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Regulation and Wage Premia

by

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Abstract

The paper explores the link between wage premia and the determinants of product market rents. We first estimate 2-digit industry premia from 1996 wage earnings data by category of worker (age, sex, education and type of contract) in 10 European countries, the US and Canada. Using industry-specific regulation data, we then look at the effects of restrictions to competition and public ownership on wage premia in non-manufacturing industries, where regulatory conditions vary the most and are better documented. We find that, given workers' bargaining power, anticompetitive regulations significantly increase wage premia, reflecting the presence of rents. However, premia decline in industries dominated by legal public monopolies, suggesting a hump-shaped relationship between regulation and premia. We show that the hump-shape is consistent with a model of non-pecuniary rent-sharing between workers and a populist public monopolist.

JEL: J31, L51, C23

Keywords: Regulation, competition, wage premia, rent-sharing, panel data

Contents

Non-technical summary

If the labour market was perfectly competitive, wage differentials would reflect only the characteristics of workers (e.g. age, gender, education, skills) and, possibly, working conditions (firm location, health hazards, etc.). This is far from being the case, however, and the term of "wage premium" refers to the difference between the wage actually earned by a worker, and the wage that he would have been expected to earn, based on his observable characteristics (and working conditions). In this working paper, we study to what extent these wage premia reflect interindustry differences in competitive pressures and employee bargaining power. The intensity of competition influences the magnitude of rents firms are able to extract from product markets. If workers and firms bargain over wages, part of these rents is likely to be appropriated by workers, to an extent depending on their bargaining power.

There is abundant evidence of a positive relationship between product market rents (or measures of market power) and wage premia (or workers' bargaining power). One problem with this evidence is that it is often affected by potential measurement and endogeneity problems: proxies for product market competition are difficult to construct, and most available measures (such as profit per worker, mark-ups or concentration rates) are likely to be determined jointly with the wage outcomes. Moreover, there is no univocal relationship between many of these empirical measures and the actual degree of product market competition. This is the reason why the approach taken here is to proxy product market competition with anticompetitive product market regulation. In potentially-competitive product markets, regulations can curb the intensity of competition among incumbent firms as well as hinder (or prevent) entry of new firms. Restrictions to competition can result from direct hindrances, such as legal barriers to entry or price controls, or more indirectly from administrative burdens and ineffective competition laws. Regulation can also favour competition in certain industries by ensuring that market power in natural monopoly segments is not used abusively and by providing the correct incentives to market participants.

We use the cross-sectional variation of wages and product market regulations across countries and industries to explore the long-run effects of anticompetitive regulation on wage premia. Thus, we look for evidence that labour market rents are relatively high where regulation is most restrictive of competition. Our estimations concern a single year, due to the lack of time-series data on regulation for all the industries covered by the analysis. However, to our knowledge, no empirical study to date has focused explicitly on the role of product market regulation using such cross-country/cross-industry data. To this end, we use the two-step estimation methodology of Dickens and Katz [1987]. We first filter out of interindustry wage differentials the effects due to observed worker characteristics. In this way, we separate out wages

differences due to the influence of gender, age and education from differences due to industry-specific variables. This results in a set of industry-specific wage premia estimates for 12 OECD countries, spanning various regulatory and market settings. In the second step, we regress the estimated wage premia on indicators of industry-specific regulations that restrict competition, controlling for other country and industry-specific factors that may have a bearing on wage differentials. While other authors have applied this approach to data concerning individual workers in specific industries or countries, we apply it to more aggregate data concerning different categories of workers across both industries and countries. By using two-way (industry and country) fixed effects, we are able to isolate the effect of differences in regulation on wages.

Since wage premia estimates present an interest per se and to ease comparisons with earlier estimates, in the first step we estimate premia for both manufacturing and non-manufacturing industries. Conversely, in the second step, we focus on the relationship between wage premia and regulation in non-manufacturing industries. This is because industry-level regulations and market conditions are particularly variable in these industries, ranging from virtually free-entry, atomistic competition – such as in retail distribution – to public legal monopoly – such as in the utilities of many OECD countries. Moreover, our data set of industry-level product market regulations [recently used also by Nicoletti and Scarpetta, 2003, and Alesina *et al.*, 2003] is better documented and more detailed for non-manufacturing industries.

We find that anticompetitive regulations tend to raise wage premia in non-manufacturing industries. However, this effect is non-monotonic, with premia tending to decline as restrictions to market mechanisms become severe. We explore this non-monotonicity by means of a simple model in which workers bargain in each industry with both private and public firms, managed by a populist public monopolist. The impact of public ownership on wage premia is a priori ambiguous: by curbing market competition public enterprises may be able to maintain rents, which can be shared with workers; but, being insulated from market forces by special corporate governance arrangements, public enterprises may also be able to maintain inefficient behaviour (such as overmanning or lower work effort), which can result in non-pecuniary rents for workers.

Distinguishing between public ownership and other kinds of regulations, we show that it is indeed the combination of restrictions to competition and public control that accounts for the hump-shape in the estimated wage premia. Restrictions to competition do increase unambiguously wage premia, ceteris paribus; but the larger public ownership, the more limited the influence of regulation on wage premia is. Actually, strongly regulated sectors exhibiting widespread public ownership do not tend to originate large

wage premia. This result suggests the presence of a low-productivity trap implied by x-inefficiency or the existence of a trade off between pecuniary and non-pecuniary rents (e.g. longer job tenure and/or lower work effort). An alternative interpretation, in terms of a disciplining effect of regulation on rents in public monopolies, is made implausible by the absence of a direct effect of public ownership on wages.

I. Introduction

A large amount of evidence points to the existence of significant inter-industry wage differentials in OECD countries [see, for instance, Krueger and Summers, 1988; Gittleman and Wolff, 1993; Haisken-DeNew and Schmidt, 1999]. If the labour market was perfectly competitive, wage differentials would reflect only the characteristics of workers (e.g. age, gender, education, skills) and, possibly, working conditions (firm location, health hazards, etc.). In an efficiency-wage setting, earnings differentials are also related to the characteristics of firms (industry affiliation, size, etc.), with firm profits increasing with wages over some range [Krueger and Summers, 1988]. But how much do these differentials reflect interindustry differences in competitive pressures and employee bargaining power? If workers and firms bargain over wages, the larger are product market rents,the larger is the share of these rents that are likely to be appropriated by workers [Abowd, 1989; Nickell *et al.*, 1994]. Therefore, differences in the degree of product market competition and rent sharing may provide an additional explanation of interindustry wage differentials, giving rise to so-called wage premia.

There is abundant evidence of a positive relationship between product market rents (or measures of market power) and wage premia (or workers' bargaining power) [Katz and Summers, 1989; Abowd and Lemieux, 1993; Nickell *et al*., 1994; Abowd and Allain, 1996; Blanchflower *et al*., 1996; Benito, 2000]. There is also evidence of a significant impact of trade openness on wage premia both at the single country [Gaston and Trefler, 1994, 1995; Borjas and Ramey, 1995; Pizer, 2000] and cross-country levels [Oliveira-Martins, 1993; Mirza, 2001], though its sign appears to depend on industry and worker characteristics (including union membership).[1] One problem with this evidence is that it is often affected by potential measurement and endogeneity problems: proxies for product market competition are difficult to construct, and most available measures (such as profit per worker, mark-ups or concentration rates) are likely to be determined jointly with

1. Concerning import penetration, for instance, Borjas and Ramey [1995] find a negative impact on wages of low-skilled workers in concentrated industries. Oliveira-Martins [1993] finds a clear negative effect only in fragmented industries producing homogeneous goods, and a positive effect in fragmented industries producing highly differentiated goods. Pizer [2000] finds differential effects on unionised and non-unionised workers. Neary [2001] provides a model of oligopolistic competition rationalising the opposite effects of trade liberalisation on the wages of skilled and unskilled workers.

the wage outcomes.[2] Moreover, recent research shows that there is no univocal relationship between many of these empirical measures and the actual degree of product market competition [Boone, 2000].

This paper looks at the empirical relationship between wage premia and product market competition proxying the latter with anticompetitive product market regulation. Indeed, regulation is one of the main determinants of product market competition. In potentially-competitive product markets, regulations can curb the intensity of competition among incumbent firms as well as hinder (or prevent) entry of new firms. Restrictions to competition can result from direct hindrances, such as legal barriers to entry or price controls, or more indirectly from administrative burdens and ineffective competition laws. Regulation can also favour competition in certain industries by ensuring that market power in natural monopoly segments is not used abusively and by providing the correct incentives to market participants.

Since anticompetitive regulation can create and/or protect product market rents, it is a potentially important determinant of wage premia. Being policy-determined, product market regulation can be assumed to be much less endogenous to the bargaining outcome than the rents themselves and, therefore, represents a more appropriate empirical proxy for the influence of product market conditions on it.[3] Moreover, empirical results based on product market regulation also provide for a direct link to policy, which is missing in analyses based on measures of industry concentration or product market rents. Studying the linkage between anti-competitive product market regulations and the wage premia resulting from market and bargaining power has important implications for regulatory policies. For instance, recent research has emphasised the potential positive effects of product market liberalisation for employment [see, for instance, Nickell, 1999, and Blanchard and Giavazzi, 2001]. Most of these effects are thought to result from the impact of liberalisation on product and labour market rents.

2. Acknowledging the endogeneity problem, Abowd and Lemieux [1995] use an instrumental variable estimation approach.

3. It is possible that the emergence of rents in a sector (e.g. due to changes in technology or shifts in demand) encourages interest groups to lobby for protective legislation. This phenomenon could make regulation endogenous to rents, though not necessarily to the bargaining outcome. While we cannot exclude that regulation can retain some endogeneity through this channel, it is certainly less endogenous to wage premia than the rents themselves. Moreover, in our estimates, the structural characteristics that could give rise to such rents should be controlled for by the industry dummies.

One dimension of product market regulation is public control of business enterprises. Public enterprises play a dual role *vis-à-vis* competition: on the one hand, it may be easier for them to implement anticompetitive practices, such as predatory pricing [Sappington and Stiglitz, 2003]; on the other hand, their special status may make it possible to shelter them from market forces. Thus, the impact of public ownership on wage premia is a priori ambiguous: by curbing market competition public enterprises may be able to maintain rents, which can be shared with workers; but, being insulated from market forces by special corporate governance arrangements, public enterprises may also be able to maintain inefficient behaviour (such as overmanning or lower work effort), which can result in non-pecuniary rents for workers [Haskel and Sanchis, 1995]. The distinction between public ownership and other kinds of anticompetitive regulations indeed turns out to be important in our analysis of wage premia.

Empirical evidence on the influence of product market regulation on inter-industry wage differentials is scant, especially at the cross-country level. Conceptually, this linkage can be studied in two different but complementary ways. First, premia should be found to be relatively higher in countries and industries in which regulations restrict competition. Second, premia should decrease as anticompetitive regulations in these countries and industries are removed. Taking the second approach, a few studies have concentrated on the effects of liberalisation in specific countries and regulated industries. For instance, the reaction of industry wages to deregulation outside manufacturing in the United States was studied by Hendricks [1977, 1994] and Peoples [1998]. Their conclusions were mixed: while competition is often found to lead to decreases in average earnings, in some cases market power is found to be associated with lower pay levels, and increased competitive pressures were found to lead to either no or positive effects on wage premia.

This paper follows the first approach. It uses the cross-sectional variation of wages and product market regulations across countries and industries to explore the long-run effects of anticompetitive regulation on wage premia. Thus, we look for evidence that labour market rents are relatively high where regulation is most restrictive of competition. Our estimations concern a single year, due to the lack of time-series data on regulation for all the industries covered by the analysis. However, to our knowledge, no empirical study to date has focused explicitly on the role of product market regulation using such cross-country/cross-industry

data. To this end, we use the two-step estimation methodology of Dickens and Katz [1987]. We first filter out of interindustry wage differentials the effects due to observed worker characteristics. In this way, we separate out wages differences due to the influence of gender, age and education from differences due to industry-specific variables. This results in a set of industry-specific wage premia estimates for 12 OECD countries, spanning various regulatory and market settings. In the second step,we regress the estimated wage premia on indicators of industry-specific regulations that restrict competition , controlling for other country and industry-specific factors that may have a bearing on wage differentials. While other authors have applied this approach to data concerning individual workers in specific industries or countries, we apply it to more aggregate data concerning different categories of workers across both industries and countries. By using two-way (industry and country) fixed effects, we are able to isolate the effect of differences in regulation on wages.

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We find that anticompetitive regulations tend to raise wage premia in non-manufacturing industries. However, this effect is non-monotonic, with premia tending to decline as restrictions to market mechanisms become severe. We explore this non-monotonicity by means of a simple model in which workers bargain in each industry with both private and public firms, managed by a populist public monopolist. Distinguishing between public ownership and other kinds of regulations, we show that it is indeed the combination of restrictions to competition and public control that accounts for the hump-shape in the estimated wage premia,

possibly suggesting the presence of a low-productivity trap implied by x-inefficiency (Liebenstein, 1966) or the existence of a trade off between pecuniary and non-pecuniary rents (e.g. longer job tenure and/or lower work effort). An alternative interpretation, in terms of a disciplining effect of regulation on rents in public monopolies, is made implausible by the absence of a direct effect of public ownership on wages.

The paper is organised as follows. In the next section, we describe a simple model of rent sharing and our estimation approach. Then we describe the data, focusing on our proxies for industry-level regulation. In Section III, we discuss the empirical results, showing that the relationship between product market regulation and wage premia is non-monotonic. We then propose (Section IV) an interpretation based on the joint role played by public ownership and other regulations, and test it against the data. A few conclusive remarks draw policy implications from the analysis and suggest further extensions and refinements.

II. Model specification

1. The bargaining framework

The basic framework for our estimations is a rent-sharing model in which wages result in partial equilibrium from bargaining between the union and the firm over wages, given an outside option for workers.[5] With risk-neutral workers, the Nash solution to the bargaining problem in each profit-maximising firm is:

$$w^* = \underset{w}{\operatorname{argmax}} \left[\left(L(w)(w-x)\right)^{\gamma} \left(p(w)F(L(w)) - wL(w)\right)^{1-\gamma} \right],$$

where w is the wage, L is employment, x is the alternative market wage, p is the price of the good's variety produced by the firm, $F(L)$ is the production function and γ is a parameter measuring the bargaining power of the union ($0 \leq \gamma \leq 1$). The first term in parenthesis is workers' utility function and the second term is the firm's profit function. Negotiated wages can be shown to be a function of the workers' reservation wage (i.e.

4 . Estimates of the effect of simpler measures of regulation, focusing on border barriers, and manufacturing wage premia can be found in Jean and Nicoletti (2002).

5. This is known in the literature as the "right-to-manage model" . Abowd and Lemieux's also treat the case of the "strongly efficient" bargaining model proposed by Brown and Ashenfelter [1986].

the alternative market wage) and the firm's product market rents, with the share of rents accruing to workers depending on their bargaining power [Abowd and Lemieux, 1993]. Assuming for simplicity a constant price-elasticity of demand (σ) and $F(L) = L$, as in Blanchard and Giavazzi [2001], negotiated wages (w^*) can be shown to be a linear function of the union's bargaining power and the markup (μ) of the good's price over the reservation wage: [6]

$$w^* = x + \frac{\gamma}{\sigma - 1} x = x + \gamma \mu x .$$

2. Empirical implementation

In the empirical implementation of this wage determination model, we assume that the markup is a function of a number of industry and/or country-specific variables, among which we include explicitly industry-level anticompetitive product market regulations. Replacing the markup by product market regulation helps side-stepping some of the potential problems pointed out by Abowd and Lemieux [1993]. These problems may arise due to both errors in measuring the markups and their endogeneity to wages in a "right-to-manage" negotiation framework. The use of product market regulation instead of markups is likely to reduce measurement error (because markups need to be estimated, while regulations are observed) and minimise possible endogeneity bias.

Our units of observation are wages at the industry level, therefore the basic log-linear model specification for wages of the typical worker (ω) negotiated in industry k of country i is:

$$(1) \qquad \omega_{ki} = \alpha + \alpha_i + \beta_k + \delta PMR_{ki} + \varphi BP_{ki} + \eta_{ki} ,$$

where α_i are country characteristics that are common across industries, subsuming for instance the going reservation wage in each country; β_k are industry characteristics that are common across countries, such as

[6] Assuming workers to be risk averse would modify the bargaining outcome, depending on the curvature of the utility function. Even in this case, though, there would be no reason to expect risk aversion to vary across sectors, so that the results would not be qualitatively affected, as far as the impact of regulation is concerned.

technology; PMR_{ki} are country and industry-specific product market regulations that restrict competition; and BP_{ki} is a proxy for workers' bargaining power in each country and industry. The parameter δ measures the extent to which pure rents generated by anticompetitive regulations are shifted to the negotiated wage; the parameter φ measures the effect of the bargaining power of workers on rent appropriation. In estimating equation (1) we also attempt to explicitly model industry effects that are common across countries, replacing the $ß_k$ by explanatory variables that capture intrinsic characteristics of each industry such as economies of scale and competitive structure.

Equation (1) describes the determination of wages in a given industry under the unrealistic assumption that workers in the industry are homogeneous. In fact, observed industry wages will deviate from this benchmark due to differences in the characteristics of the workforce (*e.g.* demographic and skill composition) across industries. To account for heterogeneity in worker characteristics across industries, we filter their effects out of the observed wage data following the two-step estimation approach of Dickens and Katz [1987] and Katz and Summers [1989]. Therefore, we estimate the wage of the typical worker (ω_{ki}) in industry k of country i (relative to the wage in a benchmark industry of country i) regressing, country by country, observed wages (w_{ki}) on industry dummies (θ_k) and other dummies (D_s) reflecting a set of observable characteristics of workers in each industry ($s \in C$):

$$(2) \qquad w_{ki}^{s \in C} = \alpha_i + \theta_{ki} + \sum_{s \in C} \alpha_{si} D_s + \varepsilon_{ki} \ .$$

The estimates of the industry dummies ($\hat{\theta}_{ki}$) provide proxies for the deviations of the wages of the typical workers in each industry from a benchmark (which we define as the average wage in the country). Therefore, $\hat{\theta}_{ki}$ can be interpreted as the industry wage premium and is used as the dependent variable in our basic equation (1), under the assumption that all the effects of different worker characteristics across industries have been eliminated through the first-step estimation. [7]

7. In an efficiency-wage perspective, wage premia correspond to the compensation paid by firms for avoiding the costs of monitoring, collecting information, etc. Even conceptually, the distinction between efficiency-wage and

While first-step estimates were made country by country pooling together all industries, the second-step analysis of the determinants of wage premia was performed in a cross section of countries. This second stage focuses on non-manufacturing industries, since this is where both bargaining power and industry-level regulation is better measured by our data. In particular, available data about product market regulations in manufacturing industries mainly cover tariff and non-tariff barriers, and are not directly comparable to those available for non-manufacturing sectors which focus on barriers to entry and other hindrances to domestic competition.[8] Still, this approach retains the bulk of the variance, since differences in industry regulation, industry structure and workers' bargaining power are particularly wide in non-manufacturing industries.

III. Empirical analysis

1. The data

Our dependent variable in the first-step estimates is hourly earnings of full-time workers. For each industry, we broke down earnings according to gender, four age groups (15-24 years, 25-34 years, 35-54 years, 55 years and over) and four categories of education (less than upper secondary, upper secondary, non-university tertiary, university). Wages and skills data are from the OECD database on employment in services [OECD, 2000].[9] The data concern 1994 for France, 1996 for Sweden, 1995 for other EU countries, and 1998 for non EU countries. The two-digit (ISIC Rev. 3) industry breakdown includes 21 manufacturing industries and 20 non-manufacturing industries.[10] The full breakdown within the manufacturing sector is available only for the

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rent-sharing elements is difficult. To the extent that rent sharing is a device to avoid the costs of labour unrest, it can also be seen as part of efficiency wages [Krueger and Summers, 1988].

8. No trade variables were included in the equations, assuming that in non-manufacturing industries competitive pressures coming from imported products are insignificant. While significant competitive pressures can originate from foreign direct investment and the activity of affiliates of foreign firms, limited industry and country coverage precluded the use of these data in our empirical analysis.

9. The primary sources of the data are: the European Structure of Earnings Survey (Eurostat) for EU countries; OECD calculations on the microdata file of the outgoing rotation group of the Current Population Survey for the US; and Structure of Earnings Surveys or Labour Force Surveys for the other countries. Only those categories for which earning data are available are represented. Many possible crossings of the various identifiers are thus absent, mainly because the insufficient number of persons concerned prevents reliable estimate for average earnings. The OECD database also also includes a breakdown into nine occupation categories (the ISCO-88 one-digit classification excluding "armed forces"). Unfortunately, however, this characteristic of workers cannot be crossed with the information about age and education.

10. Due to data limitations, electricity, gas and water had to be aggregated for Canada.

United States and for a subset of EU countries. Unfortunately, detail on industry wages was insufficient for some EU countries (e.g. Germany, the Netherlands), which therefore could not be covered in the analysis. [11]

In the second-step estimates, our explanatory variables stand for factors affecting product market rents and rent appropriation by workers through wage negotiation. These factors may be driven by industry characteristics that are common to all countries or by regulatory and market conditions that are specific to each country-industry pair. We proxy the former by either industry dummies or a set of country-independent controls that includes average (industry-specific) firm size and entry rates. Average firm size is intended to reflect industry-specific economies of scale, while average entry rates are intended to reflect the industry-specific competitive structure. These industry-specific features can affect both the bargaining power of workers and the level of product market rents, independent of regulation. Average firm size was measured in each industry by the share of total employment of firms with more than 49 employees, estimated using the OECD Small and Medium-sized Enterprises Database. Entry rates by industry, country and year were based on the firm-level data covering nine OECD countries estimated in OECD [2001b]. To use the available information on size and entry efficiently, these country-independent variables were calculated as the estimated coefficients on the corresponding industry dummies in regressions where the dependent variables were average firm size and entry rates, and independent variables only included industry and country dummies.[12] Table 1 shows the resulting estimates of average firm size and entry rates by industry.

Table 1. Characterising industries by average firm size and entry rates

We proxy workers' bargaining power specific to each country and industry with the union densities (in a year between 1994 and 1998) drawn from Ebbinghaus and Visser [2000] and Booth *et al.* [2000] for most European countries and from the OECD database on employment in services [OECD, 2000] for Canada, Ireland and the United States. To account for the fact that in some countries bargaining outcomes cover also

11 In particular, the absence of Germany from the sample is unfortunate, given its relatively strict product market regulation in many non-manufacturing industries.

12. Estimating average industry size and entry rates by panel regressions made it possible to use all the available information in our unbalanced panels. The size regressions used 413 observations covering 17 countries and 30 industries; the entry regressions used 2572 observations covering 9 countries and 37 industries over the 1978-1998 period.

non-unionised workers, we supplemented the industry-specific union densities with data on coverage of collective agreements drawn form OECD (1997). Finally, we assume that country and industry-specific product market rents are principally generated by regulations that restrict market mechanisms and proxy them with the cardinal industry-level indicators described in Nicoletti and Scarpetta [2003].[13] These indicators contain information on market and industry structure and industry-level regulations in most of the energy and marketable service industries at the three or four-digit level (a total of 21 ISIC Rev 3 industries and industry aggregates) at the end of the nineties. Depending on the industry, they cover barriers to entry, public ownership, price controls, government involvement in business operation, market concentration and vertical integration.[14] In network industries --such as utilities, post and telecommunications and railways-- the basic data concerned regulatory and market conditions in different (vertical or horizontal) segments of the industries (e.g. gas production, distribution and supply, or regular and express mail). Cardinal indicators were constructed for each of the regulatory or market dimensions covered by the data, ranking countries according to their friendliness to competition on a scale from least to most restrictive. In order to match the regulatory indicators with the estimated wage premia, indicators at the two-digit industry level were constructed by weighting the indices for lower-digit industries with average OECD employment shares.[15] This restricted the sample to 12 non-manufacturing industries. Finally, summary indicators of product market regulation for each of these industries were obtained aggregating the cardinal indicators by simple or weighted average, depending on the number and type of regulatory dimensions covered in each industry. By construction, these indicators are comparable across countries, for any given industry, since the methodology applied is strictly the same. In addition, special attention has been devoted to render these cardinal indicators comparable across industries. In particular, industry-specific indicators were rescaled to reflect structural differences in barriers to entry and state ownership across industries (e.g. electricity supply vs retail

13. See also Nicoletti *et al.*, 2001, and the papers in OECD, 2001a, for descriptions of the data and methodologies used in the construction of the indicators.

14. In some industries (such as telecommunications) market structure was used to proxy for the actual implementation of procompetitive reforms. The quality of enforcement of antitrust law could also enter usefully the indicator, but no data was available. Anyway, this aspect should not differ much across sectors, within a given country.

15. Aggregation of segments within each industry was made either by simple average (for vertical segments) or with shares in total sales (for horizontal segments). For instance, indicators for postal services were

distribution).[16] Moreover, any remaining cross-industry inconsistency in indicator scales is likely to be captured by industry fixed effects at the estimation stage. Figure 1 provides a synthetic view of how the countries included in the sample score in the non-manufacturing industries covered by the analysis, relative to the OECD average regulation level. Further details about coverage, sources and the mapping of regulation into cardinal indicators by industry are provided in the data annex.

Figure 1. Regulation in non-manufacturing industries

It is worth stressing that only regulations that have a potential for curbing competition and hindering market mechanisms -- *where competition and market mechanisms are viable* -- have been included in the regulatory indicators.[17] As a result, regulatory indicators highlight two types of cross-country patterns: i) differences in the stringency of regulatory provisions that exist in all countries, taking for granted the need for some level of regulation to correct for market failures (*e.g.* zoning restrictions for the siting of commercial outlets); and ii) differences due to the presence of specific restrictions to market mechanisms that exist only in certain countries (*e.g.* restrictions to entry in certain potentially competitive markets). Unavoidably, the construction of the indicators involved a fair amount of discretion, which can potentially affect country rankings and empirical results based on the indicators.[18]

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constructed aggregating indicators for ordinary mail, express mail and parcels using the shares of each of these services in total turnover of the post industry.

16 Namely, due to differences in industry and market structure, the most restrictive and most liberal scenarios differ across industries. For example, in electricity supply, anticompetitive regulation means a legal vertically-integrated public monopoly, while it subsumes a set of lighter restrictions to entry and business operation in retail distribution. Details on rescaling can be found in Nicoletti and Scarpetta (2003).

17. We focus on differences in regulatory settings across a set of relatively homogeneous countries in terms of economic, institutional and social characteristics. Therefore, differences in the stringency and the scope of regulations should signal differences in the reliance on market mechanisms rather than different stages of development of national institutions.

18. Unfortunately, to the best of our knowledge, no alternative measures of industry regulation are available at this level of detail and coverage. Therefore, no systematic comparisons can be done. However, our country rankings are broadly consistent with alternative indicators of regulation in the few industries for which those are available (e.g. retail distribution, business services).

2. Estimation results

2.1 *Wage premia estimates*

Estimating equation (2) country by country, we obtained first-step estimates of wage premia. These are the fixed industry effects of regressions of hourly wages of full-time workers on gender, four age classes and four education levels on a sample of 12 OECD countries (10 EU countries, Canada and the United States) and 41 two-digit industries in both manufacturing and non-manufacturing sectors.[19] Table 2 shows the resulting earning profiles, focusing on the coefficient estimates of the gender, age and education dummies as well as (in parenthesis) the shares of each group of workers in total employment that result from our sample. Coefficient estimates for each worker characteristic should be interpreted as the percentage variations relative to the (omitted) benchmark characteristic. For instance, regression results indicate that earnings of female workers are between 11 per cent (Sweden) and 25 per cent (United Kingdom) lower than those of male workers sharing the same age and education. Results for age and education are also generally consistent with standard "Mincerian" equations, with earnings increasing with age and education levels.

Table 2. Estimates of earnings profiles

Table 3 shows the estimates of industry wage premia, centred with respect to each country's (employment-weighted) average wage. Wage premia are jointly significant at conventional levels and their individual standard errors are generally low and broadly uniform across industries and countries (with the exception of France where wage premia are less precisely estimated).[20] Consistent with previous findings [*e.g.* Gittleman and Wolff, 1993], the cross-industry structure of wage premia is remarkably similar across countries, with correlations with the US structure ranging from 35 per cent in Denmark to 90 per cent in Canada. The highest premia are generally found in the manufacturing of tobacco and petroleum products, in utilities (gas and electricity), in the supply of financial and computer-related services and in air transport. The lowest

19. Results for Canada should be considered as tentative, given the lack of industry breakdown available in manufacturing.

20. In this paper, the focus is on interindustry differences in wage premia. Comparing relative levels of wage premia in one industry across countries requires an assumption as to which industry can be taken to be the common "competitive" benchmark in which premia are lowest. This line of reasoning is not pursued here.

premia are found in the manufacturing of wearing apparel and leather products, in retail trade and, especially, in hotels and restaurants. On the other hand, the inter-industry dispersion of wage premia is substantial in all countries, with standard deviations ranging from 8 per cent in Sweden to 16 per cent in the United Kingdom and Canada.[21] Wage dispersion has the same magnitude in manufacturing and non-manufacturing industries separately. The estimated wage premia may reflect both efficiency wages and pure rent-sharing deriving from workers' bargaining power in the presence of product market rents. [22] However, only the rent element directly related to market power can be expected to fall with anticompetitive product market regulation.

Table 3. Estimated industry wage premia

2.2 *Regulation and wage premia*

In the second step, we estimated equation (1) relating wage premia to product and labour market characteristics. Estimated wage premia were regressed on indicators of bargaining power, product market regulation and other controls using both fixed and random-effects specifications, pooling together countries and industries. For each country, the sample size is smaller than in the first-step regressions since indicators of bargaining power and product market regulation cover only a subset of industries, and in particular are not available in a comparable form for manufacturing sectors. Wage premia estimates were weighted by the inverse of their standard error in the first-step estimation, to control for sampling error and for possible heteroskedasticity.

Our benchmark estimates are carried out using two-way fixed effects. Indeed, country-wide variables, such as particular product market regulations (e.g. administrative burdens) and labour market characteristics (e.g. employment protection) might influence the magnitude of wage premia, as might do industry-specific characteristics, such as economies of scale or the size of sunk costs. Using both industry and country fixed

21. Standard errors were adjusted for sampling error, as in Krueger and Summers [1988]. The estimated dispersion of wages in the United States (11 per cent) is broadly consistent with the dispersion found by these authors based on 1984 micro data (14 per cent)

22. Wage premia could also reflect industry-specific human capital, or a compensation for unobserved heterogeneity, which could matter more in some sectors than in others. However, these effects should be captured by industry dummies, since they are unlikely to vary in a systematic way across countries.

effects allows these influences to be controlled for, addressing potential estimation biases due to the omission of these variables. Moreover, while our cardinal product market indicators are in principle comparable across both countries and industries, fixed effects should capture remaining industry-specific factors unrelated to regulation that may affect the indicators' cross-industry comparability. Finally, in some regressions we explicitly model some of the effects that are likely to be common to all countries but vary across industries (dropping the industry dummies). In this case, we estimate both a specification adjusting for clustering in the industry dimension [see Moulton, 1986] and a specification with random effects.

As an introduction to second-step regressions, it is useful to look at the cross-country relationship between the (cross-industry) variances of wage premia and the summary indicators of anticompetitive regulations. Figure 2 suggests that, for a subset of the countries included in the sample (most European countries and Canada), a positive correlation exists between the two variances: where anticompetitive regulations vary most, wage differentials also tend to be largest. However, the figure also points out that a few countries (the United States, the United Kingdom and Spain) deviate from this pattern. Aside from differences in industry composition, plausible explanations for these exceptions include the importance of efficiency-wage factors in decentralised bargaining settings (the United States and the United Kingdom) and biases implied by the focus on full-time workers in countries where the share of part-time work is significant in some industries (Spain). More generally, the cross-country patterns highlighted in Figure 2 illustrate the need to control for industry and country-specific factors in panel regressions.

Figure 2. The variance of regulations and wage premia in non-manufacturing industries

Figure 3 plots the first-step estimates of non-manufacturing wage premia against the industry-level indicators of anticompetitive product market regulation, showing the same scatter diagram with both industry and country labels. There is some evidence of a positive correlation between the two phenomena (the correlation coefficient is 0.3 and is significant at conventional levels), though it is blurred by the relatively high dispersion of wage premia. However, this bivariate evidence is partly contradicted by the results of regression analysis, which provide a picture of a strong but more complex relationship between wage premia and regulation.

Figure 3. Wage premia and regulation in non-manufacturing industries

Table 4 summarises the regression results. In the first column, we postulate a simple monotone relationship between regulation and wage premia, while in the rest of the table we explore more complex relationships taking into account non-monotone effects and other variables proxying for bargaining power and structural characteristics of the industries.[23] All equations include both country and industry-specific effects. Indeed, standard F-tests rejected the specifications with no industry-specific effects and controlling for them improves the fit of the model in the dimension in which wage premia vary the most.

Table 4. The effects of anticompetitive regulations on wage premia

Regression results suggest that the effect of product market regulation on non-manufacturing wage premia is hump-shaped, with decreasing premia observed in tightly-regulated industries. While regulation is not significant and wrong-signed in the simple monotone specification, its effect on wage premia is strong, significant and broadly consistent across all non-monotone specifications. There is some evidence that wage premia increase with unionisation. However, this effect is weakly significant, perhaps reflecting the fact that, in many EU countries, unionisation is a poor proxy for workers' bargaining power, due to differences in coverage of collective agreements. To the extent that these agreements cover a large share of non-unionised workers (as, for instance, in France) and such "excess coverage" varies across industries, union density underestimates true bargaining power.[24] It should also be noticed that, to the extent that union density is itself affected by regulation, the regressions estimate the effects of regulation on wage premia over and above the indirect effects through this variable.[25] Finally, replacing industry dummies with country-independent

23. Variables that turned out to be insignificant in all of them were omitted from the table. Such insignificant variables included industry and country-specific average firm size. Full regression results are available from the authors upon request.

24. If excess coverage were the same across industries, its effect on premia would be captured by the country dummies. Unfortunately, data on excess coverage by industry is lacking. We tried to proxy industry-specific excess coverage by interacting union density with various measures of (national) coverage and excess coverage, but the interaction terms were always insignificant, and so was excess coverage itself.

25. Nicoletti *et al.* [2001] provide evidence that anticompetitive product market regulations positively affect average firm size. However, the potential bias induced by this indirect effect appears to be negligible in actual estimations and results do not change when these variables are instrumented. Peoples [1998] shows that union density has declined after liberalisation in some non-manufacturing industries. Blanchard and Giavazzi [2001] suggest that low product market rents should be associated with low union density because the incentives for union membership become weaker as the rents to be shared decline.

variables suggests that there are significant "structural" influences on wage premia that are unrelated to regulation or union density. Premia tend to be higher in industries characterised by lower entry rates and larger firms, the latter effect possibly reflecting both an efficiency-wage phenomenon and stronger bargaining power of workers in large firms.[26]

To illustrate the hump-shape in the estimated premia/regulation relationship, Figure 4 plots the wage premia predicted by the indicators of industry-level regulations (net of other country and industry-specific effects) against the regulatory indicators themselves. The fact that wage premia should decrease with regulation, above a certain level, is not intuitive. Still, a plausible explanation is that pervasive anticompetitive regulation increases the possibility of x-inefficiency, leading to both low labour productivity and wages. Interestingly, however, the decreasing part of the hump-shape mostly describes the relationship between regulation and wages in countries/industries that are dominated by public-owned incumbents. This calls for a study of the role played by public ownership and its interaction with product market regulation in the appropriation of rents by workers.

Figure 4. Wage premia and regulation in non-manufacturing industries: partial correlation

IV. The role of public ownership: theory and empirics

1. Public monopoly and wage premia

In order to make clear how and why public ownership could interfere with regulation in determining wage premia, let us use a variant of the model of rent sharing under wage bargaining laid out in Section 1, and consider a public-owned firm. In this case, the employer does not seek to maximize profits. According to Shleifer and Vishny [1994], one way to stylize the behavior of a public employer (a 'politician', in their

26. The positive relationship between wages and firm size, even after controlling for observable worker characteristics and other job attributes, is a common empirical finding [for a review, see Oi and Idson, 1999].

wording) is to assume that he/she intends to maximize excess employment, that is 'employees in excess of what is needed to efficiently produce its output'.[27] The employer's problem is then:

$$\underset{p,L,L_c}{Max}\{L - L_c\}$$
$$s.t. \begin{cases} L_c = D(p) \\ pL_c - wL \geq 0 \end{cases},$$

where L_c denotes "productive" employment. The second constraint is necessarily binding at the optimum (total labor is raised until exhausting profits). Therefore, $L - L_c = \frac{p-w}{w} L_c$, and the level of productive employment is equal to $L^*(w)$, the level employment that would be hired in a similar, private-owned firm. The implied markup ratio (equal to p/w, given the production function) is also the same as for a private-owned firm.

The Nash solution of the bargaining problem is now given by:

$$w_{public} = \arg\max_{w} \left[\left((L(w))(w - x) \right)^{\gamma} \left(L(w) - L_c(w) \right)^{1-\gamma} \right].$$

After some simple algebra, it follows that:

(3) $$w_{public} = x + \frac{\gamma}{\sigma - \gamma} x = w^* - \frac{(1-\gamma)\gamma}{(\sigma - 1)(\sigma - \gamma)} x .$$

This shows unambiguously that wage premia are lower in the public-owned than in the private-owned firm.[28] Moreover, the public-private gap increases with restrictions to competition (*i.e.* as σ declines) because the

27. However, it can be checked easily that assuming the employer to maximize total employment, instead of excess employment, would lead to the same outcome.

28. The gap is nil when the bargaining power of the union is zero (the rent is always zero in this case), and when the bargaining power of the employer is zero (the nature of the employer does not have any influence on wages). Between these bounds, the public-private gap is increasing up to a point, and then decreasing (the maximum is reached for the value of γ such that $\sigma - 2\sigma\gamma + \gamma^2 = 0$).

lack of competitive pressures widens the scope for differences in the behavior of private and public employers. Interestingly, this implies, given the markup ratio, that the price set by the public-owned firm is also lower than the one set by the private firm.

The total rent accruing to workers and/or the employer is thus larger for private firms. However, the main difference has to do with the way this rent is shared. Since the objective of the public employer is not directly to appropriate part of the rent, the whole rent accrues to workers. Nevertheless, the employer modifies the way the rent is distributed to workers: in public-owned firms, workers benefit not only from a pecuniary, but also from a non-pecuniary rent (here, excess employment). In practice, non-pecuniary rents can take the form of weak work incentives (e.g. lack of monitoring), inefficient utilisation of inputs (e.g. labour hoarding) and other business practices that induce firms to operate within the efficiency frontier (so-called X-inefficiency) while increasing the utility of workers. These competing explanations can hardly be disentangled, chiefly because no good proxies exist for x-inefficient outcomes or non-pecuniary rents.[29] However, since the result of any of these practices is to reduce pecuniary rents accruing to workers as compared to private-owned firms, the model laid out above can be tested by distinguishing the influence of public ownership and other regulations on wage premia.

2. <u>Testing public monopoly</u>

To reach a testable model specification, note that typically public and private-owned firms coexist in many industries of OECD countries. Therefore, the measured wage premia reflect the average of bargaining outcomes in these two kinds of firms. In other words, such average premia will be:

$$\overline{w} = (1-\alpha)\, w^{*} + \alpha\, w_{public},$$

29. Our attempts to test the hypothesis of non-pecuniary rents were unsuccessful. Using industry-specific data on average job tenure available in the OECD Employment in Services database, we tried to check whether job tenure bore any relationship to anticompetitive product market regulation. No such relationship was found, possibly due to the few degrees of freedom available for the panel regressions (once job tenure data were crossed with product market regulation indicators, only around 60 observations remained).

where $0 \leq \alpha \leq 1$ is the share of public firms in the industry. Expressing wage premia as percentage deviations from the reservation wage, it can be easily shown that:

$$(4) \qquad \frac{\overline{w} - x}{x} = \gamma \mu \left[1 - \alpha \frac{\mu(1-\gamma)}{\mu(1-\gamma)+1} \right].$$

Equation (4) shows that the interactions between firms' market power, the share of public-owned firms and workers' bargaining power play a key role in determining wage outcomes. Observed wage premia are decreasing in the share of public firms, with the effect getting stronger as market power increases. Therefore, the combination of strong market power and widespread public ownership results in weak wage premia, as larger non-pecuniary rents can be granted to workers. On the other hand, *ceteris paribus*, this effect tends to be reduced as bargaining power increases -- because workers claim an increasing part of rents in pecuniary terms. Given the share of public firms, the effect on premia of simultaneous increases in market and bargaining power is ambiguous, because it will depend on how workers' rents are split between pecuniary and non-pecuniary gains. These properties are tested empirically below.

To verify the differential role played by market power, public ownership and bargaining power, we approximated in different ways equation (4), estimating several variants of the simple fixed-effects specification of Table 4 (henceforth the "basic model"). To this end, we exploited the fact that public ownership was accounted for, among other aspects, in the indicators of product market regulations used above. Therefore, the indicators could be split into two components, reflecting respectively the extent of public ownership, and of other anticompetitive regulations (i.e. legal barriers to entry, restrictions to business operation, discretionary price controls). We estimate a version of (4) (henceforth the "public monopoly" model) in which our first-stage estimates of wage premia are regressed on bargaining power (proxied by industry-specific union densities), anticompetitive regulations (excluding public ownership) and several interactions terms between public ownership, anticompetitive regulations and bargaining power. However, including our proxy for bargaining power implies losing a lot of observations because of its reduced

coverage. Therefore, we also estimated the same equation excluding union densities. While the omission of this variable (and the related interaction terms) may bias the magnitude of the estimated coefficients, it should not induce any error in their sign. Finally we checked, by means of non-nested tests, whether the public monopoly model improves upon the basic model in explaining the pattern of wage premia.

Table 5. The effects of public monopoly in non-manufacturing industries

Regression results provide some support for the public monopoly model (Table 5). As in Table 4, union density still exerts a positive, but less significant, influence on premia and, as expected, its omission biases the coefficient estimate for regulation. More importantly, anticompetitive regulation (other than public ownership) has a significant positive impact on wage premia, while its combination with public ownership explains the falling part of the hump shape. Thus, wage premia fall as restrictions to competition are coupled with state control of business sector enterprises. No clear result is found for the other interaction terms, though there is a tendency for the combination of regulation and union density to lower premia, suggesting that non-pecuniary rents may become more important in tightly regulated and unionised industries when part of them is public-owned.[30]

A further question is whether the public monopoly model is a better explanation of the observed hump shape in wage premia than the basic model tested in the previous section. Given the way regulatory indicators are constructed, the two models cannot be considered as nested. Since the two model specifications are non-nested, we carried out tests following the procedure of Davidson and McKinnon [1981]. The results strongly support the public monopoly model as the best one.[31]

30. As a further check of the source of non-monotonicity in wage premia, we also looked at whether public ownership or the square of regulation (other than public ownership) per se contribute to explain the hump-shape resulting from the basic model of Table 4 by decomposing the square of the regulation term into its different terms. Regression results show that neither public ownership nor the square of regulation (other than public ownership) per se can explain the hump-shape in wage premia.

31. We first test the null of the "public monopoly" model against the "basic model", in which premia depend on regulation and its square; then we test the null of the "basic model" against the alternative of the "public monopoly" model. In each of these tests, the null is rejected if the t-statistic associated with the predicted value of the alternative model is significant. The results in Table 5 suggest that the predicted value of the "basic model" does not help explain wage premia, while the predicted value of the "monopoly model" does (at the 1 per cent level of significance when bargaining power is accounted for)

V. Concluding remarks

In this paper we applied the two-step methodology pioneered by Dickens and Katz [1987] and Katz and Summers [1989] to look at the effects of product market competition on wage premia. Instead of using data on individual workers in a single country, we focused on categories of workers (classified according to observable characteristics) in a cross-section of industries and countries. Market conditions were instrumented by a new set of industry and country-specific indicators of regulation that include both restrictions to competition and public ownership. These variables have the advantage of being more exogenous to wage outcomes than other measures of product market competition. Our results suggest that restrictions to competition do increase wage premia, as predicted by rent-sharing models, even accounting for the bargaining power of workers. However, when all types of regulations are considered together, wage premia are found to depend positively on overall product market regulation and negatively on its square.

The resulting hump-shape in wage premia could be related to a number of factors, such as widespread inefficiencies in tightly regulated industries that reduce the total size of rents. While our data cannot rule out all competing hypothesis, we are able to exploit the detail contained in our regulatory indicators to trace the likely source of the hump-shape. We find that the combination of tight entry regulation and public ownership plays an important role. A simple model of wage bargaining under product market regulation shows how the different objective of a public employer induces a different nature, and a different sharing of rents. Rents accrue entirely to workers in this case, but they take partly a non-pecuniary form. As a result, the pecuniary rents, as measured by our estimates of wage premia, are smaller than in private-owned firms. This best explains why in industries dominated by public monopolies the estimated wage premia are relatively low.

Further work should be aimed at disentangling the role played by non-pecuniary rents from the possibility that smaller wage premia are caused by x-inefficiencies that lock certain countries/industries into a low productivity trap. To this end, better data are needed to proxy for the various forms non-pecuniary rents may take (*e.g.* weak work incentives, inefficient utilisation of inputs, etc.). Our investigation focused on non-manufacturing industries, where restrictive regulations and public enterprises are widespread and better

covered by our data. A useful extension of the analysis would be to check whether regulation can also help explain differences in wage premia in manufacturing industries.

DATA ANNEX

Industry-specific product market regulation in 1998: coverage and sources

Industry	ISIC code Revision 3	Regulatory and market dimensions covered[1]	Industrial segments covered	Countries covered	Main sources[2]
Electricity and gas	**40**	E, PO, VI	Prod., Trans., Dist.	25	OECD, EC, PI, WB
of which:					
Electricity	401	P, E, PO, MS, VI E, PO, VI	Prod., Trans., Dist.	24-25 21	OECD
Gas manufacture and distribution	402	P, E, PO, MS, VI E, PO, MS, VI	Prod., Trans., Dist.	26 21	OECD, EC, PI, WB
Water works and supply	**41**	E, PO, VI		23	OECD, EC, PI, WB
Retail trade	**52**	E, CBO		28	OECD
Restaurant and hotels	**55**	E		25	OECD
Land transport	**60**	P, E		27	OECD, ECMT
of which:					
Railways	601	P, E, PO, MS, VI E, PO, MS, VI	Passenger, freight	27 21	OECD, ECMT
Road freight	602	P, E, CBO P, E		27-29 21	OECD
Water transport	**61**	E, CBO		22	APC
Air transport	**62**	E, PO, MS E, PO	Passenger	27 21	OECD OECD, EC
Auxiliary trans. activities	**63**	E, PO		21	OECD
Post, Telecommunications	**64**	P, E, PO, MS		26	OECD
of which:					
Post	641	P, E, PO, VI	Letter, parcel, express	22-26 21	OECD, EC, UPU
Telecoms	642	P, E, PO, MS, VI E, PO, MS	Fixed, mobile	20-29 21	OECD
Financial intermediation	**65**	E, CBO		23	OECD, APC
Insurance	**66**	P, E	Life, general, health	12	OECD
Other business services	**74**	E, CBO		22	APC
of which:					
Legal services	7411	E, CBO		22	APC
Accounting services	7412	E, CBO		23	APC
Architectural and engineering services	7421	E, CBO		23	APC

Note 1 :
- P = Price regulation
- E = Barriers to entry
- PO = Public ownership
- CBO = Constraints to business operation
- MS = Market structure
- VI = Vertical integration

Note 2 :
- ECMT = European Conference of Ministers of Transportation
- EC = European Commission
- WB = World Bank
- PI = Privatisation International
- APC = Australian Productivity Commission
- UPU = Universal Postal Union

Coding assumptions for indicators of regulation used in empirical analysis

Sector	Item in indicator	Weights	Description	Weights	Coding
Electricity					
	Entry	*1/3*	Average of three indicators: existence and features of third party access (TPA), existence of a liberalised power market (PM), thresholds for free choice of supplier (FC).	*1/3* *1/3* *1/3*	TPA = Regulated:0, Negotiated:2, Single Buyer:4, or None:6. PM = Yes: 0, No = 6 FC = 0GW: 0, <251GW: 1, <501GW: 2, <1001GW: 3, ≥ 1001 GW 4 no choice
	Vertical integration	*1/3*	Average of two indicators: vertical separation between generation and transmission (GTS); and overall vertical separation between generation, transmission, distribution and supply (OS)	*1/2* *1/2*	GTS = integrated: 6; accounting separation: 3; separate companies: 0 OS = integrated (incl. accounting separation): 6; some segments unbundled: 3; complete unbundling: 0
	Public ownership	*1/3*	Share of government in major companies		Private: 0; mostly private: 1.5; mixed: 3; mostly public: 4.5; public: 6
Gas manufacture and distribution					
	Entry	*1/3*	Average of indicators of degree of entry regulation in gas production (P), transportation (T) and distribution (D)	*1/3*	In each industry segment = regulated: 6; partly regulated: 3; unregulated: 0
	Vertical integration	*1/3*	Degree of separation between competitive and non-competitive activities		Full separation between P, T and D: 0; full separation between P and T/D: 1.5; some separation between P and T/D: 3; some separation between T and D: 4.5; no separation: 6
	Public ownership	*1/3*	Share of government in major companies		Public owned: 6; mixed private/public: 3; private: 0
Water works and supply					
	Entry	*1/3*	Degree of entry regulation in water treatment and distribution		Regulated: 6; partly regulated: 3; unregulated: 0
	Vertical integration	*1/3*	Degree of separation between competitive and non-competitive activities		Full separation (economy-wide): 0; utilities are unbundled in certain areas or to a certain extent: 3; no separation: 6
	Public ownership	*1/3*	Share of government in major companies		Public owned: 6; mixed private/public: 3; private: 0
Retail trade [1]					
	Entry	*0.42*	Average of three indicators: need to register business (RB), need to get license of permit (LP), special regulation for large outlet (LO)	*0.35* *0.34* *0.31*	RB = no or no delay for approval: 0; yes and delay for approval < 16 days: 1.5; yes and delay for approval < 31 days: 3; yes and delay for approval < 71 days: 4.5; yes and delay for approval > 70 days: 6 LP = no: 0; yes: 2; yes and license product-specific: 4; yes and license activity-specific: 4; yes and license product- and activity-specific: 6 LO = no: 0; yes and threshold > 4999m^2: 1; yes and threshold > 2999m^2: 2; yes and threshold > 1999m^2: 3; yes and threshold > 999m^2: 4; yes and threshold > 500m^2: 5; yes and threshold < 501m^2: 6
	Constraints to business operation	*0.34*	Average of two indicators: shop opening hours are regulated (OH); existing firms are protected (PF)	*0.59* *0.41*	OH = no: 0; yes, at local level, regulation eased in last 5 years: 3.5; yes, at local level: 4; yes, at national level, regulation eased in last 5 years: 5.5; yes, at national level: 6 PF = no: 0; yes, some products enjoy legal monopoly but professional bodies not involved in licensing: 3; yes, professional bodies involved in licensing but no products enjoy legal monopoly: 3; yes, some products enjoy legal monopoly and professional bodies involved in licensing: 6
	Price controls	*0.24*	Average of indicators for generic controls and controls on staples, gasoline,tobacco, alcohol, pharmaceuticals, other goods	*1/7*	No controls: 0; controls: 6
Restaurants and hotels					
	Entry		Existence of legal barriers to entry		Yes: 6; No: 0

Coding assumptions for indicators of regulation used in empirical analysis (continued)

Railways					
	Entry	*1/2*	Average of legal barriers to entry in passenger and freight businesses	*1/2*	Legal monopoly or compliance with EC directive: 6; Regulated entry or open tendering franchise: 3; Free entry: 0
	Prices	*1/2*	Average of indicators of basis for regulation (BR), mode of regulation (MR), target of regulation (TR) for network access (NA), passenger services (PS) and freight services (FS) and indicators of min coverage of costs requirements (MC) and rate of return regulation (ROR)	*1/8*	ROR = no: 0; yes: 6
				1/8	MC = no: 6; yes: 0
					Network access and passenger services:
				1/8	BR = benchmark: 0; costs: 3; discretional: 4.5; unregulated: 6
				1/8	MR = approved by regulator: 0; set by regulator: 3; unregulated: 6
				1/8	TR = price cap: 0; price level: 3; discretional: 4.5; unregulated: 6
					Freight services:
				1/8	BR = benchmark: 3; costs: 6; discretional: 4.5; unregulated: 0
				1/8	MR = approved by regulator: 3; set by regulator: 6; unregulated: 0
				1/8	TR = price cap: 3; price level: 6; discretional: 4.5; unregulated: 0
Road freight [1]					
	Entry	*0.85*	Average of three indicators: Involvement of professional bodies in entry and pricing (PB), licencing requirements (LR), foreign discrimination (FD)	*0.33*	PB = not involved: 0; involved in entry: 3; involved in pricing: 3; involved in entry and pricing: 6
				0.33	LR = license required, granted with discretion, capacity restrictions allowed: 6; license required, granted with discretion: 3; license required, capacity restrictions allowed: 3; license required, no discretion, no capacity restrictions: 2; no requirements: 0
				0.26	FD = no discrimination: 0; prohibition of cabotage: 6; limitation of cabotage: 3
				0.08	domestic carrier requirements for public traffic: 6; restrictions on freight pick up: 6; other constraints: 6
	Prices	*0.15*	Extent of price regulation		No regulation: 0; guidelines given to companies: 3; regulated: 6
Water transport [2]					
	Entry	*1/2*	Restrictions on establishment for domestic and foreign companies		No restrictions: 0; max restrictions: 6
	Constraints to business operation	*1/2*	Restrictions on ongoing operations for domestic and foreign companies		No restrictions: 0; max restrictions: 6
Air transport [3]					
	Entry	*1/2*	Average of indicators for entry in domestic routes (DR) and international routes (IR)	*Share of internation al traffic in total*	DR = Domestic market liberalised: 0; domestic market not liberalised: 6 IR = No regional aviation market , no open sky agreement: 6; regional aviation market, no open sky agreement: 3; no regional aviation market, open sky agreement: 3; regional aviation market and open sky agreement: 0
	Public ownership	*1/2*	Percent share of government in major airline (SH)		6*SH/100
Auxiliary transport activities					
	Entry	*1/2*	Existence of legal barriers to entry, average for land, water and air transport	*1/3*	Yes: 6; No: 0
	Public ownership	*1/2*	Presence of government enterprises, average for land, water and air transport	*1/3*	Yes: 6; No: 0

Coding assumptions for indicators of regulation used in empirical analysis (end)

Post					
	Entry	*1/4*	Average of indicators of degree of entry regulation in basic letter, basic parcel and courier services	*Revenue shares of the three activities in 1999*	In each activity = regulated: 6; partly regulated: 3; unregulated: 0
	Public ownership	*1/4*	Average of indicators of degree of public ownership in basic letter, basic parcel and courier services		In each activity = public owned: 6; mixed private/public: 3; private: 0
	Prices	*1/4*	Average of indicators of degree of retail price regulation in basic letter, basic parcel and courier services		In each activity = regulated: 6; partly regulated: 3; unregulated: 0
	Market structure	*1/4*	Average of indicators of market concentration in basic letter, basic parcel and courier services		In each activity = no dominant market player in relevant market: 0; one participant has more than 50% market share in relevant market or many local de facto monopolies: 3; one participant has more than 90% market share in relevant market: 6
Telecommunications [4]					
	Entry		Average of indicators of entry restrictions in trunk, international and mobile communications		In each activity = legal monopoly: 6; legal duopoly: 3; free entry: 0
	Market structure		Average of indicators of market structure in trunk, international and mobile communications	*Revenue shares of the three activities in 1999*	In each activity = 6*market share of new entrants
	Prices	*1/2*	Average of indicators of retail price regulation (RP) in trunk, international and mobile telephony		*Trunk and international:* RP = price cap: 0; cost based: 2; discretionary: 4; unregulated: 6 *Mobile:* RP = price cap: 3; cost based or discretionary: 6; unregulated: 0
		1/2	Indicator of price regulation for network access (NA) in fixed telephony		NA = cost-based, mandatory disclosure: 0; cost based, no mandatory disclosure: 1.5; discretional, no mandatory disclosure: 3; unregulated, mandatory disclosure: 4.5; unregulated, no mandatory disclosure: 6
	Public ownership		Percent share of government in incumbent operator (SH)		6*SH/100
Financial intermediation [2]					
	Entry		Restrictions on establishment for domestic and foreign companies		No restrictions: 0; max restrictions: 6
	Constraints to business operation		Restrictions on ongoing operations for domestic and foreign companies		No restrictions: 0; max restrictions: 6
Insurance					
	Entry	*1/2*	Average of indicators of the degree of entry restrictions in life, general and health insurance	*1/3*	In each activity = license required, minimum capital requirements: 6; license required, no min capital requirements: 3; no license required: 0
	Prices	*1/2*	Average of indicators of the degree of price restrictions in life, general and health insurance	*1/3*	In each activity = restricted: 6; partly restricted: 3; unrestricted: 0
Other business services [2]					
	Entry		Restrictions on establishment for domestic and foreign companies		No restrictions: 0; max restrictions: 6
	Constraints to business operation		Restrictions on ongoing operations for domestic and foreign companies		No restrictions: 0; max restrictions: 6

Notes:

1. Weights based on factor analysis. For details, see O. Boylaud and G. Nicoletti (2000) "Regulatory reform in road freight and retail distribution", OECD Economics Department Working Paper, No. 255
2. For precise coding and weights, see Australian Productivity Commission at http://www.pc.gov.au/research/memoranda/servicesrestriction/index.html
3. For more details, see R. Gonenc and G. Nicoletti (2000) "Regulation, market structure and performance in air passenger transportation", OECD Economics Department Working Paper, No. 254.
4. For more details, see O. Boylaud and G. Nicoletti (2000) "Regulation, market structure and performance in telecommunications", OECD Economics Department Working Paper, No. 237.

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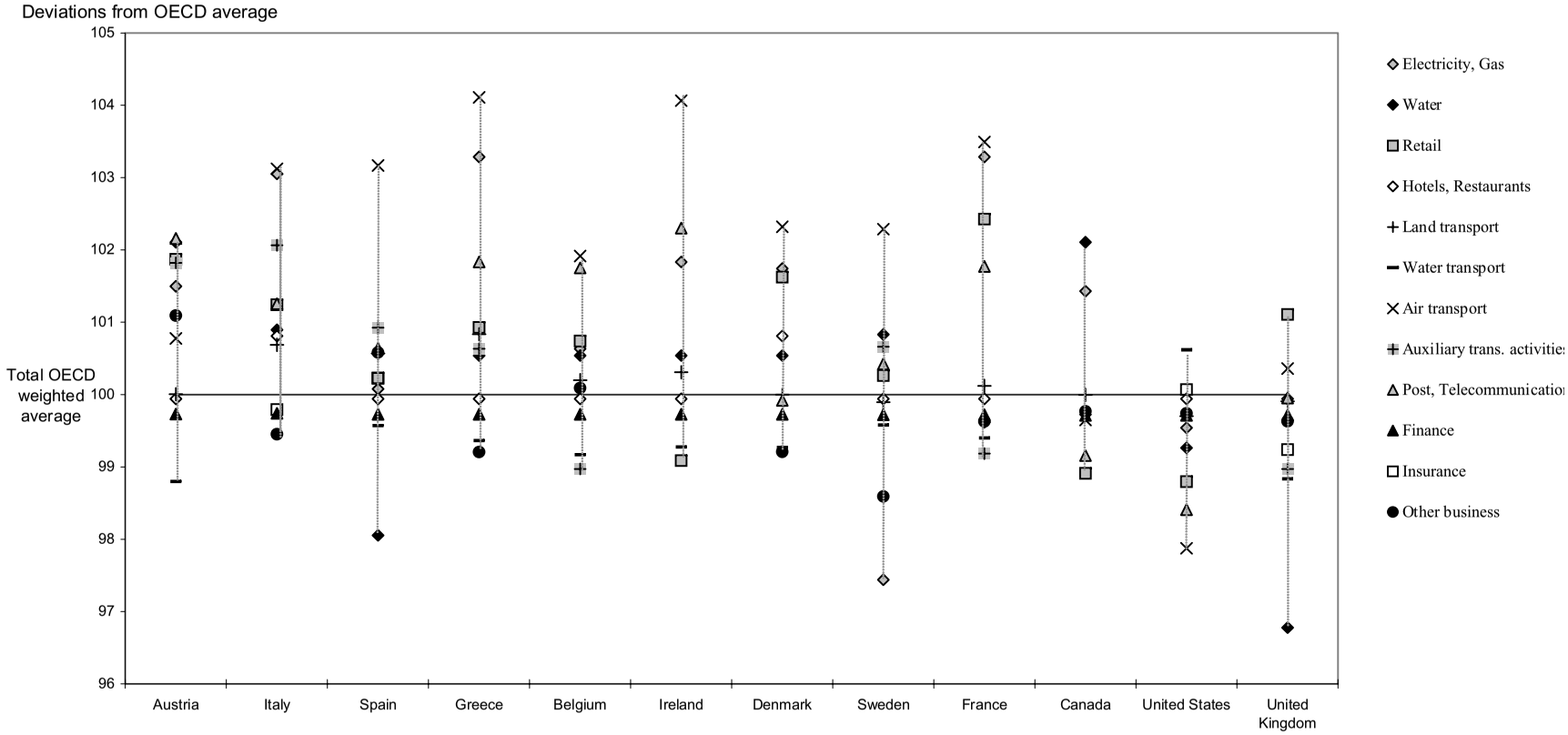
Figure 1. **Regulation in non-manufacturing industries[1], 1998**
(increasingly anticompetitive)



1. Depending on the industry, the indicators cover barriers to entry, price controls, restrictions to business operation, public ownership, market structure and vertical integration. See Data Annex for details.

Source : Nicoletti and Scarpetta, 2003.

Figure 2. **The variance of regulation and wage premia across non-manufacturing industries**

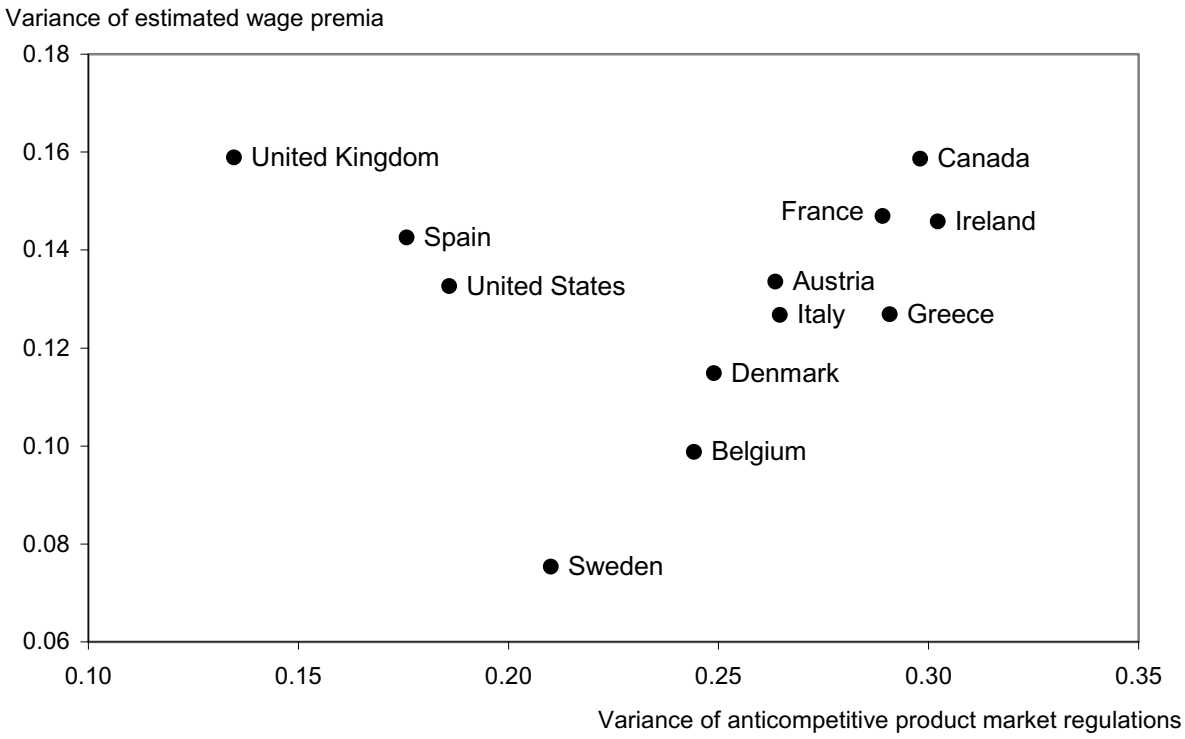
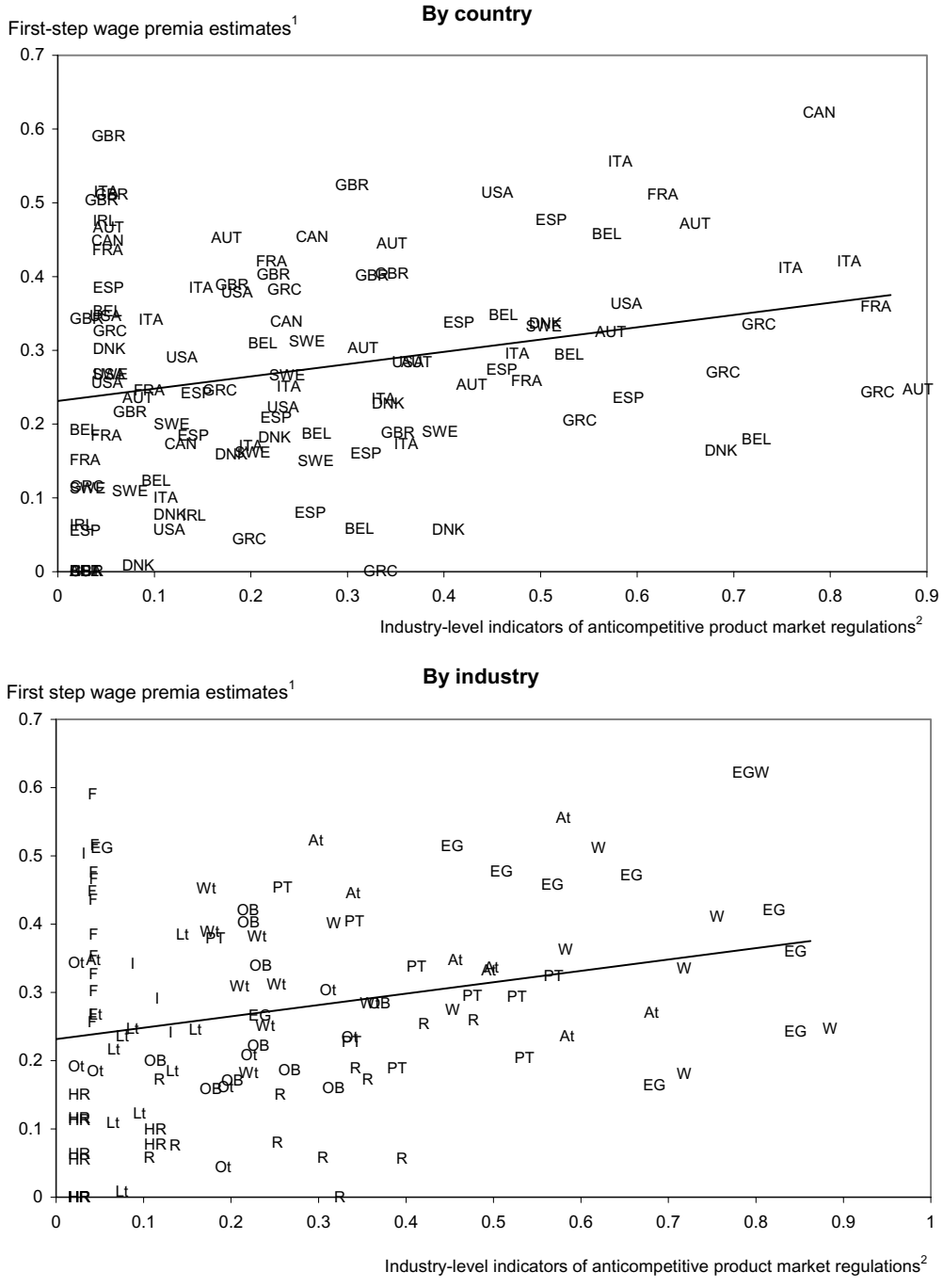


Figure 3. **Wage premia and regulation in non-manufacturing industries**

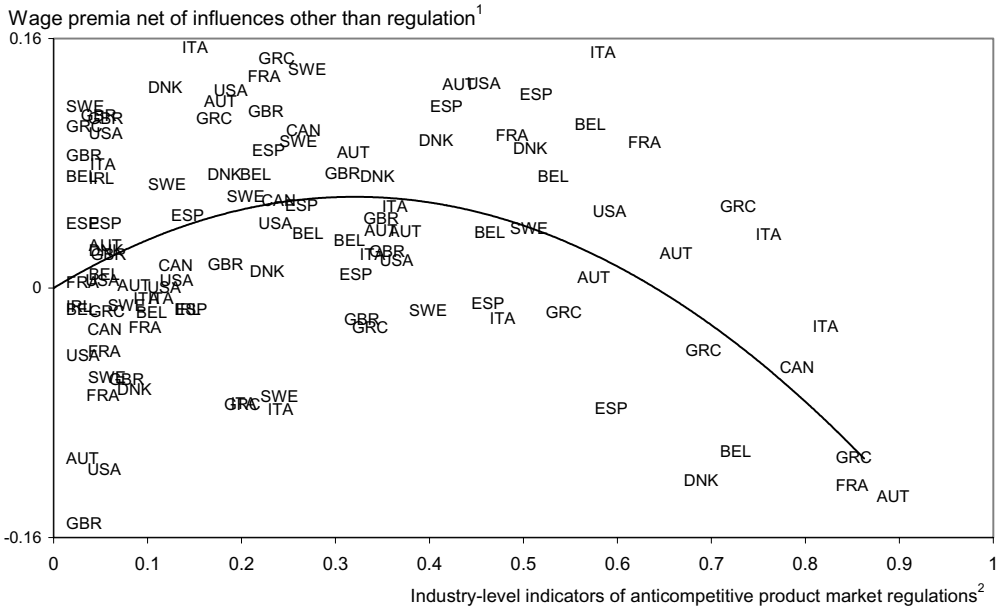


EG:	Electricity, Gas	At:	Air transport
W:	Water	Ot:	Auxiliary trans. activities
R:	Retail trade	PT:	Post, Telecommunications
HR:	Hotels, Restaurants	F:	Financial intermediation
Lt:	Land transport	I:	Insurance
Wt:	Water transport	OB:	Other business activities

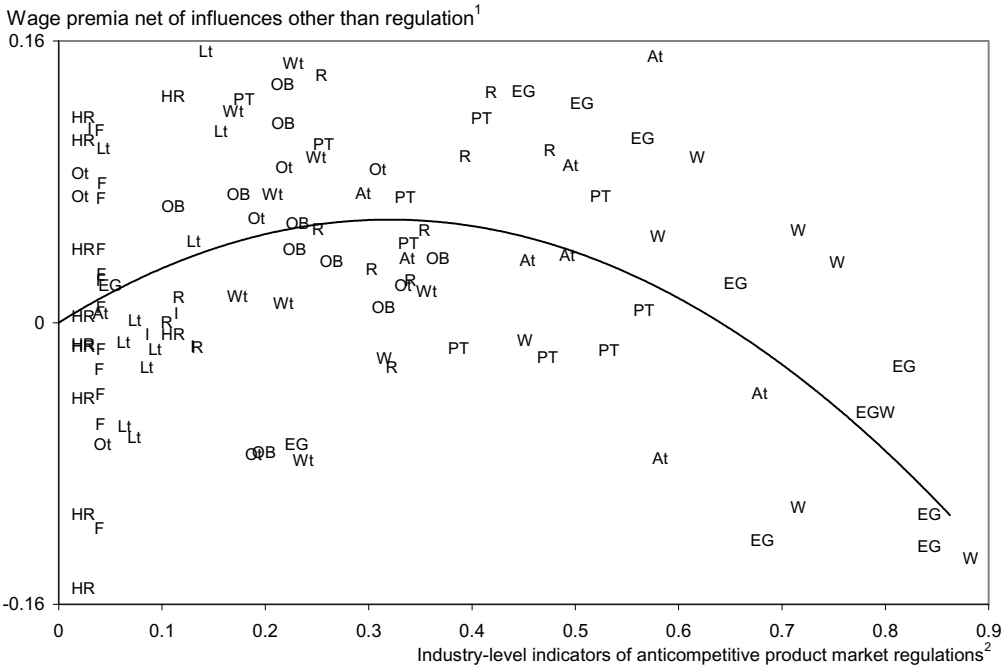
1. Wage premia estimates reported in Table 3.
2. Increasing with restrictions to competition

Figure 4 . **Wage premia and regulation in non-manufacturing industries: partial correlation**

By country



By industry



EG:	Electricity, Gas	At:	Air transport
W:	Water	Ot:	Auxiliary trans. activities
R:	Retail trade	PT:	Post, Telecommunications
HR:	Hotels, Restaurants	F:	Financial intermediation
Lt:	Land transport	I:	Insurance
Wt:	Water transport	OB:	Other business activities

1. Net wage premia are the first step estimates of wage premia net of the country and industry fixed effects estimated in Table 4 (column 1).
2. Increasing with restrictions to competition

Table 1. **Characterising industries by average firm size, entry rates and skills** [1]

Average sector characteristics
(per cent)

	Entry rate[2]	**Share of skilled workers in sector employment**	**Share of firms with more than 50 employees**[4]
Sample	*9 OECD countries 1978-1998*	*16 OECD countries from 1994 to 1998*[3]	*17 OECD countries average 1993-1997*
Total manufacturing	9.6	20.1	79.5
Food products and beverages	8.2	12.2	81.1
Tobacco	8.2	16.9	98.9
Textiles	10.6	9.5	76.6
Wearing apparel, dyeing of fur	10.6	5.7	66.0
Dressing of leather, luggage	10.6	4.1	69.3
Wood, except furniture	9.3	7.6	56.8
Pulp, paper and paper products	9.7	11.4	87.6
Publishing, printing	9.7	28.6	70.8
Coke, petroleum products	9.2	38.3	88.6
Chemicals	8.8	33.4	93.0
Rubber and plastics products	9.0	13.7	75.7
Other non-metallic mineral products	8.7	12.8	76.0
Basic metals	8.6	13.9	94.2
Metal products, except machinery and eq.	9.0	11.2	61.8
Machinery and equipment n.e.c.	9.0	18.8	79.2
Office machinery, computers	13.3	53.2	83.5
Electrical machinery n.e.c.	9.5	21.3	84.9
Radio, television and communication eq.	11.4	35.3	88.7
Medical and optical instruments	9.5	32.5	79.5
Motor vehicles	8.1	14.1	93.4
Other transport equipment	10.0	26.7	93.1
Services			
Electricity, Gas, water	7.9	24.7	97.5
Electricity, Gas	7.9	32.3	94.9
Water	7.9	27.3	88.1
Construction	11.4	12.8	55.6
Sale and repair of motor vehicles	10.9	14.4	47.7
Wholesale trade	10.9	30.1	59.7
Retail trade	10.9	16.5	69.8
Hotels and restaurants	14.5	12.2	52.9
Transport	11.3	19.6	77.5
Land transport	11.3	6.2	73.5
Water transport	11.3	28.9	83.0
Air transport	11.3	26.9	89.8
Auxiliary transport activities	11.3	20.8	77.1
Post and telecommunications	17.3	30.1	94.7
Financial intermediation	8.7	40.9	97.9
Insurance and pension funding	9.1	46.4	99.1
Auxiliary financial activities	14.6	41.6	59.5
Real estate activities	12.5	27.2	51.8
Renting of manchinery and eq.	13.7	17.0	60.7
Computer and related activities	19.7	72.1	68.5
Research and development	17.1	71.3	77.2
Other business activities	14.6	38.8	68.8

1. Estimated industry fixed effects in panel regressions of entry data, the share of the large firms and the share of the skilled workers on country and industries dummies.
2. Entry rates for industry branches in which data were missing were assumed to be identical to the entry rates for the aggregates.
3. 1994 for France, 1996 for Sweden, 1995 for other EU countries and 1998 for non-EU countries.
4. In total employment of firms with more than 10 employees.

Table 2. **Estimates of earnings profiles**
Wages and observable workers characteristics

(estimated on a hourly basis for full-time workers)

	Austria	Belgium	Canada	Denmark	France	Greece	Ireland	Italy	Spain	Sweden	United Kingdom	United States
Gender												
Male	-	-	-	-	-	-	-	-	-	-	-	-
	(0.65)	(0.69)	(1.00)	(0.63)	(0.67)	(0.64)	(0.58)	(0.71)	(0.75)	(0.70)	(0.58)	(0.61)
Female	-0.24	-0.16	-0.23	-0.14	-0.21	-0.19	-0.18	-0.17	-0.19	-0.11	-0.25	-0.20
	(0.35)	*(0.31)*	*(0.00)*	*(0.37)*	*(0.33)*	*(0.36)*	*(0.42)*	*(0.29)*	*(0.25)*	*(0.30)*	*(0.42)*	*(0.39)*
Age												
15-24	-	-	-	-	-	-	-	-	-	-	-	-
	(0.16)	*(0.10)*	*(0.00)*	*(0.20)*	*(0.12)*	*(0.11)*	*(0.22)*	*(0.10)*	*(0.09)*	*(0.08)*	*(0.15)*	*(0.17)*
25-34	0.19	0.22	0.38	0.22	0.30	0.21	0.36	0.21	0.33	0.16	0.33	0.22
	(0.32)	*(0.36)*	*(0.00)*	*(0.29)*	*(0.31)*	*(0.34)*	*(0.38)*	*(0.32)*	*(0.32)*	*(0.27)*	*(0.30)*	*(0.26)*
35-54	0.35	0.45	0.52	0.33	0.59	0.48	0.58	0.48	0.62	0.33	0.40	0.35
	(0.47)	*(0.51)*	*(0.00)*	*(0.43)*	*(0.53)*	*(0.48)*	*(0.36)*	*(0.53)*	*(0.50)*	*(0.54)*	*(0.44)*	*(0.46)*
55 and over	0.26	0.54	0.49	0.32	0.77	0.53	0.65	0.45	0.71	0.37	0.28	0.34
	(0.05)	*(0.04)*	*(0.00)*	*(0.08)*	*(0.03)*	*(0.07)*	*(0.04)*	*(0.05)*	*(0.09)*	*(0.11)*	*(0.11)*	*(0.10)*
Education												
Early childhood, primary	-	-	-	-	-	-	-	-	-	-	-	-
and lower secondary	*(0.32)*	*(0.34)*	*n.a.*	*(0.32)*	*(0.15)*	*(0.42)*	*(0.26)*	*(0.65)*	*(0.61)*	*(0.70)*	*(0.55)*	*(0.14)*
Upper secondary	0.23	0.12	0.16	0.10	0.06	0.08	0.18	0.19	0.23	0.09	0.10	0.23
	(0.66)	*(0.43)*	*n.a.*	*(0.50)*	*(0.60)*	*(0.46)*	*(0.54)*	*(0.29)*	*(0.19)*	*(0.15)*	*(0.30)*	*(0.57)*
Non-university tertiary	n.s.	0.28	0.22	0.20	0.26	0.18	0.35	n.s.	0.21	0.15	0.25	0.31
	(0.00)	*(0.14)*	*n.a.*	*(0.05)*	*(0.13)*	*(0.03)*	*(0.14)*	*(0.00)*	*(0.09)*	*(0.09)*	*(0.06)*	*(0.08)*
University tertiary	0.49	0.44	0.42	0.22	0.62	0.34	0.56	0.21	0.45	0.32	0.40	0.44
	(0.02)	*(0.09)*	*n.a.*	*(0.14)*	*(0.12)*	*(0.09)*	*(0.07)*	*(0.06)*	*(0.11)*	*(0.06)*	*(0.09)*	*(0.22)*
R-squared	0.75	0.91	0.96	0.93	0.90	0.93	0.92	0.88	0.96	0.90	0.95	0.97
R-squared adjusted	0.67	0.88	0.95	0.92	0.87	0.90	0.89	0.85	0.95	0.87	0.94	0.96

Note:
The dependent variable is the fixed effect obtained in the first-stage regression for each age *x* education *x* gender category. These equations are thus estimated with 32 observations for each country.
Data in parentheses are employment shares within each country's sample. They may differ from the actual employment share in the economy, as the sample is not necessarily representative.
n.a. : Not available.

Table 3. **Estimated industry wage premia**[1]

Results of first-step regressions

	Austria	Belgium	Canada	Denmark	France	Greece	Ireland	Italy	Spain	Sweden	United Kingdom	United States
Manufacturing												
Food & Beverages	-0.02	-0.03	-0.01	-0.06	-0.04	0.02	0.02	0.05	0.00	-0.01	-0.06	-0.07
	(0.03)	*(0.03)*	*(0.02)*	*(0.02)*	*(0.06)*	*(0.03)*	*(0.03)*	*(0.04)*	*(0.03)*	*(0.02)*	*(0.03)*	*(0.05)*
Tobacco	0.25	0.12		-0.06		0.27	0.26	-0.13	0.26	-0.07	0.35	0.26
	(0.04)	*(0.04)*		*(0.03)*		*(0.03)*	*(0.09)*	*(0.05)*	*(0.04)*	*(0.04)*	*(0.10)*	*(0.12)*
Textiles	-0.06	-0.13		-0.13	-0.20	-0.02	-0.15	-0.13	-0.13		-0.26	-0.09
	(0.03)	*(0.03)*		*(0.02)*	*(0.08)*	*(0.02)*	*(0.03)*	*(0.06)*	*(0.03)*		*(0.04)*	*(0.07)*
Wearing apparel	-0.21	-0.09		-0.14	-0.28	-0.15	-0.17	-0.23	-0.17	-0.19	-0.26	-0.21
	(0.05)	*(0.03)*		*(0.03)*	*(0.07)*	*(0.03)*	*(0.04)*	*(0.05)*	*(0.03)*	*(0.02)*	*(0.04)*	*(0.06)*
Leather	-0.20	-0.10		-0.15	-0.34	-0.09	-0.30	-0.24	-0.17	-0.09	-0.21	-0.15
	(0.03)	*(0.03)*		*(0.03)*	*(0.10)*	*(0.03)*	*(0.04)*	*(0.07)*	*(0.03)*	*(0.02)*	*(0.05)*	*(0.07)*
Wood	-0.12	-0.13		-0.10	0.38	-0.02	-0.19	-0.18	-0.20	-0.06	-0.15	-0.08
	(0.03)	*(0.03)*		*(0.02)*	*(0.05)*	*(0.04)*	*(0.03)*	*(0.05)*	*(0.02)*	*(0.03)*	*(0.04)*	*(0.05)*
Pulp & Paper	0.00	0.03		-0.02	0.05	0.06	0.04	-0.01	0.08	0.07	0.00	0.08
	(0.03)	*(0.03)*		*(0.02)*	*(0.06)*	*(0.03)*	*(0.02)*	*(0.06)*	*(0.03)*	*(0.03)*	*(0.04)*	*(0.05)*
Printing & Publishing	0.13	0.02		0.12	0.04	0.03	0.15	0.08	0.07	0.03	0.17	-0.03
	(0.04)	*(0.02)*		*(0.02)*	*(0.08)*	*(0.03)*	*(0.03)*	*(0.05)*	*(0.03)*	*(0.02)*	*(0.03)*	*(0.06)*
Coke, Petroleum	0.45	0.20		0.15	0.25	0.39		0.20	0.43	0.11	0.23	0.19
	(0.05)	*(0.04)*		*(0.02)*	*(0.05)*	*(0.05)*		*(0.04)*	*(0.03)*	*(0.03)*	*(0.04)*	*(0.07)*
Chemicals	0.11	0.13		0.06	0.13	0.15	0.11	0.09	0.12	0.08	0.11	0.10
	(0.03)	*(0.02)*		*(0.02)*	*(0.05)*	*(0.03)*	*(0.02)*	*(0.04)*	*(0.02)*	*(0.04)*	*(0.02)*	*(0.05)*
Rubber & Plastics	0.02	0.02		-0.05	-0.09	-0.04		-0.06	0.03	0.01	-0.10	-0.02
	(0.03)	*(0.02)*		*(0.01)*	*(0.05)*	*(0.03)*		*(0.05)*	*(0.03)*	*(0.02)*	*(0.03)*	*(0.05)*
Non-metallic mineral	0.07	-0.01		-0.04	0.00	0.05	-0.03	-0.06	0.04	0.01	-0.12	-0.01
	(0.03)	*(0.02)*		*(0.02)*	*(0.05)*	*(0.02)*	*(0.03)*	*(0.05)*	*(0.02)*	*(0.05)*	*(0.03)*	*(0.06)*
Basic metals	0.07	0.08		-0.07	-0.01	0.09	0.13	-0.03	0.14	0.07	-0.07	0.10
	(0.03)	*(0.02)*		*(0.02)*	*(0.07)*	*(0.03)*	*(0.03)*	*(0.06)*	*(0.03)*	*(0.03)*	*(0.04)*	*(0.06)*
Fabricated metal	0.01	-0.08		-0.09	-0.04	-0.03	-0.09	-0.09	0.04	-0.05	-0.07	-0.02
	(0.03)	*(0.02)*		*(0.02)*	*(0.05)*	*(0.03)*	*(0.02)*	*(0.05)*	*(0.02)*	*(0.03)*	*(0.03)*	*(0.05)*
Machinery & equipment	0.06	-0.07		-0.08	0.00	0.07	-0.06	-0.05	0.11	-0.05	-0.02	0.08
	(0.04)	*(0.02)*		*(0.02)*	*(0.06)*	*(0.03)*	*(0.02)*	*(0.04)*	*(0.03)*	*(0.02)*	*(0.03)*	*(0.05)*
Office machinery	0.15	-0.09		-0.04	0.08		0.00	0.11	0.16	0.03	0.21	0.09
	(0.05)	*(0.04)*		*(0.02)*	*(0.13)*		*(0.03)*	*(0.05)*	*(0.05)*	*(0.05)*	*(0.04)*	*(0.06)*
Electrical machinery	0.15	-0.02		-0.11	-0.04	0.03	-0.02	-0.05	0.07	-0.05	-0.07	0.06
	(0.04)	*(0.02)*		*(0.02)*	*(0.06)*	*(0.03)*	*(0.03)*	*(0.04)*	*(0.02)*	*(0.04)*	*(0.03)*	*(0.05)*
Radio, television	0.13	0.12		-0.12	-0.01	0.05	0.00	0.01	0.09	0.03	-0.01	0.14
	(0.03)	*(0.03)*		*(0.02)*	*(0.06)*	*(0.05)*	*(0.03)*	*(0.05)*	*(0.03)*	*(0.03)*	*(0.03)*	*(0.06)*
Instruments,Watches	0.07	-0.01		0.00	0.03	-0.09	-0.01	-0.05	-0.03	-0.01	-0.03	0.11
	(0.03)	*(0.02)*		*(0.02)*	*(0.07)*	*(0.03)*	*(0.02)*	*(0.05)*	*(0.03)*	*(0.03)*	*(0.03)*	*(0.05)*
Motor vehicles	0.04	0.08		-0.15	-0.14	0.03	-0.13	-0.12	0.15	0.03	0.05	0.20
	(0.03)	*(0.02)*		*(0.02)*	*(0.05)*	*(0.05)*	*(0.04)*	*(0.05)*	*(0.03)*	*(0.03)*	*(0.04)*	*(0.06)*
Other transport equip.	0.01	0.06		-0.07	0.07	0.28	-0.02	0.00	0.14	0.00	0.05	0.21
	(0.03)	*(0.03)*		*(0.02)*	*(0.06)*	*(0.03)*	*(0.05)*	*(0.06)*	*(0.03)*	*(0.04)*	*(0.03)*	*(0.05)*

1. In logarithm, compared to the economywide, employment weighted, average wage.

Table 3. **Estimated industry wage premia**[1] (continued)

Results of first-step regressions

	Austria	Belgium	Canada	Denmark	France	Greece	Ireland	Italy	Spain	Sweden	United Kingdom	United States
Non-manufacturing												
Electricity and Gas	0.17	0.25	0.27[2]	0.01	0.02	0.09		0.18	0.27	0.07	0.21	0.28
	(0.03)	*(0.03)*	*(0.03)*	*(0.02)*	*(0.05)*	*(0.04)*		*(0.04)*	*(0.04)*	*(0.03)*	*(0.03)*	*(0.05)*
Collection, distribution of water	-0.05	-0.03			0.17	0.19		0.17	0.07		0.10	0.13
	(0.04)	*(0.03)*			*(0.05)*	*(0.03)*		*(0.07)*	*(0.03)*		*(0.03)*	*(0.07)*
Construction	0.01	-0.06	0.05	-0.01	0.00			0.00	-0.04	-0.01	-0.03	0.13
	(0.04)	*(0.03)*	*(0.02)*	*(0.02)*	*(0.06)*			*(0.05)*	*(0.02)*	*(0.02)*	*(0.02)*	*(0.05)*
Sale , repair of motor vehicles	-0.07	-0.06		-0.07	-0.06	-0.03	-0.12	-0.10	-0.12	-0.04	-0.14	-0.13
	(0.04)	*(0.02)*		*(0.02)*	*(0.05)*	*(0.03)*	*(0.03)*	*(0.05)*	*(0.03)*	*(0.02)*	*(0.03)*	*(0.06)*
Wholesale trade	0.03	-0.01	-0.03	0.03	0.09	-0.05	0.08	0.01	-0.09	0.04	-0.02	-0.07
	(0.03)	*(0.02)*	*(0.02)*	*(0.02)*	*(0.06)*	*(0.02)*	*(0.03)*	*(0.05)*	*(0.02)*	*(0.03)*	*(0.02)*	*(0.05)*
Retail trade	-0.05	-0.15	-0.17	-0.10	-0.08	-0.15	-0.22	-0.07	-0.12	-0.04	-0.11	-0.18
	(0.04)	*(0.02)*	*(0.02)*	*(0.02)*	*(0.05)*	*(0.03)*	*(0.03)*	*(0.05)*	*(0.03)*	*(0.02)*	*(0.03)*	*(0.05)*
Hotels & Restaurants	-0.30	-0.21	-0.35	-0.08	-0.19	-0.03	-0.23	-0.14	-0.15	-0.08	-0.30	-0.24
	(0.05)	*(0.03)*	*(0.02)*	*(0.02)*	*(0.09)*	*(0.03)*	*(0.02)*	*(0.06)*	*(0.03)*	*(0.03)*	*(0.04)*	*(0.05)*
Land transport	-0.06	-0.08	-0.01	-0.14	-0.10	0.10		0.15	-0.02	-0.08	-0.09	0.03
	(0.04)	*(0.03)*	*(0.02)*	*(0.03)*	*(0.05)*	*(0.02)*		*(0.06)*	*(0.02)*	*(0.04)*	*(0.04)*	*(0.05)*
Water transport	0.15	0.10	0.00	0.03		0.23		0.01	0.32	0.12	0.09	0.05
	(0.06)	*(0.03)*		*(0.02)*		*(0.04)*		*(0.06)*	*(0.08)*	*(0.03)*	*(0.04)*	*(0.09)*
Air transport	0.15	0.14		0.18		0.12		0.32	0.03	0.14	0.22	0.11
	(0.08)	*(0.05)*		*(0.03)*		*(0.04)*		*(0.05)*	*(0.06)*	*(0.06)*	*(0.03)*	*(0.06)*
Auxiliary transport activities	0.00	-0.01		-0.01	-0.16	-0.11		-0.01	0.00	-0.03	0.04	0.01
	(0.04)	*(0.02)*		*(0.02)*	*(0.07)*	*(0.02)*		*(0.04)*	*(0.03)*	*(0.03)*	*(0.03)*	*(0.07)*
Post & Communications	0.02	0.09	0.11	0.08		0.05		0.06	0.13	0.00	0.10	0.14
	(0.05)	*(0.04)*	*(0.02)*	*(0.03)*		*(0.03)*		*(0.05)*	*(0.05)*	*(0.03)*	*(0.03)*	*(0.05)*
Financial intermediation	0.17	0.15	0.10	0.15	0.09	0.18	0.18	0.28	0.18	0.08	0.29	0.02
	(0.04)	*(0.03)*	*(0.03)*	*(0.02)*	*(0.06)*	*(0.03)*	*(0.04)*	*(0.05)*	*(0.04)*	*(0.05)*	*(0.03)*	*(0.05)*
Insurance	0.11	0.08	0.14	0.21	0.03	0.15	0.21	0.10	0.04	0.17	0.20	0.05
	(0.04)	*(0.03)*	*(0.00)*	*(0.02)*	*(0.08)*	*(0.03)*	*(0.04)*	*(0.05)*	*(0.03)*	*(0.04)*	*(0.04)*	*(0.05)*
Auxiliary financial activities	0.19	0.02		0.31	0.19	0.20		0.13	0.23	0.14	0.23	
	(0.05)	*(0.03)*		*(0.04)*	*(0.07)*	*(0.07)*		*(0.06)*	*(0.05)*	*(0.05)*	*(0.04)*	
Real estate	0.07	-0.05	-0.09	-0.06	-0.05			0.09	0.04	-0.03	0.03	-0.03
	(0.04)	*(0.03)*	*(0.04)*	*(0.02)*	*(0.20)*			*(0.09)*	*(0.04)*	*(0.04)*	*(0.03)*	*(0.05)*
Renting of machinery & equipment	-0.04	-0.06		-0.01					-0.12	-0.02	-0.02	-0.17
	(0.03)	*(0.04)*		*(0.04)*					*(0.05)*	*(0.04)*	*(0.04)*	*(0.06)*
Computer	0.21	0.04		0.20	0.28			0.06	0.03	0.12	0.24	0.18
	(0.04)	*(0.02)*		*(0.02)*	*(0.14)*			*(0.05)*	*(0.05)*	*(0.04)*	*(0.04)*	*(0.06)*
Research and development	0.08	0.03		0.16	-0.01			0.06		0.02	0.17	0.14
	(0.06)	*(0.03)*		*(0.02)*	*(0.06)*			*(0.05)*		*(0.04)*	*(0.04)*	*(0.06)*
Other business services	-0.02	-0.02	-0.01	0.01	0.08			-0.07	-0.04	0.01	0.10	-0.01
	(0.03)	*(0.02)*	*(0.02)*	*(0.02)*	*(0.06)*			*(0.04)*	*(0.02)*	*(0.02)*	*(0.03)*	*(0.05)*
Adjusted standard deviation	0.13	0.09	0.16	0.11	0.13	0.12	0.14	0.12	0.14	0.07	0.15	0.11
Correlation with US structure	0.72	0.75	0.90	0.35	0.48	0.70	0.62	0.49	0.78	0.61	0.72	1.00
R-squared	0.87	0.91	0.94	0.85	0.88	0.88	0.93	0.78	0.88	0.84	0.84	0.67
Observations	676	905	337	1128	310	677	431	733	1021	398	1023	1311

1. In logarithm, compared to the economywide, employment weighted, average wage.
2. Electricity, Gas and Water supply

Table 4. **The effects of anticompetitive regulations on wage premia**

Results of panel regressions

Dependent variable : Estimated hourly wage premia for full-time workers

	Non-manufacturing sector				
Method	Fixed effects			Cluster adjusted	Random effects
Product market regulation	-0.08	0.23 *	0.30 *	0.20	0.20 *
	(-1.18)	*(2.37)*	*(2.39)*	*(1.63)*	*(2.14)*
Non-linear effect of regulation[1]		-0.57 **	-0.63 **	-0.55 **	-0.55 **
		(-3.52)	*(-3.64)*	*(-3.28)*	*(-3.01)*
Union density			0.03	0.03 *	0.03
			(1.52)	*(2.04)*	*(1.95)*
Country-independent variables :					
Average entry rate				-0.02 **	-0.02 **
				(-2.82)	*(-4.30)*
Average size				0.10 **	0.10 **
				(4.72)	*(7.88)*
Industry dummies	Yes	Yes	Yes	No	No
Country dummies	Yes	Yes	Yes	Yes	Yes
RESET	0.44	0.91	1.67	0.35	
R-squared	0.75	0.77	0.80	0.68	
F-test on industry dummies	18.82 **	21.4 **	14.9 **		
Breusch-Pagan					21.0 **
Hausman					1.07
Observations	112	112	84	84	84
Countries	12	12	10	10	10

Note: All equations include a constant. The standard errors are robust to heteroskedasticity.
T-statistics in parentheses. *, ** denote significance at the 5% and 1% level, respectively.
Samples are adjusted for outliers based on the DFIT and COVRATIO statistics (see Belsley *et al.*, 1980, and Chatterjee and Hadi, 1988).
All variables in logs except regulation and entry rates.

1. Defined as the product of the industry-specific product market regulation indicators and their deviations from their industry means.

Table 5. **The effects of public monopoly**

Results of fixed-effects panel regressions

Dependent variable : Estimated hourly wage premia for full-time workers

	Public monopoly model			Non-nested tests				
				Public monopoly model vs basic model[1]			Basic model vs public monopoly model[1]	
	With bargaining power		Without bargaining power	With bargaining power		Without bargaining power	With bargaining power	Without bargaining power
Union density	0.04	0.03		0.03	0.03		0	
	(1.77)	*(1.78)*		*(1.36)*	*(1.34)*		*(0.01)*	
Product market regulation							0.01	0.04
							(0.10)	*(0.26)*
Non-linear effect of regulation[2]							-0.05	-0.09
							(-0.20)	*(-0.29)*
Regulation (net of public ownership)	0.48 **	0.44 **	0.19 *	0.45 *	0.42 *	0.16		
	(2.70)	*(2.89)*	*(2.55)*	*(2.47)*	*(2.54)*	*(1.64)*		
Regulation (net of public ownership)*Public ownership	-0.47	-0.39 **	-0.35 **	-0.42	0.35	-0.31		
	(-1.61)	*(-4.21)*	*(-3.82)*	*(-1.28)*	*(-1.88)*	*(-1.62)*		
Regulation (net of public ownership)*Union density	-0.07	-0.05		-0.07	-0.06			
	(-1.37)	*(-1.44)*		*(-1.34)*	*(-1.44)*			
Regulation (net of public ownership)*Public ownership*Union density	0.02			0.02				
	(0.30)			*(0.26)*				
Predicted value from basic model				0.13	0.15	0.17		
				(0.25)	*(0.28)*	*(0.29)*		
Predicted value from public monopoly model							0.95 **	0.88
							(2.94)	*(1.71)*
RESET	1.38	1.41	0.54	1.45	1.49	0.91	1.21	0.56
R-squared	0.82	0.82	0.78	0.82	0.82	0.77	0.82	0.78
Observations	85	85	113	84	84	112	84	112
Countries	10	10	12	10	10	12	10	12

Note: All equations include a constant. The standard errors are robust to heteroskedasticity.
T-statistics in parentheses. *, ** denote significance at the 5% and 1% level, respectively.
Samples are adjusted for outliers based on the DFIT and COVRATIO statistics (see Belsley *et al.,* 1980, and Chatterjee and Hadi, 1988).
All variables in logs except regulation and entry rates.

1. The basic model is the model estimated in the first two columns of Table 4. The public monopoly model is the model estimated in the 2nd and 3rd columns of Table 5
2. Defined as the product of the industry-specific product market regulation indicators and their deviations from their industry means.