Who Should set the Minimum Wage?*

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Abstract

The setting of the minimum wage involves a trade-off between reducing poverty among working people and shutting down low productivity jobs. There are two common ways of setting minimum wages. They are either government legislated or are the outcome of collective bargaining agreements, which are extended erga omnes to all workers. In this paper we develop a simple model showing that under rather mild assumptions as to the objectives of Governments, a legislated minimum wage is bound to be lower than a wage floor established within a collective agreement, which typically determines also the wage scale above the minimum. Next, we exploit a new data set on minimum wages in 66 countries that had already or introduced a minimum wage in the period 1981-2005 to test these implications. In particular, we look at the effect of the type of minimum wage determination on the level of the minimum wage. Our main conclusion is that in terms of labor market outcomes and effects on poverty, the way in which the minimum wage is set is even more important than the decision as to whether or not to have a minimum wage in place.

Keywords: Minimum Wages, Collective Bargaining, Statutory minimum.

JEL Classification Codes: J31, J41, J42.

1 Introduction

There is a large body of theoretical and empirical research on the effects of the minimum wage.

Theory offers clearcut predictions only for a competitive labour market. In this case a binding minimum wage reduces employment and increases unemployment unambiguously. However, this case is of limited empirical relevance. As Christopher Flinn (2007) kindly puts it, "recent studies indicate that the "textbook" competitive model of the labour market ... may have serious deficiencies in accounting for minimum wage effects on labor market outcomes". In imperfect labor markets, according to economic theory, there is generally a non-monotonic relationship between employment and the minimum wage. Put it another way, the key factor is not the existence of a minimum wage, but the level of this wage floor.

Empirical results have been recently surveyed by Neumark and Wascher (2007). They point to both directions: positive and negative effects of the minimum wage on employment. In particular, only two thirds of the studies reviewed by the two authors found negative employment effects of minimum wages and not always these effects were statistically significant. This empirical ambiguity is consistent with theories of labour markets where monopsonistic firms face upward sloping labour supply curves. Unsurprisingly, based on these results, some authors advocate an increase of the minimum wage, while others argue in favor of marked reductions of the minimum wage. It is a matter of fine-tuning, after all.

In spite of these results, to my knowledge there is to date no literature on the setting of the minimum wage. In some countries, a statutory minimum wage is unilaterally set by the government while in other countries, it is the outcome of negotiations between workers and firm representatives and the Government has only the passive role of providing a legal status to these agreements extending their coverage also to workers non-unionised. Among these two extreme scenarios there is a wide array of intermediate cases depending on the role attributed to the state or to collective bargaining in the setting of the minimum wage.

The approach followed by the various countries in the setting of the minimum wage is very important in determining the level of the minimum wage. This is because the setting of the minimum wage involves a trade-off between reducing poverty among working people and shutting down low productivity jobs. Depending on how these two conflicting interests are represented in the process leading to the setting of the minimum wage, we should expect to have higher or lower levels of the minimum wage.

In this paper we develop a simple model showing that, others things being equal, a Government legislated minimum wages is bound to be lower than a minimum set in a context of collective bargaining and having a number of predictions as to the relationship between minimum wages, unemployment benefits and the elasticity of labour demand. Next, we exploit a new data set on minimum wages in 66 countries having some type of national minimum wage in the period 1981-2005 to test these implications. In particular we look at the

effect of dfferences in the fixing of the minimum wage on the ratio of the minimum wage to the average wage. We also investigate the way in which different types of minimum wages react to changes in the external environment (e.g, in the elasticity of labour demand) and in the institutional landscape, i.e., in the generosity of unemployment benefits. Our main conclusion is that in terms of labour market outcomes and effects on poverty, the way in which the minimum wage is set is at least as important as the decision concerning whether or not to have a minimum wage in place.

The plan of the paper is as follows. Section 2 presents a simple model comparing different minimum wage fixing regimes. Section 3 illustrates the dataset and provides descriptive statistics. Section 4 details the econometric approach and presents our main results. Finally, Section 5 concludes.

2   Who is fixing it: some theory

The purpose of this section is to develop a simple model allowing to assess the effects of alternative methods of determination of the minimum wage. The focus will be on an imperfect labour market, where firms have some degree of monopsony power, so that there can be not only equity, but also efficiency arguments in favour of a minimum wage. We will initially consider a pure monopsony case with no minimum wage and then a context in which collective bargaining sets a minimum wage. Next, we shall characterise the Pareto optimal level of the minimum wage and the level that would be set by a Government under alternative characterisations of its objective function.

2.1   Equilibrium without the minimum wage

As discussed above, our baseline is a case where firms have monopsony power. To simplify algebra we will consider a pure monopsony case. Extensions to n-firms with some monopsony power do not alter significantly the results (Manning, 2003).

Labour demand is therefore originated by just one employer facing the aggregate labor supply. This pure monopsonist (superscript M) chooses the employment level maximizing her profits π. Assume that the marginal value of a job (labour demand), v, is a decreasing (at a constant-elasticity) function of the employment rate L, e.g., $v = AL^{-\eta}$, where A indexes labour productivity, and the index of the (inverse) labor demand elasticity, η, takes values between zero (flat labour demand at A) and unity (vertical labor demand at 1). By replacing the marginal value of a job with the market wage, w, and solving for L, we can then write the labor demand schedule as follows

$$L = \left(\frac{A}{w}\right)^{\frac{1}{\eta}} \tag{1}$$

The supply side of the labor market is given by the cumulative distribution function, $G(.)$, of the reservation wages. The latter is, by construction, increas-

ing in w. To keep things simple we shall assume that also this schedule has a constant-elasticity functional form so that:

$$G(w) = w^{\frac{1}{\epsilon}}. \tag{2}$$

where the elasticity parameter may range between $\epsilon = 0$ (in which case the labor supply is flat and normalized to unity) and plus infinity. Larger values of ϵ denote increasingly inelastic labour supply schedules, and as ϵ tends to infinity labour supply becomes perfectly vertical. Integrating labour demand over L and neglecting irrelevant constants of integration, we can write the profit maximisation of the pure monopsonist as follows:

$$\max \pi^M = \frac{AL^{1-\eta}}{1-\eta} - wL$$

subject to the aggregate labour supply curve $L = w^{\frac{1}{\epsilon}}$. Deriving the first-order-condition for employment and solving for wages one obtains

$$w^M = \left[\frac{A}{1+\varepsilon} \right]^{\frac{\varepsilon}{\epsilon+\eta}} \tag{3}$$

2.2   A Pareto Optimal Minimum Wage

From this equilibrium, a properly set minimum wage removes the deadweight loss associated with the presence of monopsony power, maximising the total surplus. Obtain first the surplus of the workers, by integrating the density function of the distribution of reservation wages over the relevant range and neglecting constants of integration

$$wL - \int_L^\xi x^\epsilon dx = wL - \frac{L^{\epsilon+1}}{\epsilon+1}$$

Maximization of the joint surplus (the sum of firm's profits and of the workers' surplus from employment) involves then solving

$$\max \left(\left[\frac{AL^{1-\eta}}{1-\eta} - \underline{w}L \right] + \left[\underline{w}L - \frac{1}{\epsilon+1}L^{\epsilon+1} \right] \right) = \max \left(\frac{AL^{1-\eta}}{1-\eta} - \frac{1}{\epsilon+1}L^{\epsilon+1} \right) \tag{4}$$

where the first term is the surplus of employers (profits) and the second the surplus of workers (the difference between the wage bill and reservation wages). In this setup the fallback option of employers is indeed zero (no production, hence no profits), whilst the fallback option of workers is the reservation wage represented by the constant elasticity labour supply. The wage maximizing the total surplus of production over the opportunity cost of employment, or the size of the economic "pie" generated by the labor market is given by

$$\underline{w}^* = A^{\frac{\epsilon}{\epsilon+\eta}}$$

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which is clearly greater than (3) to the extent that $\varepsilon > 0$, that is, labour supply is not infinitely elastic (in which case there will be no monopsony power). This level of the minimum wage equates at the margin the value of a job for the employer and workers' reservation wages, therefore maximising total employment. Indeed, the corresponding Pareto optimal employment level will exceed the employment level attained under monopsony

$$L^* = A^{\frac{1}{\epsilon+\eta}} > L^M = \left[\frac{A}{1+\varepsilon}\right]^{\frac{1}{\varepsilon+\eta}}$$

Notice that there is a range of values of the minimum wage where the latter unambiguously *increases* employment relative to the pure monopsony case. This range is given by:

$$w^M = \left[\frac{A}{1+\varepsilon}\right]^{\frac{\varepsilon}{\varepsilon+\eta}} < \underline{w} < A^{\frac{\epsilon}{\epsilon+\eta}} = \underline{w}^*$$

Any minimum wage set above $\underline{w}^*$ would *reduce* employment with respect to the Pareto optimal allocation. Thus, we have the usual theoretical ambiguity as to the effects of minimum wages on employment.

2.3   A collectively bargained minimum wage

Consider now a minimum wage resulting from collective bargaining over wages and allowing employers to choose the profit maximizing employment level, e.g. in a right-to-manage environment. The latter involves the maximization of the product of the surplus of employers and workers, that is, the Nash-bargaining rule

$$\underline{w}^C \text{ is } \arg\max \left(\left[\frac{AL^{1-\eta}}{1-\eta} - \underline{w}L\right]^{\beta} \left[\underline{w}L - \frac{L^{\epsilon+1}}{\epsilon+1}\right]^{1-\beta} \right) \tag{5}$$

The two surpluses are "weighted" by the parameter β measuring the relative bargaining power of employers and $(1-\beta)$ the bargaining power of unions. Consistently with a right-to-manage structure of bargaining (the only structure that is conceivable at a centralized, economy-wide, level), we impose that employment is on the labour demand schedule. Hence, maximizing (5) with respect to $\underline{w}$ under the constraint that $L = \left(\underline{w}/A\right)^{-\frac{1}{\eta}}$, we obtain

$$\underline{w}^C = (\mu)^{\frac{\varepsilon}{\epsilon+\eta}} (A)^{\frac{\epsilon}{\epsilon+\eta}} \tag{6}$$

where $\mu \equiv \left(1 - \beta\frac{\eta+\varepsilon}{1+\varepsilon}\right)^{\frac{1}{1-\eta}}$ is the optimal mark-up factor of wages over the opportunity cost of working. As (6) makes it clear, the minimum wage will be increasing in the bargaining power of unions. In particular, in the case of a

monopoly union unilaterally setting wages, i.e., when $\beta = 0$, the minimum wage reduces to

$$\underline{w}^C(\beta = 0) = \left(\frac{1}{1-\eta}\right)^{\frac{\varepsilon}{\varepsilon + \eta}} (A)^{\frac{\varepsilon}{\varepsilon + \eta}} \tag{7}$$

Notice that the monopoly union minimum wage (7) converges from the above to the Pareto optimal wage floor (w^*) when labour demand becomes infinitely elastic (as η tends to 0). In the more general case, the monopoly union minimum wage will exceed the Pareto efficient one. Conversely when all bargaining power is on employers, the minimum wage resulting from collective bargaining will coincide with the monopsony wage

$$\underline{w}^C(\beta = 1) = \left(\frac{A}{1+\varepsilon}\right)^{\frac{\varepsilon}{\varepsilon + \eta}} \tag{8}$$

and hence be lower than the Pareto optimal wage floor. Thus the minimum wage resulting from collective bargaining can be either higher or lower than the Pareto optimal, employment maximising, minimum wage, depending on the bargaining power of employers and workers. Notice, however, that when w^* is higher than $\underline{w}^C$ there will be no unemployment at the equilibrium with the minimum wage as $L^d(\underline{w}^C) = \left(\frac{A}{\underline{w}^C}\right)^{\frac{1}{\eta}} > L^s(\underline{w}^C) = \underline{w}^{C\frac{1}{\varepsilon}}$. Conversely, when $w^* < \underline{w}^C$, hence $L^d(\underline{w}^C) < L^s(\underline{w}^C)$ there is an excess supply of labour. Thus, the presence of unemployment under the collective agreement outcome discriminates between the two different regions in which the minimum wage is located.

2.4   A Minimum Wage set by a Government

Let us now consider a minimum wage set by a Government. As it is not obvious what drives its decision rule, we shall consider three alternative characterisations of the objective function (and of the controls) of a Government. The first case is one in which the Government represents solely the interests of the "outsiders" otherwise neglected at the bargaining table, that is, non-employed individuals. The second case is one of a Government representing insiders and employers. The third case is one of a Government setting a non-employment benefit together with the minimum wage, hence having two policy instruments at its disposal.

2.4.1   A Government representing the Outsiders

A Government representing non-employed workers would choose the minimum wage w^G that maximizes total employment. We already know from (4) that this implies choosing the wage level corresponding to the Pareto optimal allocation, that is

$$\underline{w}^G \text{ is } \arg\max L = w^*$$

As discussed above, in presence of unemployment, this Government legislated minimum wage will be lower than the minimum wage resulting from collective agreements. It is only when unemployment is zero and the Government seeks to minimize inactivity that a Government legislated minimum wage could exceed the collectively bargained wage floor.

2.4.2 A Government representing Employers and Insiders

Consider now a Government maximizing the surplus of employers and that of workers over leisure, just as in a right-to-manage model, but offering a different representation of the two parties than at the bargaining table. There can be both a positive and a normative interpretation of the criterion followed in fixing the minimum wage.

According to a probabilistic voting model, the minimum wage would maximize a social welfare function that weights the indirect utility function of employers and workers. To ease comparisons with the collective bargaining outcome, the social welfare function can be conveniently expressed as a Bernoulli-Nash

$$\underline{w}^G \text{ is } \arg\max \left(\left[\frac{AL^{1-\eta}}{1-\eta} - \underline{w}^G L \right]^{\gamma} \left[\underline{w}^G L - \frac{1}{\epsilon+1} L^{\epsilon+1} \right]^{1-\gamma} \right) \tag{9}$$

where γ can be interpreted as a measure of the electoral power of employers and profit earners (Coughlin, 1992). This electoral power will reflect the size of the two groups as well as the relative presence of swing voters in their ranks.

An alternative interpretation of (9) is in the objective function of a social planner caring for income distribution. In this case the parameter γ represents the distributional weight of employers, that is, the relative importance attributed by the Government to redistribution in favour of profit-earners.

The solution of (9) will coincide with (6) except that now β is replaced by γ. It follows that when the electoral power (or distributional weight) of profit-earners is larger than their bargaining power, a minimum wage set by a Government will be *lower* than a wage floor established within collective bargaining.

Notice also that the solution of (9) will coincide with the Pareto optimum when

$$\gamma = \frac{\varepsilon}{\varepsilon + \eta} (1 - \eta), 1 - \gamma = \frac{\eta}{\varepsilon + \eta} (1 + \varepsilon) \tag{10}$$

as in this case the solution is

$$\underline{w}^G = A^{\frac{\epsilon}{\epsilon+\eta}} = w^* \tag{11}$$

Simple rearrangement of (10) yields

$$\frac{1-\gamma}{\gamma} = \frac{\eta}{1-\eta} \frac{1+\varepsilon}{\varepsilon}. \tag{12}$$

This condition is similar to the Hosios (1990) condition for efficiency when individual workers and jobs meet randomly according to a given matching technology, under constant returns[1]. There is no reason to expect a priori that this condition is fulfilled. However, it is relevant in assessing dis-employment effects of minimum wages: any deviation from the Pareto optimal allocation involves employment losses.

In a probabilistic voting setting, γ is not exogenous in the long-run. It reacts to changes in the relevant elasticities, ε and η as the electoral power of the two groups ultimately depends on the employment effects of a minimum wage. In particular, γ is bound to increase as η declines as the electoral power of workers is lower when the labour demand elasticity is larger. A similar argument applies to β in the collectively bargained outcome. Collective bargaining institutions may adjust wage claims to the new environment requiring that the size of the labour market, hence the pie to be shared between workers and firms, is not "too small". Unions engaged in nation-wide wage bargaining internalize the fact that unemployment would increase unless pay concessions are made. Small, decentralized unions may instead resist changes in their members' take-home pay: if every union follows the same policy, the outcome would be too high wages at the macroeconomic level, to imply a bigger employment cost than with a nationwide union. This is consistent with the arguments originally developed by Calmfors and Driffill (1988) as to the labour-market effects of macroeconomic shocks under different bargaining structures. Thus, we expect both $\underline{w}^G$ and $\underline{w}^C$ to be *lower* in presence of a higher elasticity of labour demand although the responsiveness of the two minimum wages to the elasticity of demand may vary depending also on the frequency of collective agreements with respect to Government legislated adjustments of the minimum wages.

2.4.3   A Government with two policy instruments

There are clearly intermediate cases in which a Government can represent at varying degrees employers, insiders as well as outsiders. The above results suggest that the inclusion of outsiders will bias the minimum wage towards to the Pareto optimal level, increasing any deviation of the Government legislated from the collectively agreed wage floor.

A more interesting case is one where the Government can also set a non-employment benefit, b. A key difference between a Government legislated and a collectively bargained minimum wage is indeed that a Government could also activate other redistributive policy instruments, such as an unemployment benefit system or social assistance. These transfers are typically set jointly with the minimum wage. This link is so strong that in several countries the levels of such transfers are legally established as fractions of the minimum wage (when the latter is strictly a control variable for the Government). Although they target different groups (ex-post) of the population, they are both anti-poverty devices.

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[1]It should be stressed that in that framework unemployment is present in equilibrium but, if the Hosios condition is satisfied, unemployment efficiently coordinates the search decisions of workers and firms in a frictional labor market.

An important difference though is that while the minimum wage is paid by employers, the non-employment benefit is at least partly paid by the workers.

Assume then that the benefit is provided by the state to non-employed individuals and is at least partly financed via a payroll tax on wages, τ, i.e.:

$$\lambda b(N - L) = \tau w L \tag{13}$$

where N is the population in working age (the potential labour force) and λ the fraction of the costs of non-employment benefits funded via a payroll tax on employees. Labour supply in presence of a social minimum reads

$$G(w) = (w - b)^{\frac{1}{\epsilon}} \tag{14}$$

that is, the wage must strictly exceed b to induce participation in the labour market. Consider now the collective bargaining outcome (5) after substituting (14) for labour supply over the minimum wage taking b (and τ) as given. This obtains the gross minimum wage:

$$\underline{w}^C = b + (\mu)^{\frac{\varepsilon}{\epsilon + \eta}} (A)^{\frac{\epsilon}{\epsilon + \eta}}$$

that is, the minimum wage is shifted out by the non-employment benefit, as the latter increases the outside option of workers. This is the standard Nash-bargaining wage rule with employees (or non-encompassing unions) that do not internalise the Government budget constraint.

Consider now the problem faced by a Government that jointly sets the minimum wage and the social minimum, internalizing the Government budget constraint (13). Assuming that $\beta = \gamma$, so that, without non-employment benefits the collective agreed and the Government legislated minimum wages would coincide, we now have that

$$\underline{w}^G = b(1 - \lambda) + (\mu)^{\frac{\varepsilon}{\epsilon + \eta}} (A)^{\frac{\epsilon}{\epsilon + \eta}}$$

that is, ceteris paribus, the minimum wage set by a Government will be lower than a collectively agreed minimum wage when a non-employment benefit system is in place. The intuition is that a Government has two instruments at its disposal and hence can better fine-tune the level of the minimum wage with that of the non-employment benefit, internalizing the fiscal costs of unemployment.

2.5 Non-degenerate wage distributions

The above discussion has been carried out neglecting wage setting above the minimum. In models allowing for non-degenerate wage distributions, collective bargaining over the minimum wage would differ from Government legislated wage floors in that unions (and employers associations) negotiate also over wages above the minimum. Insofar as unions are concerned about membership and have egalitarian wage policies, they may pursue a higher minimum wage than the one set by the Government in order to benefit the mass of workers located in

the middle of the skill distribution. This result is obtained by Boeri and Burda (2009) showing that collective bargaining over wages under endogenous union membership generates a wage floor which is above the statutory minimum.

Overall, under a rather broad set of circumstances, theory predicts that a Government legislated minimum wage should be lower than a collectively bargained wage floor. It also points to relevant effects of environmental (e.g., the elasticity of labour demand) and institutional (e.g., non-employment benefits) variables on the setting of the minimum wage. The purpose of the next section is to evaluate these theoretical predictions.

3 The data

In this paper we exploit a new database on minimum wages around the world built by the fondazione Rodolfo Debenedetti (fRDB) in co-operation with the Imf[2]. The fRDB minimum wage database contains information on the levels of minimum, average, and median wages in national currencies for 91 countries for the period 1980-2005. Unfortunately information on some countries is available only for a subperiod, providing us with an unbalanced panel.

Minimum wages are calculated on a monthly basis (standardizing to 8 hours of work per day, 40 hours per week, 22 days per month, 52 weeks per year). For each country, national data sources were explored first, including National Statistics Offices, Ministries of Labour and Finance, Central Banks, Trade Unions and datasets of national legislations. International data sources were subsequently explored, including OECD, Eurostat, World Bank, IMF, ILO (Geneva and regional offices, archives and online databases), UN, African, Asian and Inter-American Development Banks and the reports from the US Department on Human Rights Practices. Researchers, policy-makers, representatives of trade unions and employers organizations were also contacted and a search through press and business reports was conducted.

The information on the level of minimum wage was completed with qualitative information on the methods followed in each country in the setting of the minimum wage. The latter was obtained primarily from the ILO Minimum Wage Database (http://www.ilo.org/travaildatabase/servlet/minimumwages) and the ILO Natlex database. Information provided by local Ministries of Labour was also used in this context.

The sample used in this paper involves 66 countries for which information on both minimum wage levels and determination was available. Tables 1.A, 1.B and 1.C provide country groupings based on the methods followed in fixing the minimum wage as well as descriptive statistics on minimum to average wage ratios. As shown by the table, out of 66 countries, 24 countries have a minimum wage set by "social partners" and then simply ratified by the Government or determined by a tripartite body (a commission, a council or an independent agency) where representatives of the government, unions and employers' organisations are represented on a equal stance (the Government typically acts as

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[2]See Aleksynska for a detailed description of the dataset.

go in between); 26 countries set the minimum wage after formal consultations between the Government and representatives of employers and workers; 16 had the minimum wage set by the Government without any formal consultation with the social partners.

Country	Number of country-year observations	Minimum to Mean wage Ratio	Unemployment rate
Argentina	26	32,6%	9,9%
Belgium	26	57,0%	8,8%
Colombia	25	49,8%	12,0%
Costa Rica	27	67,2%	6,0%
Dominican Republic	16	55,3%	16,8%
Ecuador	25	70,1%	8,8%
El Salvador	24	78,9%	7,8%
Estonia	15	26,0%	9,2%
France	26	60,3%	9,8%
Ghana	24	27,7%	7,4%
Greece	21	56,1%	8,6%
South Korea	18	25,4%	3,4%
Lithuania	16	36,3%	13,5%
Madagascar	1	14,1%	4,7%
Mexico	26	26,8%	3,5%
Nicaragua	24	46,4%	10,2%
Paraguay	20	85,0%	6,1%
Peru	27	36,9%	7,8%
Philippines	25	55,8%	8,0%
Poland	26	34,0%	14,7%
Thailand	17	52,7%	2,3%
Turkey	26	26,6%	8,5%
Ukraine	17	28,0%	9,1%
Venezuela	7	30,7%	10,5%
Total	505	47,2%	8,1%

Table 1.A: Bargaining process

Country	Number of country-year observations	Minimum to Mean wage Ratio	Unemployment rate
Albania	16	54,3%	22,7%
Algeria	9	32,9%	22,6%
Australia	19	51,9%	7,7%
Bulgaria	27	42,0%	15,0%
Burkina Faso	4	57,2%	2,5%
Canada	26	35,8%	8,9%
China	14	63,1%	3,4%
Czech Republic	16	34,7%	6,5%
Guatemala	23	35,4%	2,4%
Hungary	27	36,9%	8,0%
India	9	73,6%	4,3%
Indonesia	7	53,8%	6,2%
Ireland	7	51,9%	4,3%
Jamaica	17	29,3%	17,6%
Japan	26	34,9%	3,3%
Jordan	4	52,9%	14,9%
Kenya	14	26,6%	9,8%
Latvia	14	33,5%	12,5%
Morocco	15	60,4%	15,0%
Nepal	3	94,8%	6,7%
Portugal	25	3,9%	6,2%
Romania	26	49,5%	7,2%
Spain	27	5,3%	16,5%
Sri Lanka	26	50,2%	10,4%
United Kingdom	8	14,9%	5,1%
Vietnam	10	19,4%	2,3%
Total	419	37,9%	9,8%

Table 1.B: Consultation process

Table 1.C: Government legislated			
Country	*Number of country-year observations*	*Minimum to Mean wage Ratio*	*Unemployment rate*
Azerbaijan	15	8,7%	16,3%
Belarus	16	13,4%	
Bolivia	18	22,7%	4,6%
Brazil	19	19,8%	6,1%
Cameroon	4	12,5%	7,8%
Chile	26	33,2%	8,1%
Ethiopia	4	4,5%	5,6%
Israel	21	47,5%	8,7%
Kyrgyzstan	15	11,0%	9,5%
Netherlands	26	23,1%	7,1%
New Zealand	26	41,3%	6,4%
Nigeria	5	36,4%	3,9%
Pakistan	12	52,0%	4,7%
Russia	15	8,8%	9,0%
United States	26	35,2%	6,2%
Uruguay	17	6,1%	11,0%
Total	265	25,9%	7,4%

Notice that countries like Germany or Italy are not displayed as they do not have a national minimum wage set by collective agreement, as the latter involve only industry-level wage floors. Notice further that most countries display non-frictional unemployment rates, exceeding the 3,5 per cent threshold (second column of Tables 1.A, 1.B and 1.C).

This dataset was then merged with another database developed by Boeri and Macis (2009) providing information on the presence of unemployment benefit systems and on labour market indicators (employment rate and employment shares in various industries), as well as political and cultural variables in 45 countries. The information on unemployment benefits was taken by the above two authors primarily from the publication Social Security Programs throughout the World, the Mutual Information System on Social Protection (MISSOC), OECD data and the ILO Natlex database.

Finally information on the progressiveness of tax systems in 40 countries was obtained from Labartino (2008) enabling us to obtain the indexes of the progressiveness of the tax systems which are used in this paper as proxy for preferences of Governments for redistribution (as in an inverse optimum procedure). Descriptive statistics on all these variables are provided in Table 2. The latter suggests that differences in the levels of GDP per capita and openness to trade (trade turnover over gdp) across the three groups are relatively modest.

Table2: Descriptive Statistics

|			Bargaining process		
Variable	Obs	Mean	Std. Dev	Min	Max
Unemployment benefit	787	0,158	0,209	0	0,731
Log of GDP per capita	711	8,764	0,935	6,375	10,427
Openness to trade	711	55,662	30,370	9,275	180,350
Yearly inflation	786	0,611	3,759	-0,012	74,817
Tax progressiveness	647	0,281	0,181	0	0,750
			Consultation process		
Variable	Obs	Mean	Std. Dev	Min	Max
Unemployment benefit	595	0,130	0,174	0	0,675
Log of GDP per capita	479	8,391	0,972	6,530	10,260
Openness to trade	479	61,956	30,148	12,843	187,361
Yearly inflation	602	0,146	0,515	-0,041	10,584
Tax progressiveness	393	0,286	0,155	0	0,650
			Government legislated		
Variable	Obs	Mean	Std. Dev	Min	Max
Unemployment benefit	340	0,131	0,165	0	0,720
Log of GDP per capita	291	8,491	1,153	5,660	10,490
Openness to trade	291	52,762	35,454	11,129	164,829
inflation	356	1,064	6,871	-0,098	117,496
Tax progressiveness	227	0,255	0,183	0	0,600

3.1   Descriptive statistics

The analysis in Section 2 suggests that in countries displaying structurally an excess supply of labour, a Government legislated minimum wage should be lower than a minimum wage set in the context of a collective agreement. It also yields testable implications as to the relation between minimum wages, the elasticity of labour demand and other policy-driven parameters.

We begin our empirical analysis by offering a visual summary of the raw data. Figure 1 displays the means of the minimum to average wage ratios for the two group of countries with a collectively bargained and a Government legislated minimum wage (the two extreme groupings displayed in Tables 1.A, 1.B and 1.C). Only the 30 countries displaying information over the entire sample period are considered and 95% confidence bands are plotted (dotted lines) around the means.

Fig 1 provides initial evidence that Government legislated minimum wages are lower than minimum wages set in the context of collective agreements. Such unconditional means clearly cannot capture observable and unobservable differences between the two grouping of countries which could affect the minimum to average wage ratios, independently of the wage setting regime. Moreover, being both selected groups of countries, one cannot rule out "reverse causality"

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Figure 1: Minimum wage to average wage ratio
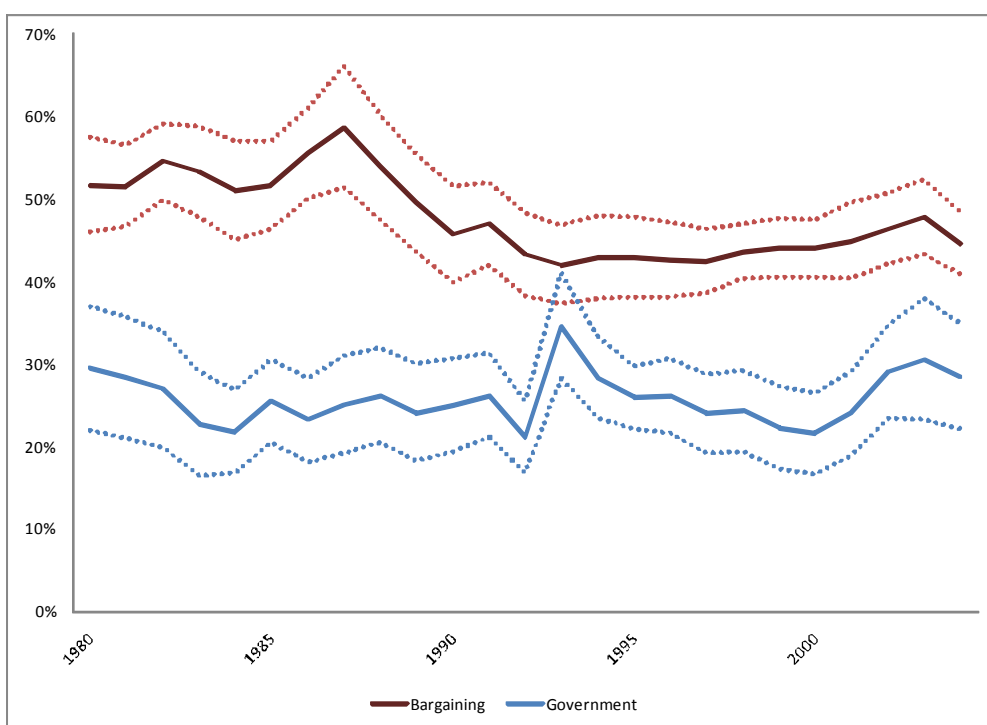
by which countries that "can afford" a relatively high minimum wage self-select themselves in a different wage setting regime. Some of these issues are tackled in the multivariate analysis below.

4   Methodology

We estimate the following model

$$Y_{it} = SET_i\theta + X_{it}\beta + \tau + \gamma_i + \tau\gamma_i + u_{it} \tag{15}$$

where the dependent variable denotes the minimum to average wage ratio of country i at time t, SET is a set of dummy variables capturing the three different minimum wage setting mechanisms (collective bargaining, consultation, and Government legislated, the latter taken as reference group) displayed in Tables 1A, 1B and 1.C, τ is a time-trend and γ_i denotes geographical country groupings (OECD, non-OECD Europe, Africa, Asia, Latin America, Middle East and former Soviet Union) which in some specifications are interacted with the time trend. Finally, X_{it} is a set of time-varying, observable, country-specific characteristics that may affect Y_{it}. These controls include in some specifications (at the cost of losing degrees of freedom as this information is not available for all countries and time periods) the presence in the country of an unemployment benefit system, the degree of trade openness (a proxy for the elasticity of labour demand), the degree of tax progressiveness (top to bottom marginal tax rates, proxying the degree of redistribution pursued by the Government) as well as a classification of GDP per capita levels (high, upper middle, middle, lower-middle, and low income). Results controlling for the sectoral composition of the workforce (the share of employment in services and agriculture) are also reported in the Appendix as this information is available only for a restricted number of countries.

4.1   Results

Table 2 reports random effects estimates of equation (15). By exploiting both cross-country and time-series variation we can indeed make better use of available data as some countries have a very short, if any, time-series. Our estimates suggest that a minimum wage setting regime based on collective bargaining is correlated in all specifications with a significantly higher minimum to average wage ratio. The coefficients in specification (1) and (2) (before introducing interaction dummies) suggest that collective bargaining involves, ceteris paribus, a 17 percentage points higher ratio of the minimum wage to the average wage. A higher unemployment benefit system involves a lower minimum wage, pointing to some substitutability between minimum wages and unemployment benefits as redistributive tools. However, this result may be affected by spurious correlation as the generosity of the unemployment benefit system is measured by the replacement rate which uses the average wage as denominator. A specification allowing instead for a dummy capturing the presence of an unemployment

benefit system (some countries in the panel did not have one, at least limited to a subperiod) also yield a negative coefficient (see the Appendix). Contrary to the theoretical predictions of Section 2, trade openness positively affects the minimum to average wage ratio. However, the coefficient is very small and not always statistically significant. Finally, the inflation rate (capturing effects related to a low frequency in the adjustment of the minimum wage) enters negatively the minimum wage equation, but this effect vanishes when we include a time trend.

Table 2: Minimum wage and wage setting mechanism: Regression results

	(1)	(2)	(3)	(4)	(5)
	Minimum wage to average wage				
Bargaining process	0.176***	0.172***	0.149***	0.167***	0.268***
	(0.015)	(0.016)	(0.030)	(0.033)	(0.040)
Consultation process	0.076***	0.070***	0.120***	0.054	0.090*
	(0.016)	(0.018)	(0.035)	(0.040)	(0.054)
Unemployment benefit level		-0.216***	-0.235***	-0.283***	-0.273***
		(0.053)	(0.055)	(0.058)	(0.058)
Log of GDP per capita		-0.013	-0.012	0.095***	0.075***
		(0.013)	(0.013)	(0.028)	(0.028)
Openness to trade		0.001***	0.001*	0.000	-0.000
		(0.000)	(0.000)	(0.001)	(0.001)
Inflation rate		-0.002*	-0.002*	-0.002	-0.002
		(0.001)	(0.001)	(0.002)	(0.002)
Bargaining process * trade openness			0.000	0.001	0.001
			(0.000)	(0.001)	(0.001)
Consultation process * trade openness			-0.001	-0.000	0.000
			(0.001)	(0.001)	(0.001)
Tax progressiveness				-0.002	0.253***
				(0.046)	(0.079)
Time trend				-0.009*	-0.009**
				(0.005)	(0.005)
High income non-OECD				0.134	0.131
				(0.083)	(0.082)
Low income				0.540***	0.501***
				(0.070)	(0.070)
Lower middle income				0.477***	0.443***
				(0.060)	(0.059)
Upper middle income				0.369***	0.346***
				(0.054)	(0.054)
Bargaining process * tax progressiveness					-0.406***
					(0.093)
Consultation process * tax progressiveness					-0.240**
					(0.109)
Regional dummies	Yes	Yes	Yes	Yes	Yes
Regional dummies * time trend	No	No	No	Yes	Yes
Constant	0.247***	0.328***	0.311***	16.240*	17.834*
	(0.024)	(0.097)	(0.101)	(9.573)	(9.478)
Observations	1189	915	915	706	706
R-squared	0.24	0.25	0.26	0.40	0.41

Standard errors in parentheses. Reference cathegory is the Government legislated minimum wage
* significant at 10%; ** significant at 5%; *** significant at 1%

Columns (3), (4) and (5) report estimates where openness to trade and tax

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progressiveness are interacted with the regime variables and where regional dummies are interacted with the time trend to capture region-specific trends in the level of minimum wages, as in the "random growth models" literature (Ashenfelter and Card, 1985). We also include controls for the degree of economic development of the various countries. These extensions do not significantly alter our results as far as the markup induced by a collective bargaining regime over a Government legislated one is concerned. However, in some specifications there is no longer a significant difference between the "consultation" and the "Government legislated" bargaining regime. Trade openness is still not significant even when interacted with the regime variables, while tax progressiveness becomes significant only when interacted with the regime variables. A more progressive tax schedule positively affects the minimum wage level, but only in Government legislated regimes. This is in line with the theoretical predictions reviewed in Section 2 insofar as tax progressiveness measures the degree of egalitarianism pursued by Governments.

4.2 Robustness checks

In tables 3 and 4 we perform the same regressions as above, confining this time our attention to OECD countries. This is useful to address some of the econometric issues discussed at the outset. These countries indeed constitute a more homogeneous set of nations and have well established wage setting mechanisms, so that there is less of a risk of self-selection into a particular regime depending on the evolution of the wage structure. Moreover, measurement issues are less serious in this context.

We still find a positive, sizeable and highly significant effect of a collectively bargained regime over a Government legislated regime. The significance and sign of the tax progressiveness and unemployment benefits variables is in line with the above theoretical predictions. Furthermore, trade openness is now significant when interacted with a collectively bargained regime, although the coefficient is very small.

Table 3: Regression results - OECD countries only

	(1)	(2)	(3)	(4)	(5)
	Minimum wage to average wage				
Bargaining process	0.247***	0.283***	0.294***	0.546***	0.860***
	(0.024)	(0.022)	(0.041)	(0.038)	(0.064)
Consultation process	-0.075***	-0.071***	-0.066*	0.122***	0.165***
	(0.021)	(0.019)	(0.039)	(0.032)	(0.053)
Unemployment benefit level		-0.417***	-0.420***	-0.361***	-0.291***
		(0.052)	(0.054)	(0.041)	(0.039)
Log of GDP per capita		0.032	0.032	0.477***	0.579***
		(0.035)	(0.037)	(0.042)	(0.043)
Openness to trade		0.000	0.000	0.002***	0.001***
		(0.000)	(0.000)	(0.000)	(0.000)
Inflation rate		-0.364	-0.374	0.297	0.692***
		(0.248)	(0.262)	(0.210)	(0.206)
Bargaining process * openness to trade			-0.000	-0.002***	-0.003***
			(0.001)	(0.000)	(0.000)
Consultation process * openness to trade			-0.000	-0.000	-0.000
			(0.001)	(0.000)	(0.000)
Tax progressiveness				0.178***	0.483***
				(0.043)	(0.094)
Time trend				-0.023***	-0.023***
				(0.002)	(0.002)
Bargaining process * tax progressiveness					-0.646***
					(0.121)
Consultation process * tax progressiveness					-0.139
					(0.109)
Constant	0.332***	0.171	0.169	41.704***	41.104***
	(0.017)	(0.354)	(0.373)	(3.385)	(3.104)
Observations	289	239	239	205	205
R-squared	0.45	0.64	0.64	0.85	0.88

Standard errors in parentheses. Reference cathegory is the Government legislated minimum wage
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4 allow for separate effects for countries with low unemployment rates. According to the theoretical perspectives in Section 2, a Government legislated minimum wage is bound to be lower than a collectively agreed wage floor only in countries with high structural unemployment. Consistently with this prediction we find that in countries with unemployment lower than 3.5 per cent, the effect of the wage setting regime on the minimum wage almost disappears (.245 - .234=.011). Moreover, the effect of the bargaining process dummy is somewhat stronger when we concentrate on the subset of countries with unemployment rates larger than 3.5 per cent.

Table 4: Regression results - Middle to high unemployment levels

	(1)	(2)	(3)	(4)
	Minimum wage to average wage			
Bargaining process	0.173***	0.245***	0.187***	0.244***
	(0.016)	(0.040)	(0.031)	(0.040)
Consultation process	0.072***	0.108**	0.152***	-0.007
	(0.019)	(0.054)	(0.042)	(0.064)
Unemployment benefit level	-0.223***	-0.301***	-0.356***	-0.464***
	(0.053)	(0.058)	(0.059)	(0.062)
Log of GDP per capita	-0.012	0.119***	0.025*	0.123***
	(0.013)	(0.030)	(0.014)	(0.031)
Openness to trade	0.001***	-0.000	0.001***	0.001
	(0.000)	(0.001)	(0.000)	(0.001)
Inflation rate	-0.002*	-0.002	-0.002	-0.001
	(0.001)	(0.002)	(0.001)	(0.002)
Bargaining process * low unemployment	-0.053	-0.234***		
	(0.056)	(0.056)		
Consultation process * low unemployment	-0.023	-0.042		
	(0.033)	(0.033)		
Bargaining process * trade openness		0.001*	-0.000	0.001*
		(0.001)	(0.000)	(0.001)
Consultation process * trade openness		-0.000	-0.001**	0.001
		(0.001)	(0.001)	(0.001)
Tax progressiveness		0.243***		0.232***
		(0.078)		(0.079)
Bargaining process * tax progressiveness		-0.342***		-0.264***
		(0.093)		(0.094)
Consultation process * tax progressiveness		-0.210*		0.085
		(0.111)		(0.120)
Time trend		-0.010**		-0.010**
		(0.005)		(0.005)
High income non-OECD		0.163**		0.040
		(0.081)		(0.107)
Low income		0.601***		0.781***
		(0.073)		(0.102)
Lower middle income		0.544***		0.459***
		(0.063)		(0.094)
Upper middle income		0.417***		0.359***
		(0.056)		(0.089)
Regional dummies	Yes	Yes	Yes	Yes
Regional dummies * time trend	No	Yes	No	Yes
Constant	0.318***	18.801**	0.003	17.967**
	(0.098)	(9.370)	(0.113)	(9.115)
Observations	915	706	812	613
R-squared	0.25	0.43	0.31	0.49

Standard errors in parentheses. Reference cathegory is the Government legislated minimum wage
* significant at 10%; ** significant at 5%; *** significant at 1%

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4.3 Identifying Assumption

The above results can hardly be interpreted as causal effects of the minimum wage fixing regime on the lminimum to average wage ratio. In order to identify the effects of the fixing regime on the minimum wage we need an exclusion restriction. In this section we are going to assume that the degree of democracy in a given country and time period is correlated with the wage fixing regime, but not directly with the level of the minimum wage. In other words, our identifying assumption is that, after controlling for all the relevant country specific characteristics, a variable capturing the democratic or autocratic nature of the political regime in which the minimum wage is fixed influences the level of the minimum wage only through its impact on the fixing mechanism (as we measure it).

The characteristics of the political regime are captured by the Polity2 index, a widely used source of cross-national, longitudinal data on the authority characteristics of modern politics. The encompassing Polity2 index assigns to each country and year an integer score ranging from -10 to +10 (high values associated with better democracies). The current data releases in the public domain cover the time period 1800-2002.

Table 5 reports the results of instrumental variables estimates of the effects of the fixing regime on the minimum wage. The minimum wage fixing equation estimates the probability that a Government legislated minimum wage is chosen (a dummy variable taking value 1 when the minimum wage is legislated by the Government and zero when it is either set in consultation with social partners or within collective bargaining). This first stage equation includes all the controls also present in the minimum wage equation, plus the variables Polity2index (columns 1-3) or a democracy dummy assigning value 1 to all country-periods with a positive Polity2 index (columns 2-4), denoting democratic regimes. The latter two variables are instead excluded from the minimum wage, second stage, regression.

As shown in the upper panel of Table 5, the democracy variables are a strong predictor of the probability of choosing a Government legislated minimum wage fixing regime. Less democratic regime are less likely to choose collective bargaining of consultation regimes in the fixing of the minimum wage, as perhaps in these country-periods union activism is not even tolerated. The lower panel of Table 5 shows that minimum wages under Government legislated minimum wage fixing regimes are lower than under the alternative fixing regimes, and this effect is statistically significant. We also report for comparison the coefficients of the OLS regression run with the same specification when we likewise pool together the consultation and collective bargaining regimes. The IV coefficient estimates are twice as large as the OLS ones. Notice further that the estimated coefficient of the Government legislated dummy in the IV regression is rather similar in all columns of Table 5, despite the different definitions of the democracy variable.

Table 5: Effects of the Fixing Regime on the Minimum Wage (IV estimates)

First Stage regression				
	(1)	(2)	(3)	(4)
	Government legislated dummy			
polity2 index	-0.008***		-0.011***	
	(0.003)		(0.003)	
Democracy dummy		-0.144***		-0.183***
		(0.040)		(0.044)

Second Stage regression				
	(1)	(2)	(3)	(4)
	Minimum wage to average wage			
Memo Item: Government legislated dummy	-0.142***	-0.142***	-0.139***	-0.139***
	(0.016)	(0.016)	(0.015)	(0.015)
Government legislated dummy	-0.270	-0.349**	-0.304**	-0.315***
	(0.182)	(0.143)	(0.143)	(0.116)
Openness to trade	0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Unemployment benefit level	-0.174**	-0.145*	-0.157**	-0.154**
	(0.087)	(0.079)	(0.076)	(0.070)
Log of GDP per capita	0.035	0.043**	0.112***	0.113***
	(0.023)	(0.021)	(0.027)	(0.026)
Inflation rate	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Time trend			-0.003	-0.003
			(0.004)	(0.004)
High income non-OECD			0.326***	0.328***
			(0.087)	(0.086)
Low income			0.308***	0.309***
			(0.085)	(0.086)
Lower middle income			0.315***	0.314***
			(0.077)	(0.077)
Upper middle income			0.182***	0.182**
			(0.071)	(0.071)
Regional dummies	Yes	Yes	Yes	Yes
Regional dummies * time trend	No	No	Yes	Yes
Constant	0.130	0.093	4.452	4.389
	(0.137)	(0.131)	(8.690)	(8.745)
Observations	900	900	900	900
R-squared	0.17	0.08	0.21	0.19

Standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

5 Final Remarks

The way in which the minimum wage is fixed has wide ranging implications as to the level of the minimum wage in the long-run. Although economic theory and empirical work offer plenty of evidence that there is a non-monotonic relationship between minimum wages and employment, little attention has been devoted so far to the determination of the minimum wage.This process deserves further investigation. In this paper we offered a first, preliminary, and highly simplified treatment of the trade-offs involved in defining the minimum wage setting regime. We also exploited a new dataset of minimum wages and their determination mechanisms in 66 countries. Our results are broadly in line with theoretical predictions. In particular, they indicate a sizeable markup of collectively agreed versus Government legislated minimum wages, which survives to different specifications and robustness checks and can be interpreted as a causal effect of the fixing regime on the level of the minimum wage if our identifying assumption (the autocratic or democratic nature of the political regime affects the fixing regime, but not directly the level of the minimum wage) is accepted.

Further work will have to go more in depth in the trade-offs involved in the setting of the minimum wage, based on a richer, albeit necessarily more complex, theoretical framework. To get a flavour of the intracacies involved, take the following history of the fixing of the minimum wage in Britain:

"*There was a potential conflict of interest, in that the higher the minimum wage was pushed relative to average earnings, the smaller would be the benefit of union membership (the union 'mark-up') that might encourage recruitment. In the early days of the Commission, there were some signs that this consideration might have had a slight influence. But there was a strong counterargument.Private sector unions benefit because a minimum wage limits the extent to which non-union firms can undermine collective bargaining by using low wages to compete in the same product markets. The minimum wage provides a solid floor on which collective bargaining can build. Public sector unions have an interest in a relatively high minimum wage insofar as they are vulnerable to the outsourcing of some of their members' jobs to non-union firms.*" (Brown, 2009)

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7 Appendix

Table A1: Regression results with Unemployment Benefit Dummy

	(1)	(2)
	Minimum wage to average wage	
Bargaining process	0.183***	0.247***
	(0.017)	(0.041)
Consultation process	0.066***	0.023
	(0.018)	(0.054)
unemployment benefits dummy	-0.037*	-0.038
	(0.021)	(0.024)
Log of GDP per capita	0.029**	0.091***
	(0.015)	(0.029)
Openness to trade	0.000	-0.001**
	(0.000)	(0.000)
Inflation rate	-0.002*	-0.002
	(0.001)	(0.002)
Bargaining process * openness to trade		0.001***
		(0.001)
Consultation process * openness to trade		0.001**
		(0.001)
Time trend		-0.009*
		(0.005)
Tax progressiveness		0.263***
		(0.081)
Bargaining process * tax progressiveness		-0.443***
		(0.097)
Consultation process * tax progressiveness		-0.214*
		(0.112)
High income non-OECD		5.992
		(10.331)
Low income		6.330
		(10.325)
Lower middle income		6.271
		(10.327)
Upper middle income		6.159
		(10.330)
Regional dummies	Yes	Yes
Regional dummies * time trend	No	Yes
Constant	0.037	12.040***
	(0.108)	(4.573)
Observations	900	691
R-squared	0.28	0.39

Standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table A2: Regression results with Sectoral Employment Shares

	(1)	(2)
	Minimum wage to average wage	
Bargaining process	0.174***	0.259***
	(0.020)	(0.054)
Consultation process	0.007	-0.089
	(0.023)	(0.079)
Unemployment benefit level	-0.272***	-0.316***
	(0.063)	(0.070)
Log of GDP per capita	0.020	0.134***
	(0.020)	(0.041)
Openness to trade	0.001***	0.001
	(0.000)	(0.001)
Inflation rate	-0.004**	-0.003
	(0.002)	(0.002)
Bargaining process * openness to trade		-0.000
		(0.001)
Consultation process * openness to trade		0.001
		(0.001)
fraction of employment in services	-0.072	-0.444**
	(0.145)	(0.198)
fraction of employment in agriculture	-0.247*	-0.241
	(0.135)	(0.199)
Time trend		0.011
		(0.015)
Tax progressiveness		0.007
		(0.111)
Bargaining process * tax progressiveness		-0.126
		(0.127)
Consultation process * tax progressiveness		0.167
		(0.157)
High income non-OECD		-38.185
		(30.876)
Low income		-37.717
		(30.874)
Lower middle income		-37.861
		(30.874)
Upper middle income		-37.953
		(30.880)
Regional dummies	Yes	Yes
Regional dummies * time trend	No	Yes
Constant	0.315*	15.930***
	(0.186)	(5.469)
Observations	564	443
R-squared	0.34	0.45

Standard errors in parentheses.

* significant at 10%; ** significant at 5%; *** significant at 1%