FE	OLS	OLS	FE	IV-FE	IV-FE	IV-FE
Control Variables	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Country Fixed effects	no	no	yes	yes	yes	yes	no	no	yes	yes	yes	yes
Year Fixed effects	no	yes	yes	yes	yes	yes	no	yes	yes	yes	yes	yes
PMR endogeneity	no	no	no	yes	no	yes	no	no	no	yes	no	yes
EPL endogeneity	no	no	no	no	yes	yes	no	no	no	no	yes	yes
Adjusted R^2	0.83	0.88	0.43	0.45	0.50	0.48	0.87	0.90	0.45	0.48	0.52	0.51
Number of observations	317	317	317	281	279	277	317	317	317	281	279	277
Weak identification test	/	/	/	63.52	141.91	33.44	/	/	/	20.19	137.33	14.46
Overidentification test	/	/	/	0.14	0.86	0.17	/	/	/	0.35	0.88	0.45
Endogeneity test	/	/	/	0.34	0.72	0.37	/	/	/	0.52	0.47	0.29

Note: (standard errors), *significant at 90%, ** significant at 95%, ***significant at 99%

3. Regressions by type of employment protection legislation

The employment protection legislation can be divided by types of contract (regular or temporary). For regular contracts, employment protection can refer to individual or collective dismissal costs. I estimate the specified unemployment equation for the three types of EPL. While the aggregate EPL index has a negative coefficient, the sub-division shows this is only reflected in individual dismissal costs and regulation on temporary contracts. The largest effect occurs for individual dismissals. Less stringent protection (a fall in the index by on average 0.08) is associated with an increase in the predicted unemployment rate by 0.7 percentage point.

Table 5: Impact of different types of employment protection legislation on unemployment

	(1)	(2)	(3)	(4)	(5)	(6)
Employment Protection						
1) individual dismissals	-0.00	-1.14***	-8.52***	-8.30***	-10.09***	-10.27***
	(0.29)	(0.28)	(1.22)	(1.72)	(2.13)	(2.25)
2) collective dismissals	1.31***	0.20	1.62**	1.77**	3.10***	3.08***
	(0.28)	(0.14)	(0.73)	(0.87)	(1.03)	(1.03)
3) temporary employment	0.48***	0.47***	-1.22***	-1.49***	-1.60***	-1.54***
	(0.17)	(0.16)	(0.35)	(0.48)	(0.59)	(0.59)
Product Market Regulation	2.50***	5.25***	3.02***	2.87***	2.22**	2.73**
	(0.82)	(0.63)	(0.92)	(1.11)	(1.04)	(1.18)
Estimator	OLS	OLS	FE	IV-FE	IV-FE	IV-FE
Control Variables	yes	yes	yes	yes	yes	yes
Country Fixed effects	no	no	yes	yes	yes	yes
Year Fixed effects	no	yes	yes	yes	yes	yes
PMR endogeneity	no	no	no	yes	no	yes
EPL endogeneity	no	no	no	no	yes	yes
Adjusted R^2	0.84	0.88	0.41	0.47	0.50	0.50
Number of observations	312	312	312	278	274	274
Weak identification test	/	/	/	282.12	25.66	24.57
Overidentification test	/	/	/	0.27	0.46	0.43
Endogeneity test	/	/	/	0.27	0.18	0.26

Note: (standard errors), *significant at 90%, ** significant at 95%, ***significant at 99%

To a lesser extent, a lower rate of regulation in the use of temporary contracts (-0.07 on average) would also raise the unemployment rate by 0.1 percentage point. Regulation of temporary contracts includes rules for fixed-term contracts (valid cases for use of fixed-term contracts, maximum number of successive fixed-term contracts and maximum cumulated duration of successive fixed-term contracts) as well as rules for temporary work agency employment (types of work for which temporary work agency employment is legal, restrictions on the number of renewals, maximum cumulated duration and equal treatment of regular and agency workers at the user firm).

Deregulation in employment protection legislation for collective redundancies, on the contrary, appears to reduce unemployment. However, decrease in the rigidity of rules for collective redundancies (such as specific requirements, delays and costs to employers) has been very limited over the period, meaning that the average level of reform (-0.03) is predicted to have induced only a slightly reduction in the unemployment rate by 0.05 percentage point.

Since aggregate results were different when excluding some countries, I also tested the estimation of sub-components of EPL without Portugal, Greece, Spain and Italy. Interestingly, coefficients of individual dismissals and temporary employment become not statistically significant, such that different level of regulation has no incidence on the unemployment rate. The only remaining effect is coming from collective dismissals which keep a positive and highly statistically significant coefficient. In other words, even after controlling for countries which implemented the largest labour market reforms during the period, reducing protection against collective dismissals still remains beneficial to decrease the unemployment rate[11].

4. Regressions by types of workers

Based on the unemployment rates for different categories of workers, I estimated the impact of PMR and EPL using fixed-effects regression[12]. Workers are distinguished by gender, age and educational attainment. Three categories are considered for the age of individuals: 15-24 years old, 25-49 years old and 50-74 years old. Educational levels are provided by degrees and not by years of schooling to facilitate comparison by country and to avoid the possibility of repeated grades. The categories are based on the International Standard Classification of Education (ISCED). The low educational level corresponds to pre-primary education, primary education and lower secondary education (levels 0-2 of the ISCED). Middle education corresponds to upper secondary education and post-secondary non-tertiary education (levels 3-4). Finally, the high education level corresponds to first and second stages of tertiary education (levels 5-6).

The results show effects in similar directions across types of workers. All estimated regressions provide a negative coefficient for EPL, meaning that deregulation raises the unemployment rate, and a positive coefficient for PMR which implies that deregulation reduces the unemployment rate. The magnitude of the coefficients differs. Analysis by gender shows a larger effect of structural reforms on women: a reduction by one standard deviation of PMR reduces the female unemployment rate by 1.7 percentage points against only 1.5 percentage points for men. In the case of employment protection reforms, a decrease by one standard deviation raises the unemployment rate by 3.3 percentage points for women and 2.8 percentage points for men. Nevertheless, for both structural reforms, coefficients for men and women are not statistically different for men and women.

[11] See annex 3.

[12] Endogeneity tests also show no evidence of reverse causality for different types of workers. As a result, only the fixed-effect estimation is presented in this section.

Table 6: Impact of PMR and EPL on unemployment rate for different type of workers using FE regressions

	Gender		Age			Education		
	Female	**Male**	**15-24 (Y)**	**25-49 (M)**	**50-74 (O)**	**Low**	**Middle**	**High**
Employment Protection	-7.02***	-6.08***	-12.80***	-6.91***	-6.09***	-5.84***	-6.33***	-5.84***
	(1.29)	(1.37)	(2.74)	(1.24)	(0.99)	(1.81)	(1.41)	(0.73)
Product Market Regulation	3.76***	3.26***	4.42**	3.19***	2.54***	5.05***	3.50***	1.32***
	(0.92)	(0.98)	(1.96)	(0.89)	(0.71)	(1.29)	(1.00)	(0.52)
Estimator	FE	FE	FE	FE	FE	FE	FE	FE
Control Variables	yes	yes	yes	yes	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Year fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
Adjusted R^2	0.30	0.40	0.39	0.38	0.41	0.44	0.37	0.44
Number of observations	317	317	317	317	317	314	314	314
|Coeff| EPL statistically different	F=M	M=F	Y>M* and Y>O**	M<Y* and M=O	O<Y** and O=M	L=M and L=H	M=L and M=H	H=L and H=M
|Coeff| PMR statistically different	F=M	M=F	Y=M and Y=O	M=Y and M=O	O=Y and O=M	L=M and L>H***	M=L and M>H*	H<L*** and H<M*

Note: (standard errors), *significant at 90%, ** significant at 95%, ***significant at 99%

Sub-division of workers by age indicates that the impact of deregulation in EPL on the unemployment rate is larger for young workers. Reduction in the strictness of employment protection increases the unemployment rate by 6 percentage points for 15-24 years old workers, against 3.2 percentage points for 25 to 49 years old and 2.8 percentage points for workers older than 50. While young workers are the most affected, coefficients between the two other age categories are not significantly different. Moreover, no statistical differences are observed in terms of product market deregulation.

The three levels of education are equally impacted by reforms in employment protection legislation (the coefficients are not statistically different). Deregulation by one standard deviation pushes the unemployment rate up by 2.7 percentage points on average. The effect of product market reforms does not differ between low- and middle-educated individuals either, but is significantly lower for highly-educated workers. While deregulation in product market reduces the unemployment rate by 2.2 for low-educated workers and by and 1.6 percentage points for middle-educated people, the unemployment rate falls by only 0.6 percentage points for highly-educated workers.

Results on sub-components of regulation for different types of workers provide similar results as the aggregate effect. Moreover, coefficients for all workers and for all sub-components remain of the same sign than the baseline regression with the total unemployment rate. In terms of gender, the magnitude of the effect is equivalent for all types of regulation except for state control for which the effect is greater among men than among women. However, the difference is significant only at 90%. The decomposition by age shows that results on the aggregate EPL index hold only for individual dismissals and not for collective dismissals and temporary employment. For those two types of regulation, results are not statistically different for the three age categories. In terms of PMR, younger workers are slightly more impacted than older workers for state controls and barriers to trade and investment. Finally, the analysis by level of education shows that results for the aggregate index hide some opposing effects. For individual and collective dismissals, middle educated workers are significantly more impacted than highly educated workers. On the other hand, regulation on temporary contracts has a higher effect on low educated workers. Regarding PMR, we see that highly educated workers are significantly less affected by all types of regulation. While on the aggregate index, low and middle educated workers are equally impacted, the effect of barriers to entrepreneurship seems to slightly affect more low than middle educated workers.

Table 7 - Relationship between the absolute values of the coefficients, are they statistically different for different types of workers?

	Gender		Age			Education		
	Female	**Male**	**15-24 (Y)**	**25-49 (M)**	**50-74 (O)**	**Low**	**Middle**	**High**
EPL	F=M	M=F	Y>M* and Y>O**	M<Y* and M=O	O<Y** and O=M	L=M and L=H	M=L and M=H	H=L and H=M
Individual dismissals	F=M	M=F	Y>M*** and Y>O***	M<Y*** and M=O	O<Y*** and O=M	L=M and L=H	M=L and M>H**	H=L and H<M**
Collective dismissals	F=M	M=F	Y=M and Y=O	M=Y and M=O	O=Y and O=M	L=M and L=H	M=L and M>H**	H=L and H<M**
Temporary employment	F=M	M=F	Y=M and Y=O	M=Y and M=O	O=Y and O=M	L>M* and L>H**	M<L* and M=H	H<L** and H=M
PMR	F=M	M=F	Y=M and Y=O	M=Y and M=O	O=Y and O=M	L=M and L>H***	M=L and M>H*	H<L*** and H<M*
State controls	F<M*	M>F*	Y=M and Y>O*	M=Y and M=O	O<Y* and O=M	L=M and L=H	M=L and M>H**	H=L and H<M**
Barriers to entrepreneurship	F=M	M=F	Y=M and Y=O	M=Y and M=O	O=Y and O=M	L>M* and L>H***	M<L* and M>H***	H<L*** and H<M***
Barriers to trade and investment	F=M	M=F	Y=M and Y>O*	M=Y and M=O	O<Y* and O=M	L=M and L=H	M=L and M>H**	H=L and H<M**

Note: *significant at 90%, ** significant at 95%, ***significant at 99%

V. Conclusion

This paper provides a robust estimation of the impact of both product and labour market regulations on unemployment using data for 24 European countries over the period 1998-2013. I contribute to the literature by analysing a longer period of time than previous studies which allows me to control for endogeneity of the regulatory variable and to find significant results. Interestingly, the endogeneity tests contradict the assumption that effects of structural reforms are endogenous to the economic environment. In line with some previous findings, the absence of endogeneity could be explained by the fact that the regression estimates the effect of regulation level in year t on the level of unemployment rate during the same year. Since structural reforms can take time to be implemented, it is reasonable to assume that the unemployment rate does not influence the current level of regulation in product and labour markets.

Controlling for country-fixed effects, endogeneity and various covariates, results show that product market deregulation overall reduces unemployment rate. By implementing the average level of reform that occurred in the period 1998-2013, a country could decrease its unemployment rate (other things being equal) by one percentage point. This finding is robust to all specifications and in line with theoretical predictions. The overall positive effect of product market deregulation can be decomposed into the effect of deregulation regarding State controls, barriers to entrepreneurship and barriers to trade. While a reduction of barriers to entrepreneurship and trade implies a decline in the unemployment rate, the reverse occurs for State controls. The estimations suggest that reducing government involvement in business operations (such as price controls and command and control policies) tends to push up the unemployment rate.

According to the baseline regression, labour market deregulation, proxied by the employment protection legislation index, is detrimental to unemployment: implementing the average level of reform that occurred in the period 1998-2013 would increase the unemployment rate (other things being equal) by 0.4 percentage point. However, contrary to what is observed in product markets, the trend in reducing regulations is less strong in labour markets. Deregulation took place in the very last period of the sample, so that the estimated impact could be a short-run effect of deregulation. To test this hypothesis, I excluded countries which implemented the largest employment protection reform during the last five years from the sample. While the coefficient of product market regulation remains the same, even if slightly lower, the effect of employment protection on the unemployment rate is reversed and statistically significant. In line with recent empirical and theoretical findings, this result shows that deregulating the labour market could be detrimental to unemployment in the short run while a positive impact (i.e. a reduction of the unemployment rate) occurs only in the long run. Analysis by sub-indicators shows that reducing protection against collective dismissals helps in reducing the unemployment rate. Moreover, this finding remains true even after controlling for countries which implemented the largest labour market reforms.

This paper also goes further in the analysis by distinguishing unemployed workers by age, gender and education. For all types of workers, the sign of the coefficients remains the same as for the

aggregate unemployment rate, namely positive for product market regulation and negative for employment protection legislation. The magnitude of the impact differs, however. Younger workers (aged between 15 and 24 years) are more impacted by labour market regulations than workers aged 25 and over. The effect is approximately two times bigger. Analysis by level of education shows a larger effect of product market deregulation on the unemployment rate of low- and middle-educated workers than for highly-educated workers. The effect of employment protection legislation, however, does not differ by educational attainment. Finally, men and women are almost equally impacted by both types of reforms.

Further research can be done. First of all, this paper only considers the impact on the unemployment rate; it does not provide evidence about the effect on the employment or inactivity rates. A reduction in the unemployment rate can result from either a higher employment rate or a higher inactivity rate (when workers leave the labour force). The data do not make it possible to measure flows into and out of employment, and into and out of the labour force. Secondly, another distinction that could be made in addition to the type of regulation and the type of workers is a sectoral analysis. It could also be interesting to evaluate which sectors are most affected by deregulation and see whether these are the sectors that are creating more jobs.

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Annex 1 – Descriptive statistics

	Number of observations	Mean	Standard Deviation	Min	Max	Average variation over the period
Unemployment rate						
Total	384	7.9	4.2	1.8	27.5	
By gender						
Female	384	8.5	4.8	2.2	31.4	
Male	384	7.5	4.2	1.3	25.6	
By age						
15-24 years	384	17.9	9.6	4.3	58.3	
25-49	384	7.1	4.0	1.3	27.8	
50-74	373	5.5	3.2	0.8	20.3	
By level of education						
low education	379	13.7	8.8	2.5	53.3	
middle education	376	7.9	4.7	1.4	31.2	
high education	369	4.4	2.6	1.2	20.4	
Employment Protection Legislation						
Total	344	2.6	0.5	1.6	4.1	-0.06
individual dismissals	344	2.4	0.7	1.0	4.6	-0.08
collective dismissals	344	3.2	0.7	1.6	5.1	-0.03
temporary employment	338	1.7	1.0	0.3	4.8	-0.07
Product Market Regulation						
Total	354	1.8	0.4	0.9	3.2	-0.29
State Control	354	2.6	0.6	1.2	4.2	-0.32
Public ownership	354	3.0	0.8	1.1	5.0	-0.23
Price controls and command and control	359	2.1	0.9	0.9	4.8	-0.41
Barrier to entrepreneurship	354	2.2	0.5	1.1	3.4	-0.36
Regulatory and administrative opacity	354	2.5	0.9	0.4	4.5	-0.44
Administrative burdens on startups	359	2.4	0.7	1.1	4.1	-0.29
Barrier to competition	354	1.6	0.6	0.6	3.0	-0.36
Barrier to trade and investments	359	0.6	0.5	0.1	3.1	-0.18
Barriers to FDI, tariffs and discriminatory procedures	359	0.3	0.3	0.0	1.6	-0.09
Regulatory barriers	359	1.0	0.8	0.2	4.7	-0.27
Control variables						
Net Replacement Rate	352	39.7	14.7	10.9	74.0	
Union density	375	35.1	22.2	6.5	99.1	
GDP gap (%)	382	0.0	1.8	-10.6	9.3	
Inflation	376	2.8	2.3	-1.7	16.3	
Labor productivity growth	384	1.4	2.4	-6.4	11.4	

Annex 2 – Instrumental variable estimations using different lagged values

	Testing PMR endogeneity					Testing EPL endogeneity					Testing PMR and EPL endogeneity				
	lag 1	**lag 2**	**lag 3**	**lag 4**	**lag 5**	**lag 1**	**lag 2**	**lag 3**	**lag 4**	**lag 5**	**lag 1**	**lag 2**	**lag 3**	**lag 4**	**lag 5**
Employment Protection	-6.74***	-6.36***	-6.35***	-6.80***	-7.53***	-6.43***	-5.96**	-6.55**	-7.26**	-8.24**	-7.13***	-6.68**	-7.25**	-8.24**	-9.47**
	(1.90)	(2.06)	(2.18)	(2.30)	(2.46)	(2.38)	(2.57)	(3.18)	(3.43)	(3.56)	(2.61)	(2.75)	(3.31)	(3.63)	(3.73)
Product Market Regulation	4.14***	3.97***	4.25***	4.28***	4.25**	3.14***	3.29***	3.50***	3.10***	2.68**	4.25***	3.89***	4.24***	4.17***	4.44**
	(1.12)	(1.19)	(1.33)	(1.48)	(1.73)	(0.97)	(1.01)	(1.06)	(1.15)	(1.26)	(1.17)	(1.18)	(1.33)	(1.48)	(1.80)
Estimator	IV-FE	IV-FE	IV-FE	IV-FE	IV-FE	IV-FE	IV-FE	IV-FE	IV-FE	IV-FE	IV-FE	IV-FE	IV-FE	IV-FE	IV-FE
Control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
PMR endogeneity	**yes**	**yes**	**yes**	**yes**	**yes**	no	no	no	no	no	**yes**	**yes**	**yes**	**yes**	**yes**
EPL endogeneity	no	no	no	no	no	**yes**	**yes**	**yes**	**yes**	**yes**	**yes**	**yes**	**yes**	**yes**	**yes**
Adjusted R^2	0.39	0.39	0.39	0.40	0.41	0.41	0.44	0.44	0.45	0.46	0.41	0.45	0.44	0.46	0.47
Nb of observations	299	281	263	242	221	298	279	260	238	216	297	277	257	234	211
Weak identification test	80.1	327.2	178.8	99.4	56.3	37.1	137.3	92.0	56.2	40.6	42.6	69.0	44.4	26.1	16.6
Overidentification test	-	0.30	0.24	0.16	0.16	-	0.84	0.18	0.31	0.50	-	0.60	0.27	0.37	0.54
Endogeneity test	0.20	0.19	0.17	0.22	0.34	0.99	0.95	0.31	0.45	0.66	0.33	0.42	0.81	0.96	0.94

Note: (standard errors), *significant at 90%, ** significant at 95%, ***significant at 99%

Annex 3 – Excluding PT, GR, ES and IT as robustness check[13]

	(1)	(2)	(1')	(2')	(1'')	(2'')	(1''')	(2''')
Employment Protection	-6.56***	4.21***			-6.16***	3.35**	-6.21***	2.76*
	(1.30)	(1.59)			(1.23)	(1.49)	(1.24)	(1.56)
1) individual dismissals			-8.52***	-0.70				
			(1.22)	(1.48)				
2) collective dismissals			1.62**	4.65***				
			(0.73)	(0.77)				
3) temporary employment			-1.22***	-0.51				
			(0.35)	(0.55)				
Product Market Regulation	3.45***	2.83***	3.02***	2.82***				
	(0.93)	(0.78)	(0.92)	(0.78)				
1) State Control					-1.74***	-1.54***		
					(0.54)	(0.46)		
a) Public ownership							-0.14	-0.08
							(0.39)	(0.32)
b) Price controls and C&C							-2.20***	-1.63***
							(0.46)	(0.44)
2) Barrier to entrepreneurship					3.91***	3.21***		
					(0.72)	(0.64)		
a) Regulatory and admin opacity							1.43***	1.29***
							(0.29)	(0.24)
b) Administrative burdens on startups							2.24***	1.88***
							(0.56)	(0.58)
c) Barrier to competition							0.48	-0.68
							(0.57)	(0.56)
3) Barrier to trade and investment					1.53***	1.34***		
					(0.47)	(0.39)		
a) Barriers to FDI							1.89*	0.82
							(1.10)	(0.92)
b) Regulatory barriers							0.29	0.71**
							(0.38)	(0.34)
Estimator	FE	FE	FE	FE	FE	FE	FE	FE
Adjusted R^2	0.35	0.28	0.41	0.33	0.43	0.38	0.45	0.42
Nb of observations	317	254	312	249	317	254	317	254

Note: (standard errors), *significant at 90%, ** significant at 95%, ***significant at 99%.

[13] Regressions (1) are baseline regressions, regressions (2) are estimations excluding Portugal, Greece, Spain and Italy.

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