THE ECONOMIC JOURNAL

The Economic Journal, **122** (*February*), F79–F104. Doi: 10.1111/j.1468-0297.2011.02494.x. Published by Blackwell Publishing, 9600 Garsington Road, Oxford OX4 2DQ, UK and 350 Main Street, Malden, MA 02148, USA.

EMPLOYMENT EFFECTS OF PRODUCT AND LABOUR MARKET REFORMS: ARE THERE SYNERGIES?*

Giuseppe Fiori, Giuseppe Nicoletti, Stefano Scarpetta and Fabio Schiantarelli

This article investigates the effect of product market liberalisation on employment allowing for interactions between policies and institutions in product and labour markets. Using panel data for OECD countries over the period 1980–2002, we present evidence that product market deregulation is more effective at the margin when labour market regulation is high. The data also suggest that product market liberalisation may promote employment-enhancing labour market reforms.

Over the past two decades, many OECD countries have sought to promote productivity and long-term growth by improving the efficiency of goods and services markets through liberalisation and privatisation programmes. There is a growing body of evidence suggesting that these programmes have indeed boosted productivity performances in the sectors concerned,[1] but there is less evidence on their impacts on employment. A few recent theoretical and empirical studies suggest that product market deregulation may stimulate aggregate employment, yet firm conclusions are still lacking.[2] In assessing the effect of product market regulatory reforms, it is crucial to take into account that these reforms have been implemented in countries with very different labour market settings. This raises two related questions. First, do the employment gains from product market deregulation depend upon the underlying labour market policies and institutions that shape the bargaining power of workers and, if so, how? Second, do reforms that promote stronger product market competition lead to changes in labour market policies and institutions?

The employment effect of interactions between product and labour market policies is still an open issue.[3] Empirical analyses of interaction effects have typically not been based on predictions of fully specified theoretical models, the estimated employment

* Corresponding author: Giuseppe Fiori, Universidade of São Paulo - FEA Departamento de Economia, Avenida Prof. Luciano Gualberto, 908 - Prédio FEA 2 - CEP 05508-090 Cidade Universitária, São Paulo - SP, Brazil. Email: giuseppefiori@gmail.com.

We thank two referees, Alberto Alesina, Silvia Ardagna, Andrea Bassandni, Tito Boeri, Pierre Cahuc, Daniele Checchi, Alain de Serres, Romain Duval, Francesco Giavazzi, Arthur Lewbel, John Martin, Jan Svejnar, Kathy Terrell, the participants of the NBER Political Economy programme meeting (Cambridge, MA, 4 May 2007), of the IZA - Fondazione Rodolfo De Benedetti Conference on 'Measurement of Labor Market Institutions' (Bonn 4 July 2007) of the 3rd Annual World Bank - IZA Conference on 'Employment and Development' (Rabat, 5–6 May 2008) and participants of seminars at OECD, the European University Institute, University of Bologna, University of Milan, University of Rome 'La Sapienza' and Bank of Italy for useful comments and suggestions. The opinions expressed in the article are those of the authors and do not engage the OECD or its member countries.

[1] See Schiantarelli (2010), Nicoletti and Scarpetta (2006) and Crafts (2006) for a review of the cross-country evidence.

[2] Theoretical models include Blanchard and Giavazzi (2003), Spector (2002), Amable and Gatti (2001), Ebell and Haefke (2009) and Koeniger and Prat (2006).

[3] Interactions between labour market policies have been explored, for instance, by Saint-Paul (2000) and Belot and van Ours (2004). Nickell *et al.* (2005) provide evidence on the effects of labour market policies, shocks and institutions on unemployment. For microevidence on the employment effects of entry regulation, see also Bertrand and Kramarz (2002). For additional macroevidence, see Boeri *et al.* (2000).

or unemployment models have been mostly static and findings have differed across studies. While, for instance, Nicoletti and Scarpetta (2005), Griffith *et al.* (2007) and Amable *et al.* (2007) find that product market deregulation is more effective at the margin in highly regulated labour markets, Berger and Danninger (2006) and Bassanini and Duval (2006) find that product market deregulation is more effective when labour market policies are less restrictive. Robust evidence is still lacking, especially in the context of dynamic econometric models that control for the many observed and unobserved factors that determine employment. Finally, none of the empirical analyses accounts for the fact that policies may be interdependent, for instance because the power of unions to lobby for restrictive labour market policies may change as competitive pressure in product markets increases due to deregulation.

In this article, we address some of the limitations of previous empirical research on the effect of product market liberalisation on employment under different labour market regimes. Our work is related to recent research by Griffith *et al.* (2007), who explore the effects of interactions between product market policies and labour market institutions, such as union density and coverage of collective agreements, on unemployment. Empirically, we investigate the interaction between product market deregulation and both labour market policies and institutions. Our main contribution is to take into account political economy linkages between policies and institutions in product and labour markets, as well as their potential endogeneity to macroeconomic outcomes. We use a dynamic specification of the employment rate equation that includes both country-specific fixed effects and trends. The empirical analysis is based on harmonised panel data for 20 OECD countries over the period 1980–2002. We account for product market reforms by looking at changes in product market regulatory indicators that cover both changes in domestic regulation and in border barriers to investment, while labour market settings are described by standard indicators of policies and institutions.

We illustrate the channels at work based on an extended version of the Blanchard and Giavazzi (2003) model of bargaining in a monopolistic competitive economy which allows for a fuller specification of the fall back position of the union as well as taxation. Treating initially product market regulation and labour market regulation as exogenous and independent from each other, the model suggests that employment gains from product market deregulation are the largest in situations where labour market settings provide strong bargaining power to workers. The basic intuition behind this result is that, with unions' weak bargaining power, real wages will be close to the level that clears the labour market and employment close to its full employment level. In this case, liberalisation measures that lead to a decrease in the markup have the potential to generate only small changes in employment. In contrast, if the unions' bargaining power is high and the economy is far away from full employment, a decline in the markup can lead to large employment responses. We show that this result holds both in the short run and in the long run, and both in efficient bargaining and right-to-manage frameworks. The model can be extended to allow unions to lobby for labour market regulations so as to increase their bargaining power. This captures the idea that product market deregulation, by increasing competition and creating downward pressures on market rents, also reduces incentives for unions to defend high levels of bargaining power through stricter labour market settings. This idea is consistent with a

burgeoning political economy literature that links competition to weakening bargaining power of workers.[4]

Our main empirical result is that product market liberalisation is more effective in stimulating employment where labour markets are rigid. This result holds even when the possible endogeneity of policies and institutions to labour market outcomes is accounted for. Moreover the effects of product market deregulation on employment may become even larger, over time as stronger competitive pressures lead to a decline in the tightness of labour market regulation. In other words, the results suggest that product and labour market reforms can be classified as 'economic substitutes', since employment gains from product market reforms are found to be larger when workers' bargaining power is initially high (as a result of stringent labour market regulations). But, they can be considered as 'political complements' since over time reforms in product markets lead to an easing of labour market policies. Thus, in assessing the long-run employment effects of product market deregulation, one needs to consider both its direct effect and the indirect effect stemming from the induced changes in labour market policies.

The structure of the article is as follows. In Section 1, we illustrate the channels explored in the empirical analysis with our extended version of the Blanchard and Giavazzi (2003) model. In Section 2, we discuss the data used in the empirical analysis. In Section 3, we outline our empirical strategy. Section 4 presents our empirical results for employment, with particular emphasis on the importance of taking into account inter linkages between product and labour market policies and their potential endogeneity to labour market outcomes. In Section 5, we illustrate the economic significance of our estimates. Section 6 concludes the article.

1. A Simple Bargaining Model with Interactions Between Product and Labour Markets

In this Section, we highlight the channels explored in the subsequent empirical analysis by presenting a simple bargaining model that allows one to assess the effects of product market liberalisation on employment, while also considering possible interactions between product and labour market regulation. The model is based on the efficient bargaining setting under monopolistic competition proposed by Blanchard and Giavazzi (2003) (BG thereafter), which we extend to allow for a richer specification of the fall back position of the union and taxation. The first question the model addresses is whether, for independently and exogenously set policies, a deregulation of the product market has more beneficial employment effects when the labour market is heavily or lightly regulated. The punch line is that product market deregulation is more effective, both in the short run and in the long run, when the labour market is more tightly regulated. Although the model is very simple and it is used here mostly as an expositional device, its conclusions are shared by more complex calibrated models based on individual bargaining with search and matching frictions (Ebell and Haefke,

[4] Ebell and Haefke (2006) develop a model in which greater product market competition induces a shift from collective to individual bargaining. In Boulhol (2006), trade and investment liberalisation generates pressures on social partners to lift labour market regulations that enhance workers' bargaining power (such as restrictive employment protection legislation).

2009; Cacciatore and Fiori, 2010). The second question is whether product market deregulation may actually lead to labour market deregulation. The model can be tweaked to address this issue, but in a very reduced form way. Even then the predictions are not as tight and tend to depend upon the specification of the unions' objective function.

1.1. *Efficient Bargaining Model*[5]

Assume that employment and the wage are determined by solving a cooperative Nash Bargain between unions and imperfectly competitive firms. Denoting by V_i the union's utility function and by Π_i the firm's profits, the efficient bargain solution is obtained by maximising the generalised Nash maximand, $\beta \ln(V_i - \bar{V}_i) + (1 - \beta) \ln \Pi_i$, with respect to both the wage and employment, where β captures the workers' bargaining power as resulting from both labour market policies (e.g. those that reduce the pressure of outsiders on incumbent workers) and institutional characteristics of the labour market such as union density (the proportion of workers who are union members) and coverage rate (the share of workers covered by bargaining agreements). Obviously V_i is equal to the sum of the income of employed workers, L_i, who earn a wage equal to W_i/P and the income of union members not employed by the firm, whose expected income is W_i^A/P. $\bar{V}_i$ represents total income expected by the union if a bargaining agreement is not struck with the firm and equals W_i^A/P times union membership, N. In defining W_i^A/P, we will assume that the alternatives to employment with the present firm are either unemployment benefits, public employment or a job with another firm. Unemployment benefits are not taxed and public employment is assumed to be fixed exogenously. For simplicity, we assume that the private and public wage are identical. Firm i uses one unit of labour, L_i, to produce one unit of output, Y_i. Each firm faces a downward sloping demand function $(Y_i/Y) = (P_i/P)^{-\sigma}$, where Y is total output. $\sigma = \bar{\sigma} g(m)$, with $g' > 0$. σ captures the elasticity of substitution among goods, $\bar{\sigma}$ is a constant, and m denotes the number of firms. The markup over marginal costs, μ, equals $[\sigma/(\sigma - 1)]$. We will assume that the markup is affected by product market policies, such as legal constraints to entry or to rivalry among firms. Labour income is subject to an income tax rate of τ^L, while employers are subject to a payroll tax of τ^p. Finally, to close the model, we will assume that the government budget is kept in balance (and there is no public spending on goods).

In the efficient bargain, at an optimum, relative output prices, P_i/P, and the real wage, W_i/P, are proportional to the alternative wage, with constants of proportionality equal to $(1 + \mu)(1 + \tau^p)$ and $(1 + \mu\beta)$, respectively. In the symmetric short-run equilibrium $[(P_i/P) = 1, (W_i/P) = (W^o/P) = (W/P)$, fixed number of firms], the alternative wage and the real wage are:

$$\frac{W^A}{P} = \frac{1}{(1 + \mu)(1 + \tau^p)} \tag{1}$$

and

[5] More details on the results and derivations can be found in the Online Appendix and in Fiori *et al.* (2007).

$$\frac{W}{P} = \frac{(1+\mu\beta)}{(1+\mu)(1+\tau^{p})}. \tag{2}$$

Using the definition of the alternative wage, the assumption that private and government wages are equal, and the balanced budget condition, in general equilibrium, when wages are equal across union-firm pairs, we can obtain an upward sloping relationship between the alternative wage and the employment rate[6]:

$$\frac{W^{A}}{P} = \frac{(1+\mu\beta)}{(1+\mu)(1-\tau^{l})}\, l, \tag{3}$$

where $l = (L/N)$ is the employment rate. Its short-run equilibrium value is obtained by solving (1) and (3) for l:

$$l = \frac{1}{(1+\mu\beta)[(1+\tau^{p})/(1-\tau^{L})]}. \tag{4}$$

As in BG, a decrease in the markup, due, for instance, to an increase of substitutability among products, captured by an increase in $\bar{\sigma}$, or to an exogenous increase in the number of firms m, leads to an increase in employment. The increased substitutability could be for instance the result of measures that lower border barriers, thereby facilitating the entry of foreign products into the domestic market. An increase in the number of firms, may be due to a policy-induced decrease in entry barriers, which will be analysed more fully below. Employment is also adversely affected by workers' strong bargaining power and by payroll or income taxes.

What is of particular interest is the interaction between product and labour market regulation, captured by μ and β, respectively, assuming that they are set independently from one another. The sign of the interaction is determined by the sign of the cross derivative of the employment rate with respect to β and μ, which is negative, provided $\beta < (1/\mu)$, which is the case for any realistic value of μ. As a result, a reduction in the markup has greater positive effects on employment when the labour market is more regulated and workers have greater bargaining power. Some authors define product and labour market deregulation in this case as economic substitutes. When, instead, the cross derivative is positive and it pays more in terms of employment to reduce the markup when workers bargaining power is low, then product and labour market deregulation are classified as complements.

The basic intuition behind this result is that unions' weak bargaining power will be associated with low real wages and employment close to the full employment level. In this case, product market deregulation measures that lead to a decrease in the markup have the potential to generate only small changes in employment. By contrast, if the unions' bargaining power is high and the economy is nowhere near full employment, a reduction in the markup can lead, instead, to large employment responses. Note, instead, that in this model, the cross derivatives between μ and taxes, or between β and

[6] Note that, contrary to BG, employment depends on β also in the short-run equilibrium due to the specification of the fall back position of the union. This results holds even if we do not make use of the balance budget condition. The latter allows us to eliminate public employment and unemployment benefits from the solution.

taxes, are positive. This means that the positive employment effects of deregulating the product or labour market are greater when taxes are low.

The qualitative results concerning the effect of product and labour market deregulation and their interaction also hold in the long run. In the steady-state equilibrium, the number of firms in the markets and hence the markup will be determined by the condition that profits must be equal to (annualised) entry costs, c, assumed to be a fraction of output. Using this condition, we can show that the markup is $\mu = c/(1-\beta-c)$. This, together with the equations defining the optimal value of employment and the real wage, (2) and (4), implies that the long-run equilibrium levels of employment and wages are:

$$l = \frac{(1-\beta-c)(1-\tau^L)}{(1-\beta-c+c\beta)(1+\tau^p)} \tag{5}$$

and

$$\frac{W}{P} = \frac{(1-c)}{(1+\tau^p)}. \tag{6}$$

A decrease of entry costs, c, union power, β, or taxes will all have a positive employment effect. The cross derivative with respect to β and c is negative (provided again that $\beta < (1/\mu)$). This implies that a reduction in entry barriers is more effective both in the short and long run in highly regulated labour markets where union power is strong.

1.2. *Robustness and Endogenising Bargaining Power*

Is the result on the interaction between product and labour market regulation robust to departures from the efficient bargaining regime we have assumed so far? The answer is, by and large, yes. For instance, it is easy to show that the short-run solution for the employment rate of a right-to-manage model, in which firms and unions first bargain about the wage and then employment is chosen by the firm along its labour demand curve, coincides with the one for the efficient bargaining model in the short run. Hence all the conclusions reached before about the short-run first and cross derivatives still hold.[7] In the long run, the solutions differ but it remains true that the effect of a decrease in the markup is greater when unions have greater bargaining power.

Assume now that firms and unions cannot commit to a wage and the wage is subject to renegotiation and, therefore, is set simultaneously with employment. Continue to assume that unions and firms bargain about the wage and that firms choose employment by maximising profit, but taking into account the effect of employment on the wage. One then can show that the results are the same as those in the Efficient Bargain model. So for this bargaining structure our basic conclusions also still hold.[8]

Interestingly, our general conclusion also holds when we assume that the bargain is between an individual worker and the firm and this bargaining structure is embedded in calibrated models with search and matching frictions, as in Ebell and Haefke (2009) and Cacciatore and Fiori (2010). Ebell and Haefke focus on the steady-state solution

[7] In a related paper, Griffith *et al.* (2007) show that a decrease in the markup will increase employment more in a model with a monopoly union, compared with a model with a competitive labour market.

[8] We are grateful to a referee for pointing this out.

and consider the interaction between bargaining power and a lowering of entry barriers. Cacciatore and Fiori consider the interaction with both bargaining power and the size of firing costs as well as the transitional dynamics. In both cases lower entry barriers are more effective when the labour market is more regulated (higher bargaining power, more generous unemployment benefits or greater firing costs).

We now ask the question whether product market deregulation may lead to labour market deregulation. BG suggest that product market deregulation, by decreasing total rents, leads to a decrease in unions' incentives for fighting to capture those rents and makes them more willing to accept labour market deregulation. When this is the case, product and labour market regulation are classified as political economy complements.

It goes beyond the objective of this article to develop a full political economy model of how labour market regulation is determined. For a fuller analysis of lobbying for trade protection and labour market policies, see Rama and Tabellini (1998). As a way to formalise the intuition, BG endogenise β by assuming that it is the solution to the union's problem of maximising the labour income share (equal to the wage in the model), net of lobbying costs, that are assumed to be quadratic in β and have the form $(a/2)\beta^2$. When the labour income share is calculated at the values resulting from the efficient bargaining process, as described in the previous subsection, BG show that product market deregulation that lowers mark-ups will also lead to a decrease in unions' bargaining power in the short run. This still holds true in our extended version of their model. However, one can easily show that there is no effect of product market regulation in the long run. If we modify their set up by assuming that the objective function of the lobby (union federation, political party) representing the unions in the first stage of the game is the union's utility in excess of the fall back position, minus quadratic lobbying costs, then product market deregulation lowers β both in the short run and in the long run (the latter result holds if the union is not 'too powerful'), for further details, see Fiori *et al.* (2007). However, maximising the surplus, taking the outside option as given, is probably not as reasonable an option for the union federation as maximising the income share going to workers. Ultimately, whether product market deregulation induces labour market deregulation or not is an empirical issue.

2. Data

The empirical analysis is based on harmonised annual data for a sample of 20 OECD countries over the period 1980–2002. The countries are Australia, Austria, Belgium, Denmark, Germany, Greece, Finland, France, Italy, Japan, Ireland, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the UK and the US. We relate the employment rate (the share of the working-age population that is employed) to policies and institutions that are likely to affect firms' market power (the markup in our model) and workers' bargaining power. The description of the key variables is provided below.[9]

[9] Further details on data sources and definitions of all the variables are in Fiori *et al.* (2007) and in the Online Appendix to the article.

2.1. *Employment Rates*

The dependent variable in our equations is the non-agricultural business employment rate, *ERB*. Focusing on the employment rate instead of unemployment has the advantage of taking into account the effects of policies on both unemployment and participation, and sidesteps the statistical issues that may affect cross-country comparability of unemployment rates. We focus on employment in the business sector because it is the component of employment most directly influenced by labour and product market policies and institutions. The determinants of public sector employment are largely of a different nature. However, we control for the share of public employees in the working-age population (*ERG*) to allow for the fact that the latter may crowd out business sector employment.

2.2. *Product Market Regulation*

We use time-series data on product market policies that restrict competition to measure market liberalisation in the OECD countries. To have the broadest possible coverage of the main regulations affecting the business sector, the data concern both domestic regulations in several non-manufacturing sectors and border barriers in both these sectors and manufacturing ones, where restrictions to competition in the countries covered in our sample largely come from barriers to foreign direct investment. For domestic regulations (*REG*), we draw on Conway and Nicoletti (2006) who provide indicators over the 1975–2003 period for the following non-manufacturing industries: gas, electricity, post, telecommunications, air transport, rail transport and road freight.[10] We focus on two of the areas covered by their indicators that are most likely to affect markups: legal barriers restricting access to markets and other barriers to entry related to market or industry structure (e.g. market dominance and vertical integration in network industries). We supplement this information on domestic regulations with the indicator of FDI restrictions provided by Golub (2003) and Golub and Koyama (2006). This indicator covers limitations on foreign ownership, restrictive screening and notification procedures and operational restrictions for foreign affiliates in the manufacturing sector and eight non-manufacturing industries (including energy, transport, communication, banking, distributive trades, business services and banking) over the 1980–2006 period. Indicators of both domestic and border barriers to competition are based on detailed information on laws, rules, and market and industry settings. In each period and area, country-industry observations are scored along a cardinal scale from least to most restrictive and overall indicators of domestic and border regulations are obtained by averaging across both areas and industries.[11] The resulting indicators suggest substantial cross-country differences in the average level of regulation and a generalised trend towards deregulation that differs in timing and intensity across countries. To account for anti-competitive regulations that broadly

[10] Nicoletti and Scarpetta (2003) and Alesina *et al.* (2005) used an earlier version of these indicators to estimate the effects of anti-competitive regulation on productivity and investment, respectively.

[11] The aggregate indicator of domestic regulations is obtained by simple averaging, whereas the aggregate indicator of FDI is an average of the indicators for the various industries weighted by a combination of industry shares in trade and FDI flows (Golub, 2003).

cover the entire business sector, in the empirical analysis we use a summary indicator, *REGfdi*, obtained as the first principal component of REG and of the aggregate indicator of FDI restrictions (both standardised). As the first principal component of two standardised variables gives equal weight to each of them, it is proportional to their arithmetic average. More details about construction of the indicator and trends and patterns of regulation can be found in Conway and Nicoletti (2006) and the working paper version of this article (Fiori *et al.*, 2007).

It should be noted that, even though barriers to foreign investment in the manufacturing sector are covered, our measures of restrictive (border and behind-the-border) product market policies are more detailed for non-manufacturing industries. Unfortunately, little time-series information is currently available on domestic policy restrictions affecting the manufacturing industries and, given our focus on political economy linkages between different sets of policies, we have refrained from using business surveys that are necessarily subjective and context-specific.[12] This may not necessarily be a serious empirical problem, however. In the OECD countries covered by our regressions, the non-manufacturing industries account for a large and increasing share of aggregate employment. Moreover, anti-competitive regulations are usually concentrated in these sectors. Finally, deregulation in these sectors can have important consequences for the structure of costs in manufacturing, given the input–output linkages. The strong time-series variation in our measures of regulation provides a source of identification for the effects of product market regulation on employment that has often been lacking in previous studies.

2.3. *Employment Protection Legislation and Unemployment Benefits*

To gauge the effects of labour market policy and institutional settings on workers' bargaining power, we focus on employment protection and the generosity of the unemployment benefit system. The indicator of employment protection (EPL) covers regulations affecting workers on both permanent and temporary contracts – notably procedural inconveniences that employers face when trying to dismiss a worker; notice and severance payments at different job tenures, prevailing standards of and penalties for 'unfair' dismissals as well as 'objective' reasons under which temporary contracts can be offered, the maximum number of successive renewals and the maximum cumulated duration of the contract. This information was collected and coded for the late 1980s, the late 1990s and 2003 by OECD (2004), which also provides details on sources and methodologies. The *EPL* indicator used in the econometric analysis below is time varying, with the shifts in regulations over the sample period identified on the basis of information about the timing of major *EPL* reforms (concerning both temporary and regular workers). To capture the generosity of the unemployment insurance system, we use the gross replacement rate, *BEN*, which is an average of the fraction of previous wages replaced by unemployment benefits over unemployment durations up to five years for three family types and two earnings levels.

[12] Detailed information on economy-wide regulations is provided by Wölfl *et al.* (2009) but only for the 1998, 2003 and 2007 periods. Griffith *et al.* (2007) have used information on the implementation of the Single Market Programme, which however is available for only seven EU countries and over a relatively short period of time.

Employment protection and the benefit system can increase the power of the union in the bargaining process. In particular, *EPL* tends to insulate incumbent workers from labour market pressures and raise labour adjustment costs, thereby making it harder for employers to adapt the workforce to the evolution of demand. The unemployment benefit replacement rate affects the cost of being unemployed and, therefore, the workers' fall back position. In particular, while, on the one hand, income support for the unemployed can facilitate job search and improve job matching, on the other hand, it raises the reservation wage and it is also likely to increase the bargaining power of incumbent workers. These policies have often been seen as substitutes, with stronger employment protection partially compensating for weak income support for job-seekers and *vice versa*. For example, Buti *et al.* (1998) suggest that protecting jobs – through *EPL* – may act as a substitute for protecting workers after the dismissal by supporting their job search with unemployment insurance benefits. Under this hypothesis, countries might opt for either generous unemployment benefits with lax *EPL* or the reverse.[13] Indeed, across the OECD area – and in particular within Europe – there is a negative relationship between the stringency of *EPL* and the generosity of *BEN*. Empirically, the trade-off between these two policies has been recently documented by Neugart (2007) and Boeri *et al.* (2006). Hence, one way to capture the overall labour market protection/stringency is to consider the particular combination of the two policies adopted by each country, summarising them into a single indicator. This is the choice we adopt in some specifications where we combine *EPL* and *BEN* into a single measure of labour market regulation, *LMRP*, by taking their first principal component. Otherwise, we estimate the separate effects of the two policies, in which case one emphasises the fact that they operate in a different manner.

2.4. *Taxes on Labour Use*

The tax wedge (*WEDGE*) is expressed as the ratio of total taxes and social security contributions to total labour costs (wage plus employers' social security contributions) based on revenue data from National Accounts. It includes, in addition to income taxes and employer's and employee's social security contributions, and also indirect taxes. This tax indicator captures the average tax burden on labour use but is likely to be susceptible to endogeneity problems due, among other things, to the progressivity of the tax system that may induce a spurious positive correlation between shocks to employment and the tax wedge, even controlling for the output gap. To tackle at least partially the endogeneity problem, we use its lagged value in the empirical analysis.

2.5. *Unions' Power and Bargaining Regimes*

There are different indicators available to capture unions' power in the bargaining process. First, union density, the proportion of workers who are members of the unions, provides a *prima facie* indication of the strength of unions. However, in countries where there is an administrative extension of collective agreements (e.g. many

[13] Boeri *et al.* (2003, 2006) document and formalise this policy interaction in a political economy context.

Continental European countries), it is a poor proxy for bargaining power insofar as even unions with low membership can exert a strong influence on wage settings (OECD, 2004). The second indicator is the share of workers covered by wage agreements (*UNCOV*), which is the variable we have included in our regressions. We think this is a better choice than union density alone, which may be a partial proxy for the bargaining power of the unions. For example, union density in France is 11%, the same as in the US, but coverage is much higher (around 80%). In some regressions, we account for both these dimensions of union power by constructing a variable that combines union density and coverage, *UDCO*, via principal components analysis (again, the resulting aggregate indicator is proportional to their arithmetic average).[14]

2.6. *Other Control Variables*

Throughout our regressions we control for the effect of cyclical fluctuations on the employment rate through an output gap variable (*GAP*) that measures the gap between actual and potential output (as a percentage of potential output). As explained below, in some regressions, we also control for trends in multifactor productivity, which is proxied by a standard index based on a Cobb–Douglas production function based on OECD data on business employment and capital stocks. Multifactor productivity trends are obtained by means of a Hodrick–Prescott filter.

3. Econometric Strategy

The model described in Section 1 highlighted three main channels linking policies to employment. First, product and labour market regulations, by curbing competition among firms and strengthening workers' bargaining power have a negative effect on equilibrium employment. Second, reforms in these markets are economic substitutes, in the sense that product market deregulation has a larger effect on employment when the labour market is highly regulated. Third, if product market competition influences workers' bargaining power (through its effects on labour market policies or institutions), regulations in the two markets can be seen as political complements, as product market deregulation can lead to labour market deregulation. In this Section, we lay out our econometric strategy for exploring these channels.

To relate our results to the previous literature in this area better, we proceed in stages. First, we estimate the employment effects of product and labour market interactions under the usual assumption that product and labour market policies are exogenously and independently set. We then explore the determinants of product and labour market regulations and tackle the potentially important issue of their endogeneity in the employment equation, using a control function approach. While important for ensuring the validity of the empirical results, endogeneity issues are generally not

[14] In the working paper version of this article (Fiori *et al.*, 2007), we also consider variables that capture the degree of corporatism in the wage bargaining regime as in Griffith *et al.* (2007) and consistent with an extensive literature (Nickell *et al.*, 2005). However, they are never significant at conventional levels and, therefore, we omit them from the specifications presented in this article. Note that, since we include country-specific effects, the corporatism variables are only identified by their time variation.

dealt with in the empirical literature on the impact of product an labour market deregulation – and their interactions – on employment.[15]

Most of the previous empirical work on the interaction between product and labour market regulation has typically relied on static model specifications for employment (unemployment). In principle, static regressions may be thought to capture a cointegrating relationship between the employment (unemployment) rate and the explanatory variables. However, this interpretation is questionable in our context. For instance, using the Levin *et al.* (2002) test for unit roots in panels, we can reject the unit root hypothesis for the business employment rate at the 5% level. Moreover, many of the variables representing product and labour market regulation are unlikely to be well described by unit roots. These variables often display regime changes and could be erroneously interpreted as unit root processes. Instead, we use a dynamic specification that includes lagged employment, since it is likely that the short-run and long-run effects of regulation differ. Therefore, our estimates are based on the following autoregressive model for the business (non-agricultural) employment rate in a panel of OECD countries (indexed by i) over the periods 1980–2002 (indexed by t):

$$\begin{aligned} ERB_{i,t} = {} & \alpha ERB_{i,t-1} + \beta REGfdi_{i,t} + \boldsymbol{\gamma}'\mathbf{LMR}_{i,t} + \boldsymbol{\delta}'\mathbf{REGfdi}_{i,t}\mathbf{LMR}_{i,t} \\ & + \theta' ERB_{i,t-1}\mathbf{LMR}_{i,t} + \boldsymbol{\phi}'\mathbf{Z}_{i,t} + DC_i + DT_t + \psi_i Trend_{i,t} + \epsilon_{i,t}, \\ \epsilon_{i,t} = {} & \rho_i \epsilon_{i,t-1} + \xi_{i,t}, \end{aligned} \tag{7}$$

where $REGfdi_{i,t}$ denotes our measure of product market regulation, $\mathbf{LMR}_{i,t}$ is a (column) vector of various measures of labour market regulations or institutions and $\mathbf{Z}_{i,t}$ is a set of control variables. The focus of the article is to assess the sign and significance of the coefficients of the interactions between product and labour market regulations or institutions, contained in the (row) vector $\boldsymbol{\delta}'$. Note that we also allow the degree of persistence to depend upon labour market regulation to capture the idea that more rigidly regulated labour markets may lead to greater persistence in employment.

As already mentioned, in our basic specification, product market regulation covers both domestic restrictions to competition and restrictions on foreign direct investment in a large number of business sectors.[16] We measure labour market regulation and policy by employment protection, *EPL*, and the unemployment benefits replacement rate, *BEN*, which in some specifications we also aggregate into their first principal component (denoted by *LMRP* in the Tables).[17] To account for labour market institutions, we either use the principal component of union density and union bargaining coverage, *UDCO*, or just the latter, *UNCOV*, because as explained above union density is *per se* not a good proxy for bargaining power.

[15] The endogeneity of unionisation in unemployment equations has been addressed in Checchi and Nunziata (2006).

[16] Results obtained using other measures of regulation (that focus more narrowly on barriers to entry, vertical integration and public ownership in electricity, transport and communication) are very similar and are not reported here, see Fiori *et al.*, (2007) for further details.

[17] With a balanced budget, the effect of benefits on the fall back position should be captured by the tax rate. In reality, however, government budgets are often not balanced and the generosity of the unemployment benefit system may affect the bargaining power of insiders directly.

In all regressions, we control for business cycle fluctuations captured by the deviation of actual output from potential output, *GAP*. We also include taxation on labour income, *WEDGE*, captured by the tax wedge described above, which is based on tax revenue data. We also include in the regression public employment and control for its likely endogeneity by using a lagged moving average of it at $t-1$ and $t-2$, *ERGM*. Public employment may crowd out business employment to the extent that it improves the fall back position for the union. A negative effect on private employment may also reflect the fact that public employment produces services that are close substitute for private activities. However, public employment may also increase the productivity of private employment, with favourable consequences for the latter.

The model is estimated by feasible GLS, allowing for the variance to differ across countries and for an AR(1) structure in the error term with country-specific autocorrelation coefficients, ρ_i.[18] Test results reject the equality of variance at the 1% level across countries and the absence of serial correlation in all specifications. All employment regressions include country dummies, DC_i, year dummies, DT_t and country-specific time trends $Trend_{i,t}$.[19] As in Nickell *et al.* (2005), the inclusion of these latter variables is to ensure that the estimated coefficients on the policy and institution variables are not distorted by omitted trended variables in each country or common shocks. In particular, the country-specific trends capture country-level, low frequency movements in the structure of the labour force, such as changes in participation or demographics. Moreover, they may capture, potentially non-neutral, technological progress, since the industrial composition varies across countries and the rate of technological progress is likely to be industry specific. Finally, these trends also capture any non-neutrality due to the failure of wages to promptly adjust to productivity changes (e.g. due to adjustment costs, information asymmetries or adaptive expectations). From a statistical point of view, absence of country-specific trends is always rejected at very high levels of significance. For this reason, in the empirical analysis of the next Section, we present regressions with country-specific trends. We also present some specifications in which we replace the country-specific time trends with an H–P filtered measure of multifactor productivity and allow its coefficient to be country specific.

To account for political economy linkages between product market and labour market policies and institutions, we first run Granger causality tests, controlling for other potential political economy determinants of changes in policies and institutions in the two markets. We then use the results of these first-stage regressions to deal with the potential endogeneity of our policy and institutional variables to labour market outcomes. More specifically, if the error term in the employment equation is uncorrelated with those in the equations generating the policy variables, then there are no endogeneity problems coming from this source. However, if the correlation is

[18] Note that the serially correlated nature of the residuals does not generate problems with the inclusion of the lagged dependent variable, since the model is transformed into a more complex dynamic equation with a white noise error term and common factor restrictions due to the original AR(1) error structure. We iterate until convergence.

[19] We also consider two additional country dummies for Germany post-reunification (1991–2002) and for Finland after the collapse of the Soviet Union (1991–2002). The main conclusions, however, do not hinge on the inclusion of these dummies.

non-zero, then the estimates of the employment effects of product and labour market policies and of labour market institutions obtained by GLS are, in principle, inconsistent. A test of endogeneity can be obtained using the control function approach of Rivers and Vuong (1988) and it is implemented by introducing the estimated errors from the first stage equations in the employment equation. The test of joint significance of the terms containing the errors is a test of endogeneity. Moreover, in the presence of endogeneity, the estimated coefficients on the variables of interest obtained by adding the first stage errors are consistent, although their standard errors are incorrect due to the generated regressor problem. We address this issue as well and implement the necessary correction based on Murphy and Topel (1985).

4. Empirical Evidence on Policy Interactions

4.1. *Exogenous Policies*

Estimation results obtained by using Feasible GLS under the hypothesis of policy exogeneity are reported in Table 1. We show estimates using both our summary measure of labour market policies (*LMRP*) and its separate components (*EPL* and *BEN*). The first four columns present the results of specifications with country-specific time trends, while the last two present specifications in which these are replaced by trend multifactor productivity (with a country-specific coefficient) as a robustness test.

The direct effect of product market regulation on employment is always negative and significant at the 1% level. This echoes previous results by Boeri *et al.* (2000), Nicoletti and Scarpetta (2005), Messina (2006), Bassanini and Duval (2006) and Griffith *et al.* (2007). Thus, high levels of regulation are associated, on average, with lower employment rates. Moreover, there is evidence of strong negative effects of some labour market policies on employment. It is also worth noting that the lagged employment variable is always highly significant, with a coefficient of around 0.5–0.6, pointing to a strong persistence of employment over time. Consistent with earlier results (Scarpetta, 1996; Nickell *et al.*, 2005), the persistence significantly increases with the stringency of labour market regulation. Finally, the output gap is a very important explanatory variable in all specifications, pointing to strong cyclical effects on employment.

Given the focus of this article, the most relevant result is that the coefficient of the interaction between our proxy for product market regulation *REGfdi* and labour market policies, *LMRP*, is negative and statistically significant in all specifications. This provides *prima facie* evidence that, consistent with the channels highlighted in our model, deregulating the product market is more effective at the margin when the labour market is overall more regulated. In this sense, product and labour market deregulation can be seen as economic substitutes, which implies that in situations where labour market regulation is stringent and difficult to reform politically, deregulating the product market may be the best way to promote higher employment at the margin.[20]

[20] Note that the result on the sign and significance of the interaction term is robust to using the employment rate for prime age men and women (25–54) as the dependent variable (Fiori *et al.*, 2007).

Table 1

Employment Rate (ERB) and the Interactions Between Product and Labour Market Policies and Institutions

	(1)	(2)	(3)	(4)	(5)	(6)
	ERB	*ERB*	*ERB*	*ERB*	*ERB*	*ERB*
REGfdi	−0.331***	−0.301***	−0.344***	−0.314***	−0.379***	−0.382***
	(3.203)	(2.845)	(3.298)	(2.861)	(3.663)	(3.347)
LMRP	−3.000***		−3.076***		−3.159***	
	(4.658)		(4.758)		(4.941)	
UDCO	−1.455***		−1.461***		−1.533***	
	(4.576)		(4.643)		(4.896)	
REGfdi × *LMRP*	−0.219**		−0.241***		−0.204**	
	(2.477)		(2.632)		(2.295)	
REGfdi × *UDCO*			0.010		0.001	
			(0.136)		(0.013)	
EPL		−2.552***		−2.571***		−3.052***
		(4.098)		(3.939)		(4.735)
BEN		−0.013		−0.016		−0.013
		(0.228)		(0.283)		(0.241)
UNCOV		−0.050**		−0.051**		−0.059***
		(2.354)		(2.412)		(2.786)
REGfdi × *EPL*		0.120		0.107		0.051
		(1.202)		(0.946)		(0.515)
REGfdi × *BEN*		−0.010*		−0.010*		−0.008
		(1.856)		(1.865)		(1.551)
REGfdi × *UNCOV*				0.001		0.001
				(0.120)		(0.269)
ERB (−1)	0.628***	0.498***	0.626***	0.496***	0.633***	0.485***
	(32.642)	(9.954)	(31.643)	(9.741)	(32.151)	(9.836)
ERB (−1) × *LMRP*	0.074***		0.075***		0.077***	
	(5.478)		(5.614)		(5.777)	
ERB (−1) × *EPL*		0.064***		0.064***		0.072***
		(5.017)		(4.917)		(5.554)
WEDGE (−1)	−0.052***	−0.047**	−0.055***	−0.047**	−0.048**	−0.043**
	(2.700)	(2.370)	(2.813)	(2.367)	(2.433)	(2.137)
EGRM	−0.088	−0.235***	−0.084	−0.230***	−0.106	−0.253***
	(1.078)	(3.076)	(0.995)	(2.849)	(1.195)	(2.976)
GAP	0.308***	0.305***	0.309***	0.306***	0.306***	0.300***
	(22.026)	(21.511)	(22.075)	(21.442)	(21.944)	(21.216)
No. obs.	440	440	440	440	440	440

Notes. *p < 0.10, **p < 0.05, ***p < 0.01, where p is the marginal probability level; t-statistics in parentheses. Estimation method: feasible GLS with heteroscedasticity and AR(1) errors with country-specific rho. All the equations include country-specific constants, year-effects and country-specific time trends (columns 1–4) or proxies using HP-filtered productivity trend (columns 5–6). Sample period is 1980–2002.

As already mentioned, *EPL* and *BEN* could be considered as alternative ways of protecting workers against dismissal. Given this trade-off, it is useful to consider them jointly in regression analysis, as we do when we use *LMRP* as a summary measure of labour market regulation. However, to explore this issue further, in Table 1, we also allow *BEN* and *EPL* to enter as independent regressors in the employment equation and include separate interactions between each one of them and both the lagged dependent variable and product market regulation. As expected, higher *EPL* increases

the persistence of the employment rate.[21] *EPL* also has a negative and significant effect on the employment rate. The coefficient of *BEN* is not significant. The interaction between REG and *EPL* is not significant while the one with *BEN* is negative and significant, although in these regressions in which policy endogeneity is not accounted for the interaction loses statistical significance when we replace country-specific time trends with the trend productivity. We will show below that the interaction remains significant once controls for endogeneity are introduced.

The general message that product and labour market regulations are substitutes, therefore, remains, although it appears that the negative interaction between the various measures of product market regulation and *LMRP* is mostly driven by the interaction with our measure of the unemployment benefit replacement rate. A possible explanation is that the generosity of unemployment benefits not only increases the workers' reservation wage but, by doing that, it also increases their bargaining power.

Turning to institutions, the impact of our summary measure of union strength, *UDCO*, on the employment rate is consistently negative and significant across specifications. As a robustness test, we also consider only its component capturing the coverage of collective agreements *UNCOV* (as explained above, considering only union density is undesirable because this indicator is not a reliable measure of bargaining power). The results confirm the negative and statistically significant effect on employment. Perhaps surprisingly, however, when we consider the additional interaction between *REGfdi* and either *UDCO* or *UNCOV* we do not find any significant effect, and these results do not change even if we exclude the interaction between product and labour market policies.[22]

There is also strong evidence in the data of a negative effect of the tax wedge on labour use on employment.[23] The theoretical model discussed earlier in this article also suggests that there should be interactions between the tax wedge and measures of market and bargaining power. However, the estimated interactions of our measure of the tax wedge and *REGfdi* and *LMRP* were found to be individually or jointly insignificant, and therefore were omitted from Table 1. Thus, the data do not support this particular channel of interaction highlighted in the model.

It should be stressed that if the country-specific time trends are omitted a number of results change. While the estimated coefficients of *REGfdi* and *LMRP* remain negatively signed, the former loses significance. Moreover, the coefficient of the interaction between product and labour market regulation becomes positive, albeit not always significant. Therefore, the omission of country-specific trends blurs the substitutability between product market regulation and labour market settings. As already discussed, this is in line with prior reasoning which points to potentially serious mis-specification

[21] We have also interacted the lagged dependent variable with *BEN* but the interaction is always insignificant, and therefore it has been set equal to zero.

[22] Griffith *et al.* (2007) find that (in the context of a static model with country and year-effects but no country-specific trends) a decrease in profitability caused by product market deregulation has a more favourable effect on unemployment when union density or collective bargaining coverage is high. Profits are instrumented with measures of product market regulation.

[23] Nickell *et al.* (2005) find evidence of a positive effect of the tax wedge on unemployment in the context of a dynamic model. Elmeskov *et al.* (1998) found that the tax wedge (drawn from a stylised tax model) has a positive effect on unemployment in countries with intermediate bargaining regimes, where wage negotiations do not allow higher taxes to be passed through to lower take home wages.

in the absence of trends. Such trends account for low frequency movements in employment rates that are driven by a variety of factors that may be themselves influenced by complementarities in product and labour market deregulation (e.g. productivity enhancements). For more details, see Fiori *et al.* (2007).

4.2. *Political Economy Considerations*

The results presented so far are based on the assumption that product and labour market policies are exogenous and set independently from one another but, as discussed above, there are good political economy reasons to believe that they are interrelated. The arguments in Section 1.2, based on BG, suggest that product market deregulation may lead to labour market deregulation and, as already mentioned, this linkage has been explored in a few other theoretical settings. In this Section, we explore this issue and the related issue of the potential endogeneity of product and labour market regulation (and of other variables) in the employment equation.

In Table 2, we present (extended) Granger causality tests of product and labour market regulation. We report results for both our summary measures of labour market policies and union bargaining power and for their separate components. That is, we investigate whether our measure of product market regulation Granger causes labour market policies (*LMRP* or alternatively its components) and union strength (*UDCO* or *UNCOV*) and *vice versa*, after controlling for additional macroeconomic and political economy variables.

More specifically, we regress each of these policy and institutional variables on their own three lags and three lags of *REGfdi* and we do a parallel exercise for the measure of product market regulation. As in Hoj *et al.* (2006) and Alesina *et al.* (2008), we control for a number of potential political economy influences on the reform process. Given that reforms are sometimes set in motion by economic crises, we include as controls the first and the second lag of a dummy that takes value 1 if the output gap drops by more than 4% (*BIGCRISIS*). We also take into account other political economy variables: the political orientation of the government (left or right of centre), captured by the dummy variable *LEFT* that equals one if the government is left-of-centre; and the length of time the government has been in power, *OGOV*. All the equations are estimated again by feasible GLS, allowing for a different error variance in each country. All specifications include country dummies and year dummies. We test whether the coefficients of the first three lags of the included variables are jointly significant and also if their sum is different from zero.

Consistent with earlier analyses (Hoj *et al.*, 2006; Duval and Elmeskov, 2005), political economy variables help to explain both product and labour market regulation. Notably, crises have strong effects on product market regulation, which tend to be liberalised after severe downturns. At the same time, mature governments are more likely to implement product market reforms and, not surprisingly, left-of-centre governments are more willing to tighten regulations in labour markets.

More importantly, the results suggest that *REGfdi* Granger-causes *LMRP* and *BEN* (the marginal significance levels of the tests are reported under 'JOINT' in Table 2, whereas 'SUM' refers to the test of the hypothesis that the sum of the coefficients equals zero). The converse is not true. The sum of the coefficients on the three lags of *REGfdi*

Table 2

Determinants of Product and Labour Market Policies and Institutions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	LMRP	*REGfdi*	*LMRP*	*REGfdi*	*UDCO*	*EPL*	*BEN*	*REGfdi*	*UNCOV*
LMRP (−1)	1.045***	0.001	1.022***	−0.011	0.021				
	(20.183)	(0.026)	(19.786)	(0.190)	1.203				
LMRP (−2)	−0.337***	0.027	−0.335***	0.020	−0.042*				
	(4.498)	(0.336)	(4.527)	(0.253)	(1.704)				
LMRP (−3)	0.129***	−0.033	0.149***	−0.024	0.033*				
	(2.584)	(0.603)	(2.967)	(0.437)	(1.882)				
REGfdi (−1)	−0.004	1.218***	−0.000	1.207***	−0.006	−0.003	0.135	1.192***	0.024
	(0.125)	(24.849)	(0.016)	(24.545)	(0.538)	(0.087)	(0.457)	(24.208)	(0.264)
REGfdi (−2)	0.043	−0.142*	0.034	−0.141*	0.007	0.021	−0.223	−0.119	0.035
	(0.962)	(1.806)	(0.749)	(1.802)	(0.353)	(0.422)	(0.489)	(1.533)	(0.246)
REGfdi (−3)	−0.012	−0.157***	−0.005	−0.145***	0.003	−0.014	0.626**	−0.158***	−0.027
	(0.412)	(3.126)	(0.176)	(2.867)	(0.276)	(0.448)	(2.034)	(3.156)	(0.298)
UDCO (−1)			0.011	−0.060	1.429***				
			(0.098)	(0.391)	(27.051)				
UDCO (−2)			−0.079	−0.038	−0.355***				
			(0.419)	(0.145)	(3.897)				
UDCO (−3)			0.031	0.057	−0.109**				
			(0.295)	(0.376)	(2.101)				
UNCOV (−1)						−0.007	−0.067	−0.003	1.703***
						(1.217)	(1.318)	(0.345)	(38.352)
UNCOV (−2)						0.006	0.065	0.002	−0.731***
						(0.954)	(1.233)	(0.243)	(16.646)
EPL (−1)						0.904***	−0.080	0.056	0.011
						(14.788)	(0.258)	(1.320)	(0.150)
EPL (−2)						−0.034	−0.001	−0.004	−0.033
						(0.407)	(0.002)	(0.078)	(0.328)
EPL (−3)						0.075	−0.063	−0.016	−0.003
						(1.091)	(0.186)	(0.357)	(0.036)
BEN (−1)						−0.006	1.357***	−0.009*	0.001
						(1.552)	(28.031)	(1.825)	(0.131)
BEN (−2)						0.006	−0.789***	0.010	−0.005
						(1.078)	(10.531)	(1.325)	(0.478)
BEN (−3)						−0.001	0.306***	−0.004	0.008
						(0.175)	(6.805)	(0.827)	(1.075)

Table 2
(Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	LMRP	*REGfdi*	*LMRP*	*REGfdi*	*UDCO*	*EPL*	*BEN*	*REGfdi*	*UNCOV*
BIGCRISIS (−1)	−0.002	0.006	0.002	0.008	−0.006	0.001	−0.096	0.012	−0.008
	(0.170)	(0.289)	(0.128)	(0.404)	(1.235)	(0.112)	(0.689)	(0.614)	(0.245)
BIGCRISIS (−2)	0.001	−0.044**	0.005	−0.044**	−0.012**	0.002	0.080	−0.0430**	−0.016
	(0.117)	(2.433)	(0.430)	(2.410)	(2.453)	(0.182)	(0.626)	(2.293)	(0.521)
LEFT (−1)	0.011	0.009	0.014*	0.009	0.004	0.009	0.177**	0.009	−0.012
	(1.593)	(0.793)	(1.949)	(0.802)	(1.396)	(1.181)	(2.354)	(0.743)	(0.596)
OGOV	0.006	−0.023**	0.005	−0.023**	0.000	−0.001	0.115*	−0.026**	0.009
	(0.877)	(2.188)	(0.721)	(2.206)	(0.110)	(0.201)	(1.665)	(2.454)	(0.486)
No. of observations	380	380	380	380	380	380	380	380	380
JOINT *REGfdi*	0.018		0.020		0.690	0.936	0.000		0.711
SUM *REGfdi*	0.003		0.003		0.354	0.743	0.000		0.309
JOINT *LMRP*		0.942		0.921	0.170				
SUM *LMRP*		0.829		0.532	0.140				
JOINT *UDCO*			0.023	0.228					
SUM *UDCO*			0.003	0.055					
JOINT *EPL*							0.946	0.244	0.945
SUM *EPL*							0.902	0.600	0.737
JOINT *BEN*						0.399		0.201	0.559
SUM *BEN*						0.826		0.090	0.251
JOINT *UNCOV*						0.054	0.357	0.671	
SUM *UNCOV*						0.022	0.526	0.390	

Notes. *p < 0.10, **p < 0.05, ***p < 0.01, where p is the marginal probability level; t-statistics in parentheses. Estimation method: feasible GLS allowing for heteroscedasticity. All equations include a country-specific constants and year-effects. P-values are reported for the Granger causality test (JOINT X) and for the tests of significance of the sum of the coefficients (SUM).

is positive and significant, which means that domestic deregulation of the product market leads to lower regulation in the labour market via lesser generosity of unemployment benefits and an implicit lower reservation wage for workers in the long run. However, there is no similar evidence for EPL, perhaps due to the more limited variability of this policy variable over the sample period.

An implication of this result is that in assessing the effect of product market deregulation one should consider also its indirect effects through subsequent changes in some labour market policies. Another implication is that sequencing reforms to deal first with product markets could make it easier to overcome political opposition to labour market reform later on. In this sense, reforms in product and labour markets are political complements.[24]

In contrast, no firm conclusion can be reached from our data concerning the influence of *REGfdi* on bargaining institutions. There is no evidence that product market reforms have affected UDCO or UNCOV.[25] Conversely, and somewhat unsurprisingly, labour market institutions seem to have a bearing for labour market policies, with UDCO Granger-causing LMRP, especially via the effect of UNCOV on EPL, although the sign of the long-run effect (negative) is puzzling. There is also some weak evidence that strong bargaining power (as proxied by UDCO) could lead to stricter product market regulation (at 6% level of significance based on the sum of coefficients test).

4.3. *Controlling for Endogeneity Issues in the Employment Equation*

If the error terms in the equations generating policies and institutions are correlated with those in the employment equation, we need to address the potential endogeneity of policies and institutions in the latter equation. Table 3 reproduces the specifications of the employment equation in Table 1 but controls for the endogeneity of *LMRP*, *EPL*, *BEN*, *REGfdi*, *UDCO* and *UNCOV* using a control function approach (Rivers and Vuong, 1988). In addition, we allow for the endogeneity of the *GAP* which we model as an AR(2) process, while the lagged value of *WEDGE* is used in the regression and *EGRM* is the average of public employment at year $t-1$ and $t-2$. At the bottom of each column, we report the endogeneity test. The test is implemented by introducing the estimated innovations from the first stage equations for the policy and institutional variables (Table 2) and interactions of these innovations with other variables (due to the presence of interaction effects) in the employment equation.[26] We also add the residuals of the AR(2) model for the *GAP* variable. The test of joint significance of the terms containing the errors is a test of endogeneity of *LMRP*, *EPL*, *BEN*, *REGfdi*, *UDCO*, *UNCOV* and *GAP*. Moreover, in the presence of endogeneity, the estimated coefficients

[24] Hoj *et al.* (2006) and Checchi and Nunziata (2006) also find an empirical link between policies (or institutions) in the two markets.

[25] However, there is empirical evidence from studies using different proxies for institutions that trade liberalisation and market-oriented reforms in the product markets have reduced workers' bargaining power. Initial findings by Abowd and Lemieux (1993) for Canada were followed by evidence by Dumont *et al.* (2006) and Boulhol *et al.* (2006) for European countries and by Dreher and Gaston (2007) for OECD countries.

[26] More specifically, depending upon the specification, we add to the employment equation the estimated innovation in *REGfdi*, *LMRP*, *EPL*, *BEN*, *UDCO* and *UNCOV* (denoted respectively by u^R, u^L, u^E,u^B, u^U, u^C) as well as the appropriate interactions. For instance in the specification of column 1 of Table 3 u^R, u^L and the following interactions are included: $u^L \times u^R$, $u^R \times LMRP$, $u^L \times REGfdi$, $u^L \times ERB(-1)$. See also Lewbel (2005) to whom we are indebted for very useful discussions and suggestions on this issue.

Table 3

Testing and Correcting for Endogeneity in the Employment Rate (ERB) Equation

	(1)	(2)	(3)	(4)	(5)	(6)
	ERB	*ERB*	*ERB*	*ERB*	*ERB*	*ERB*
REGfdi	−0.289**	−0.191*	−0.255**	−0.146	−0.237**	−0.124
	(2.473)	(1.655)	(2.213)	(1.190)	(2.043)	(0.951)
LMRP	−2.271***		−2.227***		−2.699***	
	(2.862)		(2.828)		(3.501)	
UDCO	−1.179***		−0.873**		−1.008***	
	(3.350)		(2.437)		(2.858)	
REGfdi × *LMRP*	−0.274***		−0.204*		−0.194*	
	(2.692)		(1.889)		(1.890)	
REGfdi × *UDCO*			−0.134**		−0.161**	
			(1.982)		(2.231)	
EPL		−2.903***		−2.764***		−3.250***
		(4.194)		(3.821)		(4.679)
BEN		0.010		0.059		0.011
		(0.696)		(1.043)		(0.765)
UNCOV		−0.036		−0.029		−0.037*
		(1.631)		(1.329)		(1.701)
REGfdi × *EPL*		0.034		0.059		0.030
		(0.315)		(0.499)		(0.296)
REGfdi × *BEN*		−0.012**		−0.010*		−0.011**
		(2.012)		(1.716)		(2.043)
REGfdi × *UNCOV*				−0.002		−0.003
				(0.307)		(0.439)
ERB(−1)	0.570***	0.497***	0.580***	0.536***	0.583***	0.475***
	(27.163)	(13.088)	(27.979)	(9.403)	(27.795)	(12.502)
ERB(−1) × *LMRP*	0.050***		0.051***		0.062***	
	(3.050)		(3.204)		(3.905)	
ERB(−1) × *EPL*		0.060***		0.058***		0.067***
		(4.162)		(3.975)		(4.687)
WEDGE(−1)	−0.029	−0.037*	−0.040**	−0.038**	−0.038*	−0.031
	(1.450)	(1.887)	(1.994)	(1.983)	(1.847)	(1.591)
EGRM	−0.092	−0.300***	−0.177**	−0.294***	−0.150*	−0.278***
	(1.124)	(3.829)	(2.297)	(3.738)	(1.856)	(3.470)
GAP	0.353***	0.341***	0.347***	0.341***	0.342***	0.336***
	(20.875)	(20.446)	(21.044)	(20.296)	(20.540)	(20.271)
No. obs.	380	380	380	380	380	380
Endogeneity test	0.000	0.001	0.000	0.003	0.000	0.001

Notes. *p < 0.10,**p < 0.05,***p < 0.01, where p is the marginal probability level; t-statistics in parentheses. Estimation obtained with Control Function Approach. Standard errors have been corrected using Murphy and Topel (1985) correction. Endogeneity test: p-values reported. Variables treated as endogenous: LMRP, *REGfdi*, *UDCO*, *EPL*, *BEN*, *UNCOV* and *GAP*. The errors are heteroscedastic and follow an AR(1) structure with country-specific rho. All the equations include country-specific constants, year-effects and country-specific time trends (columns 1–4) or proxies using HP-filtered productivity trend (columns 5–6).

on the variables of interest obtained by adding the first stage errors (and the appropriate interaction) are consistent, although their standard errors are incorrect due to the generated regressor problem. We report estimates with corrected standard errors, using an extension of the formulas in Murphy and Topel (1985). The tests indicate that we can always reject the absence of endogeneity problems at the 1% level, suggesting that the GLS estimates of Table 1 are likely to be inconsistent.

The instrumental variable estimates presented in Table 3, which correct for these potential biases, tend to reinforce the qualitative conclusions we have reached in Table 1. In particular, the coefficient on the main effect of labour market regulation remains negative and significant, although its magnitude is smaller for *LMRP* and slightly larger for *EPL* compared with those obtained under the hypothesis of exogenous policies. The main effect of *REGfdi* remains negative and significant in all but two specifications, although the absolute value of the coefficient is somewhat smaller. Most importantly, the coefficients of the interaction terms with *LMRP* remain negative and statistically significant and their magnitudes are similar to those obtained before. Interestingly, the coefficient of the interaction between *REGfdi* and *BEN* is now more precisely estimated and it is statistically significant at the 5% level in two cases and at the 10% level in one case. Considering the coefficients of the main and interaction effects together and remembering that the variables are defined in deviation from the mean, *REGfdi* has a negative and significant effect on employment starting from around the 45th percentile of *BEN* and the 42nd percentile of *LMR* (using the specifications in columns 2 and 1, respectively). The cutoff percentiles for significance were instead the 28th and 37th percentiles with exogenous policies. In other terms, the labour market must be sufficiently rigid in order for product market deregulation to have a significant positive effect on employment. The interaction between *REGfdi* and union power (*UDCO*) is now negative and statistically significant, while that was not the case in Table 1. Note that the coefficients of the lagged dependent variables tend now to be somewhat smaller, which, *ceteris paribus*, tends to reduce the long-run effects of any shock. All in all, controlling for endogeneity allows us to obtain consistent results that confirm, if not reinforce, the statistical significance of the coefficients of the interactions between product and labour market regulation.

5. Economic Significance of Product–Labour Market Interactions

The difference in the estimated effect of product market deregulation in countries where labour market policies are tight or loose is sizeable. This Section looks at the economic significance of these effects using the two main sets of estimates obtained above, that is, under the hypothesis of exogenous policies and allowing for policy interlinkages and controlling for endogeneity in the regression analysis.

Beginning with the results in Table 1, column 1, consider, for example, a product market deregulation that, *ceteris paribus*, moves a country from the third quartile of *REGfdi* to the first quartile. When labour market regulation is low and equal to the first quartile of *LMRP*, the estimated increase in the employment rate is not statistically significant at the 5% level and equals only 0.28% on impact and 0.64% in the long run. When labour market regulation is high and equal to the third quartile of *LMRP*, the positive effect of deregulation on employment is quite substantial – 1.07% on impact and 3.52% in the long run – and significant at the 1% level. Another way to highlight the different effect of product market deregulation in different labour market settings is to consider that one standard deviation decrease in *REGfdi* generates a long-run gain in the employment rate of 1.10% in France (a high *LMRP* country) and of only 0.6% in Ireland (a low *LMRP* country).

When we allow for endogeneity in the estimation of the employment equation, but still treat the policies as set independently from each other, we still obtain economically significant differences in the effect of regulation depending upon the degree of rigidity in the labour market; the long-run responses are somewhat more weak because the coefficient of the lagged dependent variable is now smaller. For instance, when labour market regulation is low, the estimated increase in the employment rate equals 0.2% in the long run (using the results in column 1 of Table 3). When labour market regulation is high, the effect of deregulation on employment is 2.83% in the long run.

Allowing for the response of labour market regulation to product market regulation, the estimated impact of product market deregulation on employment is much larger. For instance, when we control for endogeneity, the results in column 1 of Tables 2 and 3 suggest that a product market deregulation which moves a country from the third quartile of *REGfdi* to the first quartile would lead to a long-run increase in the employment rate of 1.89%, under the assumption that labour market regulation is low and equal to the first quartile of *LMRP*. When labour market regulation is high and equal to the third quartile of *LMRP*, the employment gain following product market deregulation is now 5.4%. These results stress the importance of accounting for the indirect effects of product market reforms on employment via the impact of these reforms on labour market policy and institutions. Deregulating product markets could imply a 'double dividend' in terms of employment gains in the long run.

6. Conclusions

In this article, we analyse the effects of product market deregulation and its interactions with labour market policy settings on employment outcomes. To illustrate the channels explored in the empirical analysis, we present a stylised theoretical model that includes a full specification of the fall back position of the unions and allows for union bargaining power to be endogenous. This provides a suitable framework for pointing to the full set of possible interactions between product and labour market reforms, including those working through political economy linkages that were not addressed by the previous empirical literature. For the empirical analysis, we use a dynamic specification of the employment rate equation, which controls for fixed effects and country-specific trends and addresses explicitly both political economy linkages between policies and their endogeneity in the employment equation.

The results suggest a sizeable employment effect of product market reforms aimed at strengthening competition in OECD countries. These results complement those concerning the impact of these reforms on productivity. Moreover, our empirical analysis suggests that product and labour market deregulation can be classified as economic substitutes as regards to their effects on employment: gains from reducing barriers to entry in product markets are larger when labour market policies are tight. This is an important conclusion from a policy perspective since it implies that in situations where labour market regulation is overly restrictive but where introducing more flexibility is difficult politically, deregulating the product market may be an attractive option because it has a more favourable effect on employment at the margin.

Another important result is that employment gains from deregulation are underestimated if the political economy linkages between product and labour market policies are ignored. Using different proxies of labour market policies and institutions (covering on the one hand employment protection and the generosity of unemployment benefits and on the other union density and coverage, respectively), we find that product market deregulation can, over time, lead to labour market reforms that enhance the overall employment effect. From a political economy perspective, therefore, there is some evidence that product market deregulation can be considered as complementary to labour market reforms. An implication of this result is that when assessing the effect of product market deregulation, one should also consider its indirect effects through subsequent changes in labour market policies or institutions. In other words, deregulating product markets would imply a 'double dividend' in terms of employment gains in the long run. In any case, the feedbacks between labour market policies and institutions and product market regulation deserve further discussion and investigation.

Universidade of São Paulo
OECD
OECD and IZA
Boston College and IZA

Additional Supporting information may be found in the online version of this article:

Appendix S1. Derivatives.
Appendix S2. Data sources and definitions.

Please note: The RES and Wiley-Blackwell are not responsible for the content or functionality of any supporting materials supplied by the authors. Any queries (other than missing material) should be directed to the authors of the article.

References

Abowd, J. and Lemieux, T. (1993). 'The effects of product market competition on collective bargaining agreements: the case of foreign competition in Canada', *Quarterly Journal of Economics*, vol. 108(4), pp. 983–1014.

Alesina, A., Ardagna, S. and Galasso, V. (2008). 'Structural reforms in the European Union', NBER Working Papers No. 14479, National Bureau of Economic Research, Inc.

Alesina, A., Ardagna, S., Schiantarelli, F. and Nicoletti, G. (2005). 'Regulation and investment', *Journal of the European Economic Association*, vol. 3(4), pp. 791–825.

Amable, B., Demmou, L. and Gatti, D. (2007). 'Employment performance and institutions: new answers to an old question', Discussion Paper No. 2731, IZA.

Amable, B. and Gatti, D. (2001). 'The impact of product market competition on employment and wages', Discussion Paper No. 276, IZA.

Bassanini, A. and Duval, R. (2006). 'Employment patterns in OECD countries: reassessing the role of policies and institutions', Working Papers No. 486, OECD Economics Department.

Belot, M. and van Ours, J.C. (2004). 'Does the recent success of some OECD countries in lowering their unemployment rates lie in the clever design of their labour market reforms?' *Oxford Economic Papers*, vol. 56(4), pp. 621–42.

Berger, H. and Danninger, S. (2006). 'The employment effects of labor and product markets deregulation and their implications for structural reform', CESifo Working Paper No. 1709, CESifo.

Bertrand, M. and Kramarz, F. (2002). 'Does entry regulation hinder job creation? Evidence from the French retail industry', *Quarterly Journal of Economics*, vol. 117(4), pp. 1369–413.

Blanchard, O. and Giavazzi, F. (2003). 'Macroeconomic effects of regulations and deregulation in goods and labor markets', *Quarterly Journal of Economics*, vol. 118(3), pp. 879–907.
Boeri, T., Conde-Ruiz, J.I. and Galasso, V. (2003). 'Protecting against labour market risk: employment protection or unemployment benefits?', Discussion Paper No.3990, CEPR.
Boeri, T., Conde-Ruiz, J.I. and Galasso, V. (2006). 'The political economy of flexicurity', FEDEA Documento de Trabajo, 2006-15.
Boeri, T., Nicoletti, G. and Scarpetta, S. (2000). 'Regulation and labour market performance', Discussion Paper No. 2420, CEPR.
Boulhol, H. (2006). 'Do capital market and trade liberalization trigger labor market deregulation?', Cahiers de la MSE, Centre d'Economie de la Sorbonne, 2006.62
Boulhol, H., Dobbelaere, S. and Maioli, S. (2006). 'Imports as product and labor market discipline', Discussion Papers No. 2178, IZA
Buti, M., Pench, L.R. and Sestito, P. (1998). 'European unemployment: contending theories and institutional complexities', Economic and Financial Reports, Bei/Eib, Report 98/01.
Cacciatore, M. and Fiori, G. (2010). 'Macroeconomic effects of goods and labor deregulation', HEC Montreal and Universidade of Sao Paulo, Working Paper.
Checchi, D. and Nunziata, L. (2006). 'Are labour market institutions endogenous? An investigation of unemployment, unions and wages', mimeo, IZA.
Conway, P. and Nicoletti, G. (2006). 'Product market regulation in the non-manufacturing sectors of OECD countries (1975–2003): measurement and highlights', Working Papers No. 530, OECD Economics Department.
Crafts, N. (2006). 'Regulation and productivity perfomance', *Oxford Review of Economic Policy*, vol. 22, pp. 186–202.
Dreher, A. and Gaston, N. (2007). 'Has globalization really had no effect on unions?' *Kyklos*, vol. 60(2), 165–186.
Dumont, M., Rayp, G. and Willemé, P. (2006). 'Does internationalization affect union bargaining power? An empirical study for five EU countries', *Oxford Economic Papers*, vol. 58, pp. 77–102.
Duval, R. and Elmeskov, J. (2005). 'The effects of EMU on structural reform in labour and product markets', OECD Economics Department Working Papers No. 438, OECD, Paris.
Ebell, M. and Haefke, C. (2006). 'Product market regulation and endogenous union formation', Discussion Papers No. 2222, IZA.
Ebell, M. and Haefke, C. (2009). 'Product market deregulation and the US employment miracle', *Review of Economic Dynamics*, vol. 12(3), pp. 479–504.
Elmeskov, J., Martin, J.P. and Scarpetta, S. (1998). 'Key lessons for labour market reforms: evidence from OECD countries' Experience', *Swedish Economic Policy Review*, vol. 5(2), pp. 205–52.
Fiori, G., Nicoletti, G., Scarpetta, S. and Schiantarelli, F. (2007). 'Employment outcomes and the interaction between product and labor market deregulation: are they substitutes or complements?', IZA Discussion Papers No. 2770, Institute for the Study of Labor (IZA).
Golub, S. (2003). 'Measures of restrictions on inward foreign direct investment for OECD countries', Working Papers No. 357, OECD Economics Department .
Golub, S. and Koyama, T. (2006). 'OECD's FDI regulatory restrictiveness index: revision and extension to more economies', Working Papers No. 525, OECD Department of Economics.
Griffith, R., Harrison, R. and Macartney, G. (2007). 'Product market reforms, labour market institutions and unemployment', Economic Journal, vol. 117(519), pp. 142–66.
Hoj, J., Galasso, V., Nicoletti, G. and Dang T.T. (2006). 'The political economy of structural reform: empirical evidence from OECD countries', OECD Economics Department Working Papers No. 501, OECD Economics Department.
Koeniger, W. and Prat, J. (2006). 'Employment protection, product market regulation and firm selection, Discussion Paper No. 1960, IZA.
Levin, A., Lin, C.F. and Chu, C.S.J. (2002). 'Unit root tests in panel data: asymptotic and finite-sample properties', *Journal of Econometrics*, vol. 108(1), pp. 1–24.
Lewbel, A. (2005). 'Simple estimators for hard problems: endogeneity in discrete choice related models', mimeo, Boston College.
Messina, J. (2006). 'The role of product market regulations in the process of structural change', *European Economic Review*, vol. 50(7), pp. 1863–90.
Murphy, K. M. and Topel, R. H. (1985). 'Estimation and inference in two-step econometric models', *Journal of Business and Economic Statistics*, vol. 3(4), pp. 88–97.
Neugart, M. (2007). 'Provisions of the welfare state: employment protection versus unemployment insurance', *European Economy Economic Papers* No. 279.
Nickell, S., Nunziata, L. and Ochel, W. (2005). 'Unemployment in the OECD since the 1960s: what do we know?', Economic Journal, vol. 115(500), pp. 1–27.
Nicoletti, G. and Scarpetta, S. (2003). 'Regulation, productivity and growth: OECD evidence', *Economic Policy*, vol. 18(36), pp. 9–72.

Nicoletti, G. and Scarpetta, S. (2005). 'Product market reforms and employment in OECD countries', OECD Economics Department Working Papers No. 472, OECD, Paris.
Nicoletti, G. and Scarpetta, S. (2006). 'Regulation and economic performance: product market reforms and productivity in the OECD', in (T.S. Eicher and C. García-Peñalosa, eds.), *Institutions, Development, and Economic Growth*, pp. 81–120, Cambridge, MA: MIT Press.
OECD (2004), *OECD Employment Outlook*, Paris: OECD.
Rama, M. and Tabellini, G. (1998). 'Lobbying by capital and labor over trade and labor market policies', *European Economic Review*, vol. 42, pp. 1295–316.
Rivers, D. and Vuong, Q. (1988). 'Limited information estimators and exogeneity testing for simultaneous probit models', *Journal of Econometrics*, vol. 39(3), pp. 347–66.
Saint-Paul, G. (2000). *The Political Economy of Labour Market Institutions*, Oxford: Oxford University Press.
Scarpetta, S. (1996). 'Assessing the role of labour market policies and institutional settings on unemployment: a cross-country study', OECD Economic Studies No. 1.
Schiantarelli, F. (2010). 'Product market regulation and macroeconomic performance: a review of cross country evidence', in (N.V. Loayza and L. Servén eds.), *Business Regulation and Economic Performance*, Washington DC: The World Bank.
Spector, D. (2002). 'Competition and the capital-labour conflict', *European Economic Review*, vol. 48(1), pp. 25–38.
Wölfl, A., Wanner, I., Kozluk, T. and Nicoletti, G. (2009). 'Ten years of product market reform in OECD countries – insights from a revised PMR indicator', OECD Economics Department Working Papers No. 695, OECD, Paris.