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ABSTRACT

Setting the Minimum Wage^{*}

The process leading to the setting of the minimum wage so far has been fairly overlooked by economists. This paper suggests that this is a serious limitation as the setting regime contributes to explain cross-country variation in the fine-tuning of the minimum wage, hence in the way in which the trade-off between reducing poverty among working people and shutting down low productivity jobs is addressed. There are two common ways of setting national minimum wages: they are either government legislated or are the outcome of collective bargaining agreements, which are extended *erga omnes* to all workers. We develop a simple model relating the level of the minimum wage to the setting regime. 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 the implications of the model. We find that a Government legislated minimum wage is lower than a wage floor set within collective agreements. This effect survives to several robustness checks and hints at a causal relation between the setting regime and the level of the minimum wage.

JEL Classification: J31, J41, J42

Keywords: minimum wages, collective bargaining, statutory minimum

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1 Introduction

“... on the central issue of the level of the minimum wage, the Commission negotiated increases sensitive to the shifting power relations in the product and labour markets... The consensus did not emerge simply from discussion or sweet reasons, but shifting power relations... The stated goal was initially to "help as many as possible low-paid workers without adverse effects on the economy".” Brown, W. (2007) The Process of Fixing the British National Minimum Wage, 1997-2007, British Journal of Industrial Relations, vol. 47, n. 2, 429-443.

There is a large body of theoretical and empirical research on the effects of minimum wages on labor market outcomes.

Theory offers clearcut predictions as to the effects of minimum wages only for a competitive labor 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 labor market ... may have serious deficiencies in accounting for minimum wage effects on labor market outcomes". Empirical results, recently surveyed by Neumark and Wascher (2007), indeed point to both, 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 the presence of labor market imperfections. In particular, labor markets where monopsonistic firms face upward sloping labour supply curves yield a non-monotonic relationship between employment and the minimum wage.

Due to this non-monotonicity, the crucial issue from a normative standpoint is the fine-tuning of the minimum wage to the elasticity of labor demand and supply and the presence of other labor market institutions. The way in which the minimum wage is set is very important in this respect, as the fixing regime may affect both the level and the responsiveness of the minimum wages to changes in the key parameters. 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. Interactions with other institutions setting floors to incomes and earnings are also important, hence varying degrees of involvement of the Government in the setting of the minimum wage may also discriminate among different degree of coordination in the setting of the minimum wages and other relevant policy parameters, e.g., the level of unemployment benefits.

There is a wide cross-country variation in minimum wage setting regimes. They range from conditions where a statutory minimum wage is unilaterally set

by the government and regimes where 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.

Surprisingly enough, economic theory and applied work have devoted to date little, if any attention, to the process leading to the determination of the minimum wage. There is a political economics literature, originated mainly in the US and Canada, on votes concerning the introduction of the minimum wage behaviour (Silbermann and Durden, 1976; Uri and Mixon, 1980; Blais et al., 1989; Rodrick, 1999) or, more recently, on cultural determinants of preferences for minimum wages (Algan and Cahuc, 2007). There is also some empirical literature on the time-series variation of minimum wages (e.g., Williams, 2009). However, to my knowledge there has not been to date any attempt to either relate preferences on the level of the minimum wage to the fixing regimes and use the heterogeneity in fixing regimes in explaining the cross-country (and potentially also time-series) variation in minimum wage levels.

In this paper I develop a simple model yielding implications as to the relation between the level of the minimum wage and the fixing regime. Under a rather broad set of assumptions, the model implies that a Government legislated minimum wage is lower than a minimum wage set in the context of collective bargaining. The model has a number of predictions as to the relationship between minimum wages, unemployment benefits and the elasticity of labour demand. Next, I exploit a new data set on minimum wages in 66 countries having some type of national minimum wage in the period 1981-2005 to explain the cross-country variation in minimum wage levels, using the above theory as guidance in defining the empirical framework. In particular, I look at the effect of differences in the fixing of the minimum wage on the ratio of the minimum wage to the average wage. I 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 generosity of unemployment benefits. I find that a Government legislated minimum wage is lower than a wage floor set within collective agreements. This effect survives to several robustness checks and hints at a causal relation between the setting regime and the level of the minimum wage.

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 provides directions for further research.

2 Interactions between fixing regime and magnitude: 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. Unlike the above mentioned political economy literature which typically considers unions in a otherwise perfect labor market, I will take as benchmark 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 favor of a minimum wage. This is consistent with the non-monotonicity of the minimum wage effects found by the empirical literature. It is also fairer with respect to the institution minimum wage, which is not necessarily distortionary in this context.

I will initially consider a pure monopsony case with no minimum wage and then a context in which collective bargaining sets a minimum wage. Next, I 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

Our baseline is a labor market where firms have monopsony power. To simplify algebra I shall consider a pure monopsony case. Extensions to n-firms with some monopsony power do not alter significantly the results (Manning, 2003).

Labor 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 . Along with Bertola and Boeri (2002), assume that the marginal value of a job (labor 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 infinity (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

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

The supply side of the labor market is given by the cumulative distribution function, $G(\cdot)$, of the reservation wages. The latter is, by construction, increasing in w . To keep things simple we shall assume that also this schedule has a constant-elasticity functional form so that:

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

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 $L = w^{\frac{1}{\varepsilon}}$. Deriving the first-order-condition for employment and solving for wages one obtains

$$w^M = \left[\frac{A}{1+\varepsilon} \right]^{\frac{\varepsilon}{\varepsilon+\eta}} \quad (3)$$

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

$$wL - \int_{\xi}^L x^{\varepsilon} dx = wL - \frac{L^{\varepsilon+1}}{\varepsilon+1}$$

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

$$\max \left(\left[\frac{AL^{1-\eta}}{1-\eta} - wL \right] + \left[wL - \frac{1}{\varepsilon+1} L^{\varepsilon+1} \right] \right) = \max \left(\frac{AL^{1-\eta}}{1-\eta} - \frac{1}{\varepsilon+1} L^{\varepsilon+1} \right) \quad (4)$$

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 labor 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

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

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

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

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:

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

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

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

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 $L = \left(\frac{\underline{w}}{A} \right)^{-\frac{1}{\eta}}$, we obtain

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

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

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

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

$$\underline{w}^C(\beta = 1; \eta = 0) = \left(\frac{A}{1 + \varepsilon} \right) = w^M(\eta = 0) \quad (8)$$

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

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

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) coincides with the Pareto optimum when

$$\gamma = \frac{\epsilon}{\epsilon + \eta} (1 - \eta), 1 - \gamma = \frac{\eta}{\epsilon + \eta} (1 + \epsilon) \quad (10)$$

as in this case the solution is

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

Simple rearrangement of (10) yields

$$\frac{1 - \gamma}{\gamma} = \frac{\eta}{1 - \eta} \frac{1 + \epsilon}{\epsilon}. \quad (12)$$

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 returns¹. 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 as any deviation from this condition involves employment losses.

¹It 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.

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 reducing the electoral power of workers when the labor 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 labor-market effects of macroeconomic shocks under different bargaining structures.

Overall, we expect both \underline{w}^G and \underline{w}^C to be *lower* in presence of a higher elasticity of labor 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 move the minimum wage towards the Pareto optimal level unless when the condition (12) is fulfilled.

A perhaps more interesting case occurs when 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 targeting persons not working. Insofar as these transfers are set by the same entity establishing the minimum wage, the two levels can be coordinated. Indeed, 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 minimum wages and non-employment benefits target different groups (ex-post) of the population, they are both anti-poverty devices. 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.:

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

where N is the population in working age (the potential labor force) and λ

the fraction of the costs of non-employment benefits funded via a payroll tax on employees. Labor supply in presence of a social minimum reads

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

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 labor supply over the minimum wage taking b (and τ) as given. This obtains the gross minimum wage:

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

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 collectively agreed and the Government legislated minimum wages would coincide, we now have that

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

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 pursue egalitarian pay policies, they may impose a higher minimum wage than the one unilaterally 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 labor demand) and institutional (e.g., non-employment benefits)

variables on the setting of the minimum wage. The purpose of the next section is to contribute to explain the cross-country and time-series variation in minimum wage levels based on these theoretical predictions.

3 The data

In this paper I 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 Labor and Finance, Central Banks, Trade Unions as well as 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 carried out.

Data on the level of the minimum wage were then integrated 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 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 an equal stance (the Government typically acts as go in between); 26 countries set the minimum wage after formal consultations between the Government and representatives of employers and workers; 16 countries had the minimum wage set by the Government without any formal consultation with the "social partners".

²See www.frdp.org for a detailed description of the dataset.

Table 1.A: Bargaining process			
<i>Country</i>	<i>Number of country-year observations</i>	<i>Minimum to Mean wage Ratio</i>	<i>Unemployment rate</i>
Argentina	26	32.6%	9.9%
Bangladesh	3	53.6%	2.7%
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%
Ghana	24	27.7%	7.4%
Greece	21	49.4%	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	5	36.4%	16.6%
Thailand	18	52.4%	2.3%
Turkey	27	26.5%	8.5%
Ukraine	17	28.0%	9.1%
Venezuela	7	30.7%	10.5%
Total	463	46.8%	7.9%

Table 1.B: Consultation process			
<i>Country</i>	<i>Number of country-year observations</i>	<i>Minimum Mean Ratio</i>	<i>to Unemployment wage rate</i>
Albania	17	56.3%	22.7%
Algeria	9	32.9%	22.6%
Australia	26	57.7%	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%
France	26	60.3%	9.8%
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%
Poland	11	39.9%	13.6%
Portugal	25	56.0%	6.2%
Romania	26	49.5%	7.2%
Spain	27	30.1%	16.5%
Sri Lanka	26	50.2%	10.4%
United Kingdom	8	37.2%	5.1%
Vietnam	10	19.4%	2.3%
Total	464	44.5%	9.9%

Table 1.C: Government legislated			
<i>Country</i>	<i>Number of country-year observations</i>	<i>Minimum Mean Ratio</i>	<i>to Unemployment wage rate</i>
Azerbaijan	16	9.4%	16.2%
Belarus	16	13.4%	1.9%
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%
Poland	10	26.3%	-
Russia	15	8.8%	9.0%
United States	26	35.2%	6.2%
Uruguay	17	6.1%	11.0%
Total	276	31.5%	7.4%

Note: Unemployment rate not available for Poland in the period covered by data.

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 (third 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) 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 a 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.

Table 2: Descriptive Statistics

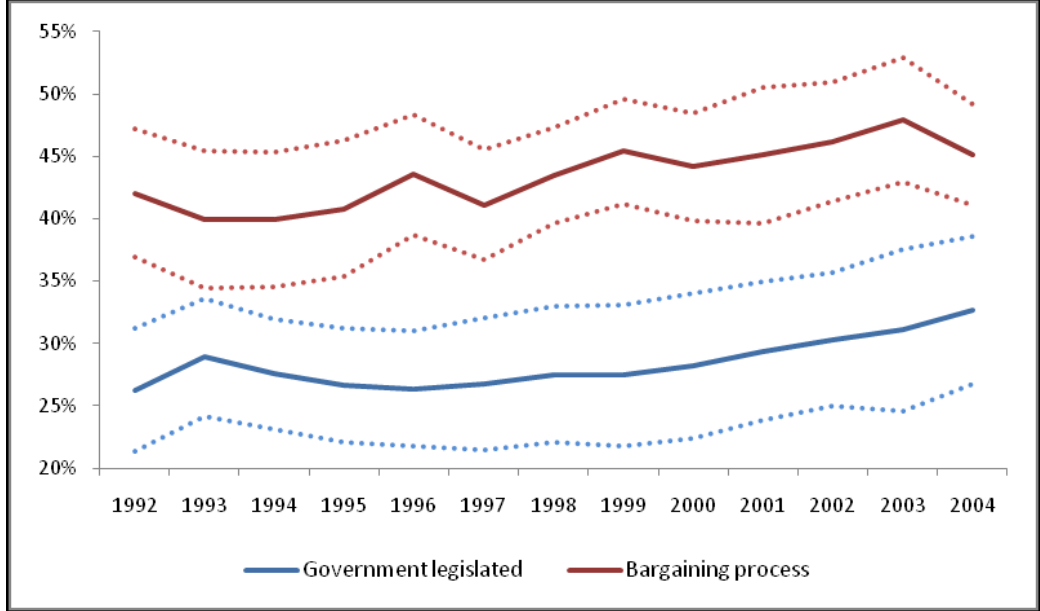
		Bargaining process				
<i>Variable</i>	Obs	Mean	Std. Dev	Min	Max	
Unemployment benefit	742	0.148	0.205	0	0.731	
Log of GDP per capita	668	8.735	0.943	6.375	10.427	
Openness to trade	668	56.929	30.682	9.275	180.350	
Yearly inflation	722	0.529	3.842	-0.012	74.817	
Tax progressiveness	614	0.271	0.176	0	0.700	
		Consultation process				
<i>Variable</i>	Obs	Mean	Std. Dev	Min	Max	
Unemployment benefit	631	0.127	0.183	0	0.675	
Log of GDP per capita	513	8.477	0.984	6.530	10.260	
Openness to trade	513	60.637	29.660	12.843	187.361	
Yearly inflation	639	0.143	0.501	-0.041	10.584	
Tax progressiveness	425	0.299	0.163	0	0.750	
		Government legislated				
<i>Variable</i>	Obs	Mean	Std. Dev	Min	Max	
Unemployment benefit	351	0.127	0.164	0	0.720	
Log of GDP per capita	302	8.477	1.139	5.660	10.490	
Openness to trade	302	86.138	35.513	11.129	164.829	
inflation	367	1.253	6.769	-0.098	117.496	
Tax progressiveness	228	0.257	0.185	0	0.700	

3.1 Descriptive statistics

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 groups of countries with a collectively bargained and a Government legislated minimum wage (the two extreme groupings displayed in Tables 1.A and 1.C). Only the 30 countries displaying information over the entire 1992-2004 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" 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.

Figure 1: Minimum wage to average wage ratio



4 Methodology

Guided by Section 2, we estimate the following model

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

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) if not GDP per capita levels themselves. Results

controlling for the sectoral composition of the workforce (the share of employment in services and agriculture) are also reported in Table A2 in the Appendix as this information is available only for a restricted set of countries.

4.1 Results

Table 3 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. The standard errors reported in parentheses are robust to arbitrary forms of heteroschedasticity and autocorrelation (clustered by country).

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 specifications (1) and (2) (before introducing interaction dummies) suggest that collective bargaining involves, *ceteris paribus*, a 12-13 percentage points higher ratio of the minimum wage to the average wage. A higher unemployment benefit system increases the minimum wage consistently with the predictions of the model in Section 2. This effect survives when I measure unemployment benefits with 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) avoiding the spurious correlation induced by using measures having the average wage as denominator (see Table A1 in the Appendix). Contrary to the theoretical predictions of Section 2, trade openness, proxying the elasticity of labor demand, is not statistically significant.

Table 3: Regression results

	(1)	(2)	(3)
			Minimum wage to average wage
Bargaining process	0.120*** (0.043)	0.134*** (0.047)	0.240** (0.118)
Consultation process	0.081* (0.043)	0.079** (0.039)	0.061 (0.117)
Unemployment benefit level		0.213* (0.122)	0.204 (0.172)
Log of GDP per capita		-0.004 (0.038)	0.013 (0.048)
Openness to trade		0.000 (0.000)	0.001 (0.001)
Inflation rate		-0.003* (0.001)	-0.002 (0.002)
Bargaining process * openness to trade			0.000 (0.001)
Consultation process * openness to trade			-0.001 (0.001)
Tax progressiveness			-0.071 (0.166)
Time trend			-0.017*** (0.005)
Bargaining process * tax progressiveness			-0.449 (0.276)
Consultation process * tax progressiveness			0.129 (0.239)
Regional dummies	Yes	Yes	Yes
Income group dummies	Yes	No	No
Regional dummies * time trend	No	No	Yes
Constant	0.056 (0.099)	0.284 (0.258)	34.830*** (8.936)
Observations	1203	910	698
R-squared	0.31	0.27	0.38

Standard errors (clustered by country) in parentheses. Reference category is the Government legislated minimum wage
* significant at 10%; ** significant at 5%; *** significant at 1%.

Column (3) reports estimates including tax progressiveness and several interaction terms. In the specification we also interact regional dummies 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). This extension does not significantly alter our results as far as the markup induced by a collective bargaining regime over a Government legislated one is concerned. However, there is no longer a significant difference between the "consultation" and the "Government legislated" bargaining regime. The coefficient for tax progressiveness is surprisingly negative, but this effect is not significantly different from zero.

4.2 Robustness checks

In table 4 we perform the same regressions as above, confining this time our attention to OECD countries (results for developing nations are reported in Table A3 in the Appendix). 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. Limited to OECD countries we also have information on sub-minimum wages, that is, exemptions granted to specific categories of workers, e.g., youngsters or workers in some industries, regions or occupations. In particular, we use an enforcement index developed by Algan and Cahuc (2007) which is increasing in the number and size of the exemptions legally allowed to statutory minimum wages³.

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 unemployment benefits variable is in line with the above theoretical predictions. Tax progressiveness, which is better measured in OECD countries than in developing nations, is now significant and positive as theory would predict, and negative when interacted with a bargaining regime. Finally, the enforcement variable is not statistically significant.

³The index is the average of two indexes: an index of dispersion (one divided by the simple number of sectoral, regional, occupational or age deviations) and an index capturing the size of these derogations (taking value 0 if there is no derogation, 0.5 if limited and 1 if large). See Algan and Cahuc (2007) for details.

Table 4: Regression results - OECD countries only

	(1)	(2)	(3)	(4)
			Minimum wage to average wage	
Bargaining process	0.111*** (0.014)	0.104*** (0.019)	0.440*** (0.094)	1.181** (0.492)
Consultation process	0.032** (0.015)	0.036** (0.014)	-0.004 (0.051)	0.032 (0.439)
Unemployment benefit level		0.252*** (0.058)	0.296*** (0.081)	0.300 (0.400)
Log of GDP per capita		0.005 (0.027)	0.206** (0.080)	0.020 (0.144)
Openness to trade		0.000 (0.000)	0.001* (0.000)	0.001 (0.007)
Inflation rate		0.317* (0.169)	0.929*** (0.273)	-0.058 (0.069)
Bargaining process * openness to trade			-0.001** (0.001)	-0.000 (0.005)
Consultation process * openness to trade			0.001* (0.000)	0.001 (0.007)
Tax progressiveness			0.427*** (0.081)	0.815 (1.687)
Time trend			-0.006** (0.003)	-0.005 (0.011)
Bargaining process * tax progressiveness			-0.618*** (0.118)	-3.828* (1.818)
Consultation process * tax progressiveness			0.008 (0.099)	-0.360 (1.562)
Minimum Wage enforcement index				-0.038 (0.498)
Constant	0.425*** (0.011)	0.261 (0.271)	10.759* (5.589)	8.939 (20.344)
Observations	296	244	209	24
R-squared	0.09	0.24	0.50	0.68

Robust standard errors in parentheses. Reference category is the Government legislated minimum wage
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5 allow for separate effects for countries with middle-to-high 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 significant (structural) unemployment. Consistently with this prediction we find that the effect of the wage setting regime on the minimum wage is larger when we include a dummy for countries with low unemployment (columns (1) and (2)) or we concentrate only on countries with unemployment rate greater than 3.5 per cent (columns (3) and (4)).

Table 5: Regression results - Middle to High unemployment levels

	(1)	(2)	(3)	(4)
		Minimum wage to average wage		
Bargaining process	0.135*** (0.016)	0.224*** (0.046)	0.114*** (0.035)	0.219*** (0.048)
Consultation process	0.091*** (0.014)	0.077 (0.052)	0.266*** (0.035)	0.021 (0.053)
Unemployment benefit level	0.192*** (0.043)	0.156** (0.062)	0.003 (0.049)	-0.002 (0.062)
Log of GDP per capita	-0.002 (0.013)	0.031 (0.025)	0.003 (0.014)	0.031 (0.027)
Openness to trade	0.000 (0.000)	0.001 (0.000)	0.001*** (0.000)	0.001** (0.000)
Inflation rate	-0.003** (0.001)	-0.002 (0.002)	-0.003*** (0.001)	-0.002 (0.001)
Bargaining process * low unemployment	-0.047* (0.025)	-0.052* (0.031)		
Consultation process * low unemployment	-0.104*** (0.031)	-0.115*** (0.036)		
Bargaining process * openness to trade		0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)
Consultation process * openness to trade		-0.001* (0.001)	-0.003*** (0.001)	-0.001 (0.001)
Bargaining process * tax progressiveness		-0.418*** (0.114)		-0.370*** (0.119)
Consultation process * tax progressiveness		0.185* (0.104)		0.391*** (0.103)
Time trend		-0.018*** (0.003)		-0.018*** (0.003)
Regional dummies	Yes	Yes	Yes	Yes
Income group dummies	No	Yes	No	Yes
Regional dummies * time trend	No	Yes	No	Yes
Constant	0.274*** (0.093)	8.474** (3.444)	0.151 (0.109)	36.171*** (5.480)
Observations	910	698	807	613
R-squared	0.28	0.39	0.30	0.43

Columns (3) and (4) include only a subset of countries with unemployment rate greater than 3.5 percent

The consultation regime is a sort of hybrid between a Government legislated regime and one in which minimum wages are bargained over. In table 6, we pool this intermediate category either together with the bargaining regime or together with the Government legislated one. We still observe a positive markup in regimes in which social partners are involved, over wage floors in Government legislated regimes. Unsurprisingly the effect of the bargaining regime is weaker when consultation is included in the same category as Government legislated regimes.

Table 6: Binary classification

(Bargaining + Consultation) vs. Government legislated			
	(1)	(2)	(3)
	Minimum wage to average wage		
Government legislated	-0.103*** (0.012)	-0.108*** (0.014)	-0.155*** (0.042)
Bargaining vs. (Consultation + Government legislated)			
	(1)	(2)	(3)
	Minimum wage to average wage		
Bargaining process	0.087*** (0.011)	0.097*** (0.013)	0.114*** (0.029)

Robust standard errors in parentheses.

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

Regressions replicate specifications (1) to (3) of Table 3.

4.3 Endogeneity issues

The above results can hardly be interpreted as causal effects of the minimum wage fixing regime on the minimum to average wage ratio. The fixing regime may indeed be endogenous to the choice of any given wage floor. To make inferences as to whether the wage fixing regime affects minimum wage levels, in Table 7 we concentrate on those countries that have a relatively long history of minimum wages. There is indeed considerable inertia in the fixing regime: no country in our sample has changed its fixing regime over time. Minimum wages, on the other hand, are adjusted typically at yearly frequencies. Thus, the focus on countries with well-established minimum wages should allow us to capture causal effects of the fixing regime over the level of the minimum wage.

In particular, we consider two set of countries: i. countries that had introduced a minimum wage at least 10 years prior to the beginning of our observation period, and ii. countries having introduced the minimum wage at least 20 years before the first observation in our dataset. Collectively bargained minimum wages still yield a positive markup over Government legislated ones. The effect is even stronger when we concentrate on countries with a longer history of minimum wages. We interpret these results as broadly supportive of a causal effect of the fixing regime over the level of minimum wages⁴.

⁴We also instrumented the fixing regime, based on some (as always debatable) exclusion restriction. In particular, the identifying assumption was 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, after controlling for all the relevant country specific characteristics. If the above identifying assumption is accepted, results (available from the author upon request) are consistent with a causal effect of the fixing regime over the level of the minimum wage. In particular, the political regime (captured by the Polity2 index) is a strong predictor of the probability of choosing a Government legislated minimum wage fixing regime over a collectively bargained one, whilst in the second stage equation (where polity2 is not significant) minimum wages under Government legislated minimum wage fixing regimes

Table 7: Countries with a long history of minimum wages

Minimum wage introduced at least 10 years before			
	(1)	(2)	(3)
	Minimum wage to average wage		
Bargaining process	0.104*** (0.016)	0.124*** (0.019)	0.184*** (0.049)
Consultation process	0.059*** (0.015)	0.066*** (0.016)	-0.084 (0.056)

Minimum wage introduced at least 20 years before			
	(1)	(2)	(3)
	Minimum wage to average wage		
Bargaining process	0.123*** (0.017)	0.172*** (0.019)	0.241*** (0.049)
Consultation process	0.060*** (0.017)	0.095*** (0.016)	-0.042 (0.055)

Robust standard errors in parentheses.

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

Columns (1) to (3) replicate the same specifications of Table 3

5 Final Remarks

Although economic theory and empirical work offer ample evidence of a non-monotonic relationship between minimum wages and employment, little attention has been devoted so far by economists to the process leading to the determination of the minimum wage. This paper offers a simplified framework allowing to understand the key interactions involved in the setting of the minimum wage and how the choice of the fixing regime may affect the level of the minimum wage. A new dataset of minimum wages and their determination mechanisms in 66 countries is also exploited to empirically evaluate these interactions in a cross-country and time-series setting. The results are broadly consistent 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. There are also indications that this markup can be interpreted as a causal effect of the fixing regime on the level of the minimum wage.

Further work will have to possibly extend further the database to better capture the enforcement of the minimum wage. Time-series extensions of the dataset would also allow to identify episodes in which the fixing regime has been changed in a given country. These natural experiments, which are not present are lower than under the alternative fixing regimes, and this effect is statistically significant.

in the period covered by our data, would enable implementation of difference-in-differences estimators.

6 References

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7 Appendix

Table A1: Regression results with an Unemployment Benefit Dummy

	(1)	(2)
		Minimum wage to average wage
Bargaining process	0.124*** (0.016)	0.247*** (0.044)
Consultation process	0.078*** (0.014)	0.086* (0.051)
unemployment benefits dummy	-0.005 (0.019)	-0.019 (0.023)
Log of GDP per capita	0.002 (0.013)	0.024 (0.021)
Openness to trade	0.000* (0.000)	0.001*** (0.000)
Inflation rate	-0.003*** (0.001)	-0.002 (0.001)
Bargaining process * openness to trade		-0.000 (0.000)
Consultation process * openness to trade		-0.001*** (0.001)
Tax progressiveness		-0.074 (0.091)
Bargaining process * tax progressiveness		-0.456*** (0.115)
Consultation process * tax progressiveness		0.148 (0.109)
Time trend		-0.019*** (0.003)
Regional dummies	Yes	Yes
Regional dummies * time trend	No	Yes
Constant	0.245** (0.096)	36.988*** (5.038)
Observations	910	698
R-squared	0.25	0.36

Robust standard errors in parentheses. Reference category is the Government legislated minimum wage
 * 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	0.149*** (0.019)	0.391*** (0.044)
Consultation process	0.081*** (0.016)	0.032 (0.055)
Unemployment benefit level	0.179*** (0.051)	0.102* (0.059)
Log of GDP per capita	-0.014 (0.020)	0.040* (0.024)
Openness to trade	0.001*** (0.000)	0.002*** (0.000)
Inflation rate	-0.005*** (0.002)	-0.002 (0.002)
fraction of employment in services	-0.080 (0.135)	-0.240 (0.174)
fraction of employment in agriculture	-0.179 (0.125)	0.177 (0.181)
Bargaining process * openness to trade		-0.001*** (0.001)
Consultation process * openness to trade		-0.001 (0.001)
Tax progressiveness		0.018 (0.080)
Bargaining process * tax progressiveness		-0.688*** (0.123)
Consultation process * tax progressiveness		0.209* (0.118)
Time trend		0.001 (0.004)
Regional dummies	Yes	Yes
Regional dummies * time trend	No	Yes
Constant	0.518*** (0.176)	-2.626 (8.395)
Observations	571	448
R-squared	0.32	0.47

Robust standard errors in parentheses. Reference category is the Government legislated minimum wage
* significant at 10%; ** significant at 5%; *** significant at 1%

Table A3: Regression results - Less Developed Countries only

	(1)	(2)	(3)
		Minimum wage to average wage	
Bargaining process	0.330*** (0.025)	0.281*** (0.030)	-0.043 (0.078)
Consultation process	0.263*** (0.025)	0.244*** (0.028)	-0.091 (0.090)
Unemployment benefit level		-0.137 (0.126)	0.450** (0.211)
Log of GDP per capita		0.059*** (0.018)	0.113*** (0.020)
Openness to trade		-0.002*** (0.000)	-0.006*** (0.001)
Inflation rate		-0.003* (0.002)	-0.003*** (0.001)
Bargaining process * openness to trade			0.007*** (0.001)
Consultation process * openness to trade			0.005*** (0.001)
Tax progressiveness			0.716*** (0.269)
Time trend			-0.010*** (0.002)
Bargaining process * tax progressiveness			-1.027*** (0.284)
Consultation process * tax progressiveness			-0.432 (0.283)
Constant	0.202*** (0.021)	-0.106 (0.138)	18.823*** (4.471)
Observations	511	374	274
R-squared	0.25	0.31	0.39

Robust standard errors in parentheses. Reference category is the Government legislated minimum wage
* significant at 10%; ** significant at 5%; ***significant at 1%