# Civil society and the state:
# The interplay between cooperation and minimum wage regulation[1]

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**Abstract**

In a cross-section of countries, the stringency of state regulation of minimum wages is strongly negatively correlated with union density and with the quality of labor relations. In this paper, we argue that these facts reflect different ways to regulate labor markets, either through the state or through the civil society, depending on the degree of cooperation in the economy. We rationalize these facts with a model of learning of the quality of labor relations. Distrustful labor relations lead to low unionization and high demand for direct state regulation of wages. In turn, state regulation crowds out the possibility for workers to experiment negotiation and learn about the potential cooperative nature of labor relations. This crowding out effect can give rise to multiple equilibria: a "good" equilibrium characterized by cooperative labor relations and high union density, leading to low state regulation; and a "bad" equilibrium, characterized by distrustful labor relations, low union density and strong state regulation of the minimum wage.

**JEL Classification:** J30, J50, K00.

**Key words:** Quality of labor relations, trade unions, minimum wage,

# 1 Introduction

In a cross-section of countries, the stringency of government regulation of minimum wages is strongly negatively correlated with union density and with the quality of labor relations. Figure 1 illustrates the negative correlation between the stringency of minimum wage regulation and the quality of labor relations. The index of state regulation of minimum wages combines information on the level of the wage floors, and the existence of a legal statutory minimum wage along with the number of derogations from the law, in 2000.[1] The index of the quality of labor relations is constructed using the 1999 Global Competitiveness Reports, a survey sent out to thousands of executives with the following question: "Do you think that labor/employer relations are generally cooperative". Figure 1 shows that pessimistic beliefs in cooperation are associated with stringent regulation of wages at the country level.[2] In contrast, Figure 2 shows the strong positive correlation between unionization rates and executives' beliefs in cooperative labor relations.

In this paper, we argue that these facts reflect different ways to regulate labor markets: either through the state or through the civil society. These different regulations are associated with different qualities of labor relations. In Scandinavian countries, the degree of state regulation of labor market is low. Labor relations are higly cooperative and union density is high. Wage floors are directly negotiated between unions and no statutory legal minimum wage exists. At the other extreme, state regulation is high in countries (in particular, France) where labor relations are distrustful and union density is low. This interpretation directly contradicts a common wisdom whereby anything that strengthens employees' bargaining power, in particular higher rates of unionization, should be negatively perceived by employers and therefore deteriorate labor relations. Countries with low union density, such as France, are characterized by distrustful labor relations, whereas Nordic countries with their high unionization rates show widespread beliefs in cooperative labor relations.

Our paper documents, and tries to explain, these different labor market regulations and their relations with the quality of labor relations. We develop a model where trade unions might improve productivity by fostering *voice* rather than *exit* in labor relations. The distinction between voice and exit, first proposed by Hirshman (1970) and then applied to trade unions by Freeman and Medoff (1984), stresses that people involved in a relation have essentially two possible responses when they perceive that the relation is not working: they can exit (withdraw from the

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[1] This index of state regulation of minimum wages and data on union density are presented more precisely in section 3.

[2] Evidence about the perceptions of the quality of labor relations across OECD countries are given each year by the *Global Competitiveness Reports*. Responses may vary from 1 for strong disagreement to 7 for strong agreement.The same pattern of correlation holds when we focus on workers' perception of the quality of labor relations. This index is presented more precisely in Section 4.

relation), or they can voice (attempt to repair or improve the relation through communication). When productivity is increased by voice, employers and trade unions can bargain higher wages.

Voice needs specific investments in the quality of labor relations to have a chance of success.[3] One might think of these investments as the degree of workplace presence of unions to gather and transmit information between workers and managers, and to produce services. But the return of such investment is uncertain. It depends on the cooperative nature of the economy. Upon deciding whether to invest or not in the quality of labor relations, individuals do not know whether they live in a cooperative economy, where the investment will indeed improve the quality of labor relations, or if they live in a non-cooperative economy where such investment is pointless. In other word, the investment decision can be seen as a costly experimentation to improve labor relations and discover the true cooperative nature of the economy.[4]

In this framework, workers have less incentives to unionize and to pay the experimentation cost when they can rely on state regulation rather than on union's strenght to get high wages (Checchi and Lucifora, 2002). Accordingly, the legal minimum wage reduces the incentives to learn about the scope for cooperation.[5] Our model thus predicts that more stringent legal minimum wages increase the probability that the economy will fall in a low quality of labor relations and low unionization trap. The model also accounts for the reverse impact of the quality of labor relations and unionization rates on state regulation of minimum wages. When beliefs in cooperation are too low to sustain involvement in trade unions, there is a strong demand for direct state regulation of minimum wage, which in turn results in a higher minimum wage being set by the government in equilibrium. This interplay between state regulation and beliefs can lead to multiple-equilibria. The negative relation between state regulation of wages and cooperative beliefs can explain that countries can be stuck in an equilibrium with high minimum wage and low union density. At the other extreme, in countries where beliefs about cooperation are optimistic enough to sustain unions and negotiations, the demand for the legal minimum wage is lower. The low stringency of the minimum wage legislation provides incentives to experiment social dialogue by joining unions and thereby learning to implement cooperative labor relations. This experimentation in turn makes it possible for such countries to converge towards an equilibrium with low minimum wage, cooperative labor relations and high union

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[3]Addison and Belfield (2004) provide a survey on the empirical and theoretical literature on voice in labor relations. They conclude that improvements in productivity are not automatic, "these may be observed given an appropriate concatenation of circumstances: the expression of effective voice, a constructive institutional response, and a cooperative industrial relations environment."

[4]Our model builds on seminal contributions by Piketty (1995), Benabou and Tirole (2006) and Alesina and Angeletos (2005) who use a Bayesian setting to explore the interactions between public policies and beliefs.

[5]The effects of state regulation of minimum wages on distrustful labor relationships in our model are similar to those identified by the political science literature on centralized rules regulating the civil society (Ostrom, 2005).

density.

Although our paper highlights new interactions between state regulation and cooperation in the civil society, it follows a large literature. First, our representation of the building-up of cooperation as resulting from experimentation in collective action can explain the high degree of persistence in cooperative values found by Putnam (1993) and confirmed by Guiso et al. (2007a). This explanation is complementary to the one proposed by Tabellini (2007b) where parents rationally choose which values to transmit to their offspring, and this choice is in turn influenced by the quality of external enforcement of values. In Tabellini's framework, values evolve gradually over time and if the quality of external enforcement is chosen under majority rule, there is hysteresis in the dynamics of values: adverse initial conditions, with weak enforcement, may lead to an equilibrium path where external enforcement remains weak and individual values discourage cooperation.[6] This paper has also some connections with the literature stressing the coevolution of policies and beliefs, along the lines of Piketty (1995), Alesina and Angeletos (2005) and Benabou and Tirole (2006). In Piketty (1995), multiple equilibria in beliefs and redistributive policies can originate from the heterogeneity in initial beliefs and the difficulty for individuals to learn the true cost and benefits of redistribution. Benabou and Tirole (2006) suggest that agents can deliberately bias their own perception of the truth. In Alesina and Angeletos (2005), multiplicity originates in the preference for fair economic outcomes.

Our paper is distinguished from this research in two central ways. First, we provide a framework that allows us to analyze the interplay between investment in cooperation within the civil society and state regulation. This framework allows us to explain why citizens with low level of cooperation within the civil society demand more state regulation, leading in turn to a crowding out of investment in cooperation within the civil society. Second we propose to illustrate this interaction with new empirical facts on state regulation of minimum wages, unionization behavior and the quality of labor relations.

The paper is organized as follows. Section 2 documents the relations between state regulation of minimum wages, union density and the quality of labor relations across countries. This section also provides information about the influence of history on beliefs in the quality of labor relations, which is the core element of our explanation of cross country differences in labor market regulations. Section 3 presents the model. Section 4 concludes.

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[6]See also Bisin and Verdier (2000), Lindbeck and Nyberg (2006) and Guiso et al. (2007b) for alternative formulation of transmission of beliefs and norms from parents to children.
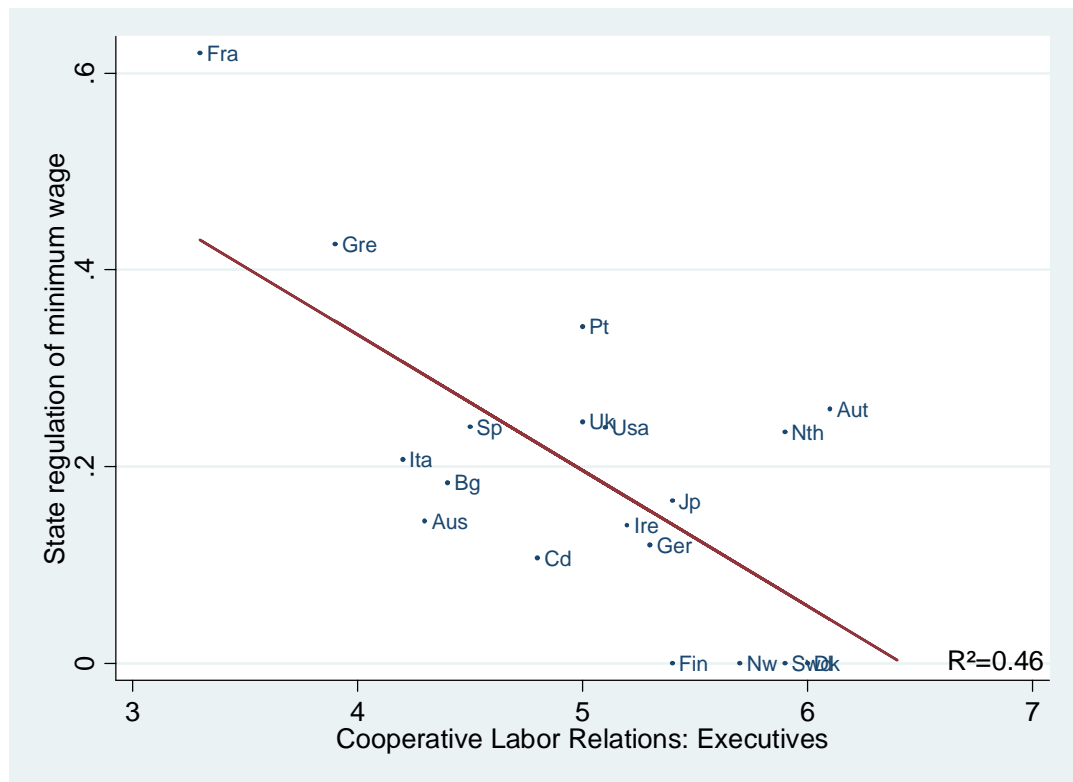
Figure 1: Correlation between State regulation of minimum wages and Executives' beliefs in Cooperative labor relations. Source: ILO and OECD 1980-2003, and GRC 1999.
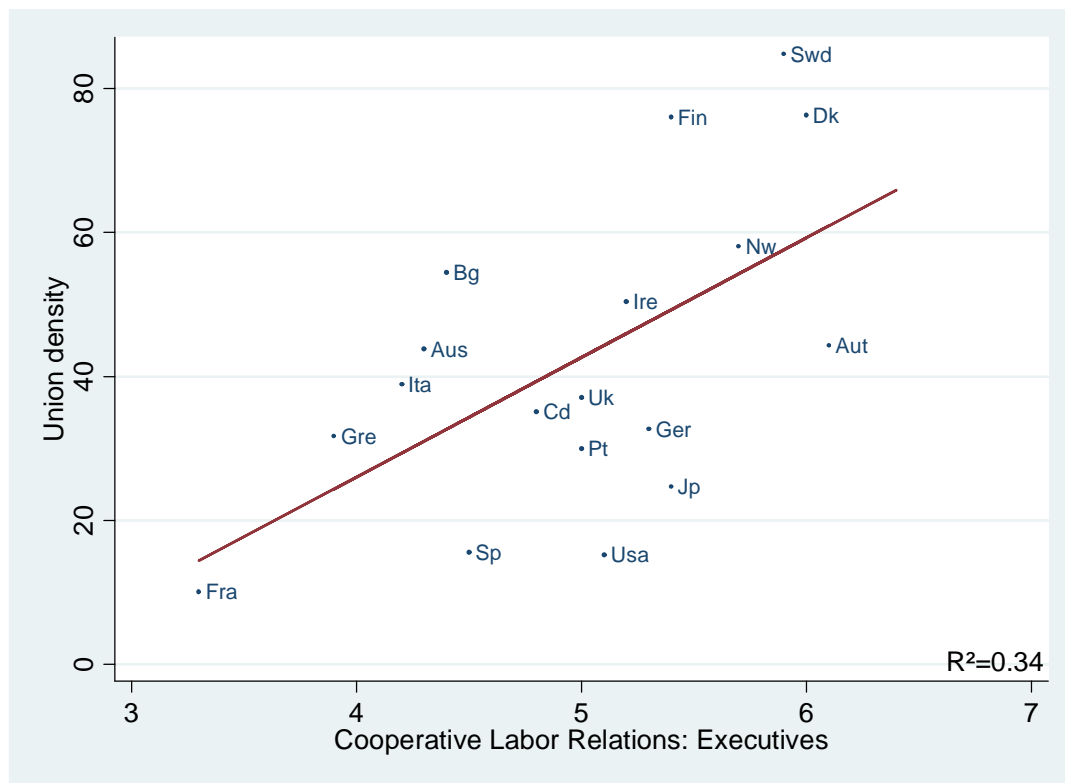
Figure 2: Correlation between union density and Executives' beliefs in cooperative labor relations. Source: OECD 1980-2003 and GRC 1999 database.

# 2 Basic facts on the quality of labor relations, unionization and state regulation of wages

This section documents the existence of a negative relation between state regulation of minimum wages and union density across countries. We also show that this cross country heterogeneity in labor market regulation is associated with different beliefs in the quality of labor relations. Countries with distrustful labor relations tend to rely more on the state than on unions to regulate the labor market. We then document how beliefs in the quality of labor relations are influenced by history and are associated with the demand for state regulation.

## 2.1 Cross-country correlations between cooperation and regulation of minimum wages

### 2.1.1 Data

Our cross-country analysis is based on 22 OECD countries: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Japan, Mexico, Netherlands, Norway, Poland, Portugal, Spain, Sweden, United Kingdom and the United States. The data covers the period 1980-2000.

- **State regulation of minimum wage**

We measure the stringency of state regulation of minimum wages through a composite index. A first component of this index is the stringency of the minimum wage legislation, including the existence of legal minimum wages and the extent of potential derogations. A second component is the level of the minimum wage. Data are borrowed from the International Labor Organization (ILO) and from the OECD database. The ILO database provides detailed description of the different legal procedures to set minimum wages. The OECD database provides information concerning the level of real minimum wages and the ratio of minimum wages relatively to average wages and median wages. The indicators are briefly described below, the full description being reported in Appendix C. The overall regulation index is simply the product of these two components.

*Minimum wage legislation*

We start by looking at the stringency of minimum wage legislations. This is measured by two main indicators: $i°$) *minwage_legal* measures the existence of a legal statutory minimum wage, and if not, the degree of coverage of the minimum wage set by collective bargaining; $2°$) *minwage_dispersion* measures the degree of dispersion in minimum wages across ages, qualifi-

cations, regions, sectors or occupations. We scale each of these two indicators between zero and one, a higher value indicating more stringent law enforcement.

Figure 3 shows the first indicator, *minwage_ legal*, which captures the existence of a legal statutory minimum wage and the extent to which minimum wages negotiated in collective bargaining are extended to all workers. The indicator *minwage_ legal* equal to 1 if a statutory minimum wage exists, 0.5 if instead the wage floor is directly bargained over by unions and then extended, and 0 otherwise. We report the average value of this indicator for the period 1980-2003. A high degree of cross-country variation shows up along this dimension. A first group of countries, namely Scandinavian countries, do not have any legal minimum wage, and no legal automatic extension of the negotiated wage floors. Wage floors are determined as part of the collective agreements between unions, and then they apply to workers covered by these collective agreements only. A similar group of countries, made up of Austria, Germany and Italy, do not have any legal statutory minimum wages. But legal dispositions stipulate to what extent the negotiated wage floors should be extended to all other workers. Lastly, a legal statutory minimum wage is implemented by most Mediterranean and Anglo-Saxon countries. In the United States, this tradition dates back at least to the 1938 Fair Act while it is more recent in United Kingdom which established a legal minimum wage in 1999.

Figure 4 shows the indicator *minwage_ dispersion* which measures the extent of dispersion and derogations in minimum wage setting. Minimum wage can differ by ages, qualifications, regions, sectors or occupations. A more constraining minimum wage legislation is one that leaves little room for derogations and dispersion. We measure this characteristic by constructing two sub-indexes for age dispersion and other kind of derogations. The sub-indexes are ranked between 0 and 1, a higher score indicating that the country provides little derogation. The sub-index of dispersion across ages is constructed as follows. The score is equal to 1 if there is no provision at all for sub-minimum wages. It is equal to 0.5 if derogations are restricted to workers younger than 18 years old or if the derogation is less than half the official minimum wage. And it takes on the value 0 if the derogations can be extended to people older than 18 years or/and if the sub-minimum wages are lower than half the standard wage floor. The sub-index for other derogations equal 0 if the minimum wage is allowed to differ along at least the three dimensions of regions, sectors and occupations, 0.33 if there are two types of distinctions, 0.67 for one type of distinction, and 1 if no dispersion at all is allowed. The indicator *minwage_ dispersion* is the average of these two sub-indexes.

Figure 4 shows a great deal of cross-country heterogeneity in the *minwage_ dispersion* indicator over the period 1980-2003. Countries like France leaves no scope for derogations based on age, occupation, or industry. Other countries allow for subminimum wages. Thus, special wage
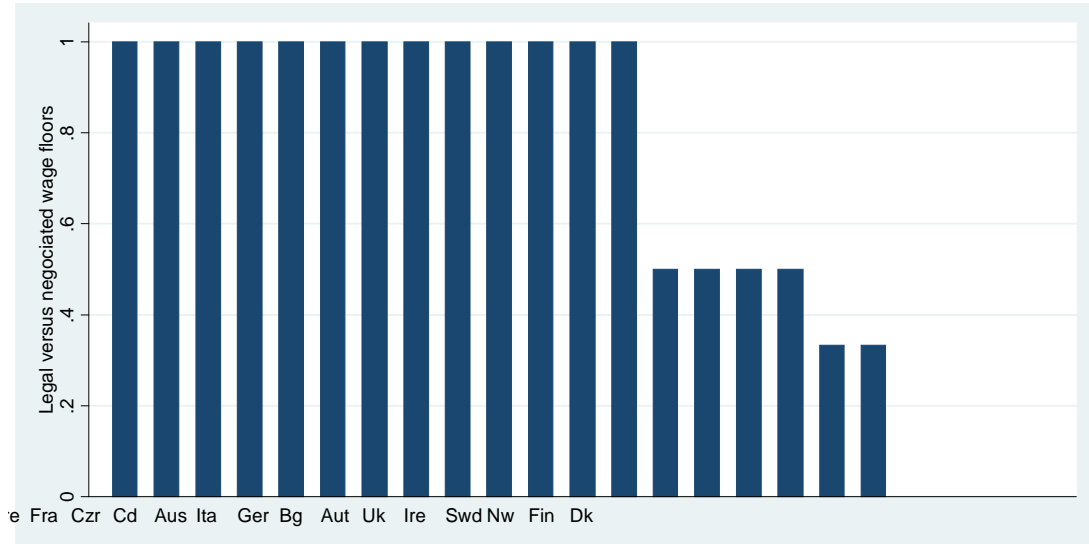
Figure 3: Legal statutory minimum wages or the degree of extension of negotiated wage floors. Period: 1980-2003.

floors extend up to age 24 in Sweden and to age 22 years in the Netherlands. The Netherlands accepts a reduction up to 40 percent of standard minimum wage at 17 years old. Nordic countries let unions negotiate the wage floor at the industry level, without any automatic extension to other parts of the economy.

Henceforth, we measure the stringency of the overall minimum wage legislation using the composite indicator *minwage_legislation*, obtained by multiplying the indicator of legal determination of the minimum wage, *minwage_legal*, by the indicator of potential dispersion, *minwage_dispersion*.

*Minimum wage levels*

We measure the minimum wage level by the index *minwage_level* defined as the ratio of the minimum wage over the median wage in the economy. Minimum wage levels are provided by the OECD database for all years since the mid-1970s. The OECD only reports countries which have a legal statutory minimum wage. We thus complete these data by using Neumark and Wascher (2004)'s indicators for other countries. These data cover two time periods, the late 1970s and the 2000s. The exact definition of the minimum wage variables used to calculate the real value of national minimum wages, is reported in the Appendix. As mentioned above, minimum wage levels display some degree of dispersion within most countries. The OECD database and Neumark and Washer reports the average value for full-time minimum wage workers who are
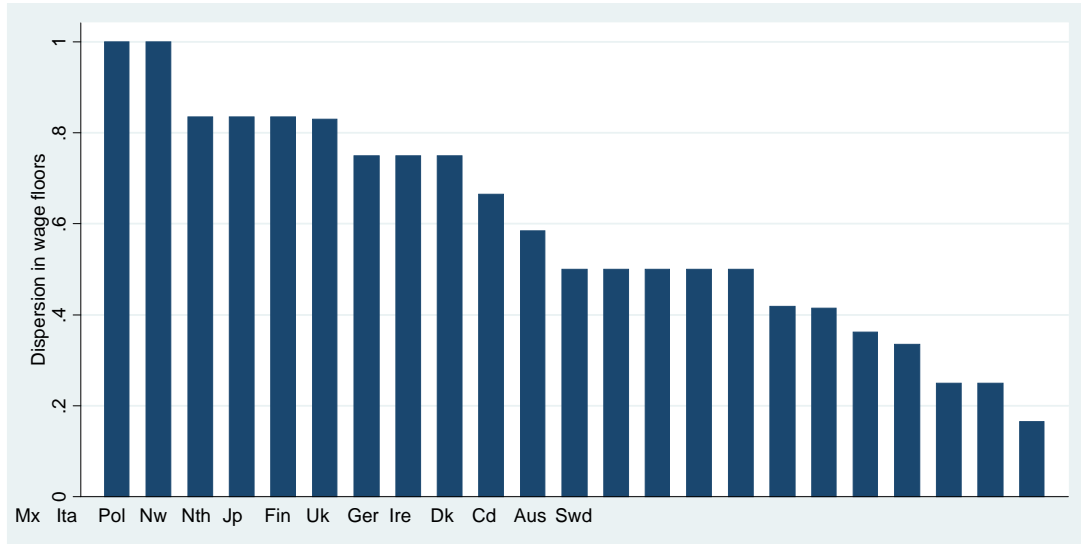
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Figure 4: Degree of dispersion in wage floors by ages, qualifications, regions, sectors or occupations. Period 1980-2003.

not subject to any derogations, as a percentage of average wages of full-time workers in the corresponding sector (see Immervoll, 2007, and Neumark and Washer, 2004).

The overall measure of minimum wage regulation used in the following tables and figures, denoted by *minwage*, is simply the product *minwage_ legislation\*minwage_ level.*

- **Data on cooperation: union density and the quality of labor relations**

We measure the perceived level of cooperation in the labor market by the quality of the relation between workers and managers. We first use the *Global Competitiveness Reports*, a survey sent out to thousands of executives each year across more than 50 countries. Among other questions, executives are asked to respond to the following statement: "*Labor/employer relations are generally cooperative*". Responses may vary from 1 for strong disagreement to 7 for strong agreement. One may of course worry about this only reflecting the perception of executives. We thus use additional information from the *International Social Survey program 1999* (ISSP), which asks similar questions but for all categories of citizens. The question is the following: "*In all countries there are differences or even conflicts between different social groups. In your opinion, how much conflict is there between management and workers in your country?*" Responses are equal to 1 for "very strong conflict", 2 for "strong conflict", 3 for "not very strong conflict", and 4 for "no conflict at all". We construct a variable equal to 1 if the

respondent chooses answer 3 or answer 4, and zero otherwise, to capture the share of workers who believe in cooperative labor relations in each country.

We measure workers' involvement in unions by using the unionization data provided by the OECD at a yearly frequency since the 1960s. We also use data from Boeri et al. (2003) to track back the evolution of unionization rates since the early 1950s. We should be clear at this point that our primary focus is on workers' propensity to cooperate and to group into associations rather than rely on state intervention to guarantee their wage. In this regard, union density appears to be a more relevant indicator than union coverage rates. Obviously, the coverage indicator provides information regarding the bargaining power of unions, and as a matter of fact the role of unions in regulating wages becomes fairly high in some countries due to the automatic extension of negotiated wages to all sectors, even if the union density rate is really low. However the coverage indicator also captures the extent of state intervention in setting wages, since negotiated wages are extended by law to the different sectors of the economy. Thus this indicator does not truly reflect workers' preference for direct negotiations over the alternative of relying on state intervention.

### 2.1.2 Correlation between state regulation of minimum wage and union density

Figure 5 depicts the cross-country correlation between workers' involvement in unions and the degree of state regulation of wage floors in OECD countries on average over the period 1980-2003.

The vertical axis shows the average union densities by country over that period. Nordic countries display the highest unionization rates over that period, with a 82 percent rate in Sweden and a 77 percent rate in Denmark. Countries such as Austria and Germany fall in the middle part of the picture with union density rates at around 40 percent. Anglo-Saxon countries like United-Kingdom or Canada, belong to the same middle group. And Mediterranean countries show the lowest unionization rates, with less than 10 % in France or Spain. Note that Italy is a clear outlier, with a unionization rate close to 40 %.

The horizontal axis shows the composite *minwage* index measuring state regulation of minimum wage. As we can see on Figure 5, the correlation between the composite index of wage regulation and unionization rates is strongly negative. Nordic countries which have very high unionization rates also display the weakest state regulations. There is no legal minimum wage in these countries: wage floors are negotiated at industry level, and there is a substantial amount of dispersion in wage floors across regions, industries, qualifications and ages. The same picture holds for Continental countries like Austria and Germany, which combine relatively high union density rates and the absence of statutory minimum wage. In contrast, Mediterranean countries display the highest level of state intervention to set minimum wages. Countries like
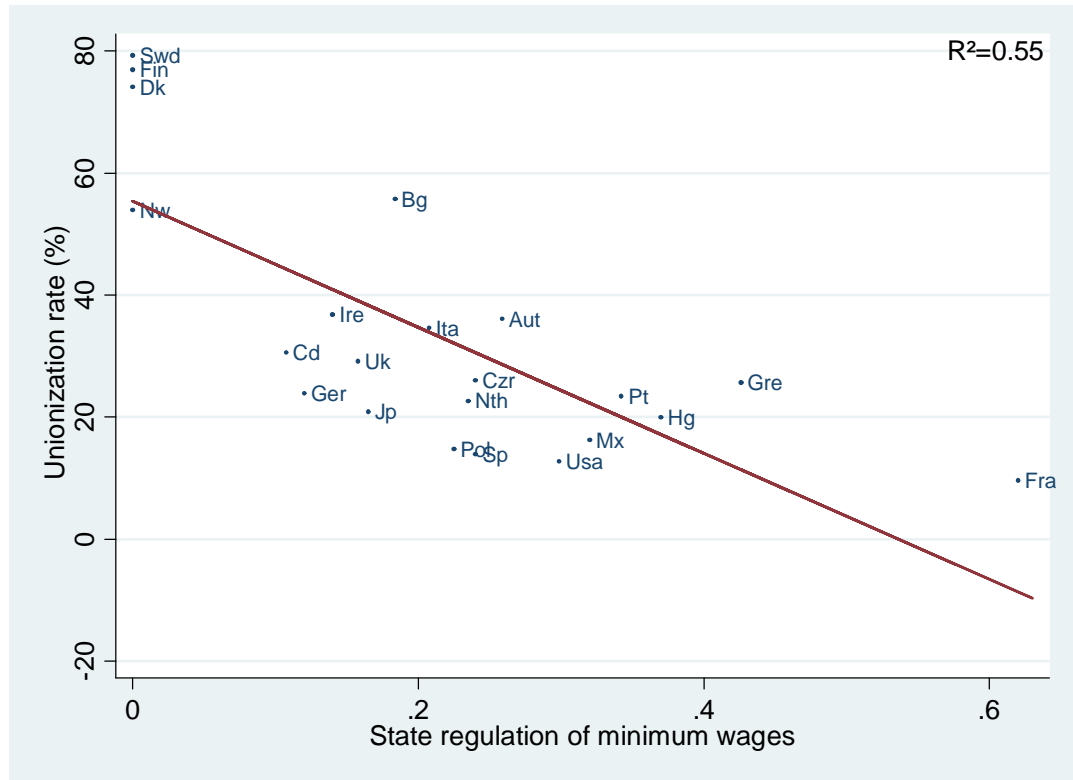
Figure 5: Union density and the index of state regulation of minimum wage. The index includes the stringency of the legislation and of the level of minimum wages. Period 1980-2003. Source: OECD and ILO.

France not only set minimum wages by law but they also limit the scope for derogations and for direct negotiations by social partners. The one clear exception among Mediterranean countries is Italy. This country does not have a statutory minimum wage, hence its lower ranking in terms of our index of state regulation. However, in Italy, wage floors negotiated at the industry level are automatically extended to other industries. Finally, we see noticeable differences within the group of Anglo-Saxon countries. Those with high index of state regulation like the United States are also characterized by low union densities. In contrast, Great-Britain appears to have a relatively high union density and a lower index of state regulation, which in turn results both, from unions being so powerful prior to the 1980s and the fact that wage floors were negotiated by wage councils before 1993.

We explore this correlation pattern further by running OLS regressions between unionization rates and our index of state regulation of the minimum wage. To maximize the number of observations, we run this estimation over three time periods, computing the average of the

composite index respectively over the periods 1980-84, 1990-94 and 2000-2003. We also look at the correlation between unionization rates and the two sub-indexes which capture respectively the existence of a legal statutory minimum wage and the degree of dispersion in minimum wages. We evaluate the correlations between unionization and the two sub-indexes taken separately, and between unionization and the interaction terms between these sub-indexes and the indicator measuring the level of minimum wages.

Table 1- Column (1) reports the cross-country estimated correlation between unionization rates and the extent of state regulation of minimum wage over the three period 1980, 1990 and 2003. The sample is unbalanced, with fewer 8 observations for the period 1980. This correlation is negative, and statistically significant at the 1 percent level. Almost 45 percent of the cross-country variation observed in the state regulation index is associated with differences in unionization rates. Table 1- Columns (2)-(5) show that the same negative correlation pattern holds when we look at the two sub-indexes, or when we combine these sub-indexes with the level of minimum wage. Overall, this first table suggests a strong negative correlation between unionization rates and the extent to which the state strictly regulates minimum wage.

The negative correlation between union density and state regulation of minimum wage also appears to hold over the time period 1980-2003 within countries. Countries which have experienced the sharpest decline in union densities are also those that have tightened state regulation of wage floors the most. A striking example is the United Kingdom where wage floors used to be set by unions before the country embraced a statutory minimum wage in 1999 to offset the decline of union bargaining power. What happened is that the unionization rate had fallen from 50 % in 1980 to less than 30% in the late 1990's, in part as a result of Margaret Thatcher's crackdown on strikes in 1982. Meanwhile, the political pressure from the workers to get a legal minimum wage has gained momentum, leading Tony Blair to introduce a statutory minimum wage. Of course the negative relation can run both ways. It might be the case that union densities have mainly increased in countries where statutory minimum wages are absent, like Scandinavian countries, because workers cannot rely on state regulation and have strong incentives to coordinate themselves to defend their wages. Conversely, the decline in union densities could have triggered changes in minimum wage legislations.

Table 2 reports the within correlation between the evolution of the composite index of state regulation of minimum wages and the evolution of union density. We focus on two time periods, the early 1980s and the early 2000s, to allow for enough time variation. We focus on the same set of countries for the period 1980 and 2000, leading to select 18 countries for each period (data are missing for Cezch Republic, Hungary, Poland and Ireland in 1980). The regressions control for country fixed effects and linear time trends.

Table 2 - Column (1) reports the within correlation between contemporaneous values of unionization rate and state regulation of minimum wage. A strong negative correlation shows up, the effect being statistically significant at the one percent level. Table 2 - Column (2) reports the correlation between the index of state regulation of minimum wage and the lagged value of union density. When looking at state regulation in the early 1980's, we use union density in the early 1970s (1970-74). The estimated coefficient is strongly negative and statistically significant at one percent level. Lower unions rates during the 70's are associated with more stringent minimum wage regulation by the state a decade or two later. This result might account for the rising political support in favor of an increase in statutory minimum wages in countries where the bargaining power of unions is declining.

Table 1: Cross-country correlation between state regulation of minimum wage and union density: OECD countries 1980-2003. OLS.

| Dependent variable | State regulation of minimum wages | | | | |
| --- | --- | --- | --- | --- | --- |
| | Composite index (1) | Legal (2) | Dispersion (3) | Legal *Level (4) | Dispersion *Level (5) |
| Union density | -.518*** (.083) | -1.568*** (.156) | -.587*** (.134) | -.606*** (.099) | -.214*** (.099) |
| $R^2$ | .441 | .658 | .262 | .442 | .102 |
| Observations | 58 | 58 | 58 | 58 | 58 |

Table 2: Time variations in unionization rates and state regulation of minimum wages. OECD countries: 1980-2003. OLS

| Dependent variable | State regulation of minimum wages (Composite index) | |
| --- | --- | --- |
| | (1) | (3) |
| Union density | -1.089*** (.312) | |
| Union density (-1) | | -0.528** (.262) |
| Country fixed effects | Yes*** | Yes*** |
| Time dummies | Yes*** | Yes*** |
| Observations | 36 | 36 |

### 2.1.3 State regulation of minimum wages and the quality of labor relations

The negative relation between state regulation and union density is associated with different beliefs in the quality of labor relations. Figure 1 illustrates the negative correlation between the stringency of minimum wage regulations and executives'beliefs in cooperative labor rela-

tions. The index of perceived cooperation on the labor market is constructed using the 1999 Global Competitiveness Reports, a survey sent out to thousands of executives each year with the following question: "Do you think that labor/employer relations are generally cooperative". Responses may vary from 1 for strong disagreement to 7 for strong agreement. State intervention is then measured by the state's propensity to directly regulate minimum wages instead of letting wage floors be negotiated between employers and employees' unions. Figure 6 shows that the same correlation pattern holds when we look at the ISSP index of workers'perceived quality of labor relations.

Figure 1, 6 and 2 show that Scandinavian countries are characterized by a low level of state intervention in the regulation of minimum wage. Wage floors are directly negotiated between unions and no statutory legal minimum wage exists. This characteristic is associated with highly cooperative labor relations. At the other extreme, state intervention is high in countries (in particular, France) where labor relations are distrustful. Another interesting fact about labor markets comes out of Figure 2. Indeed this figure reports a strong positive correlation between the executives' beliefs in cooperative labor relations and union membership. This directly contradicts a common wisdom whereby anything that strengthens employees' bargaining power in firms, in particular higher rates of unionization, should be negatively perceived by employers and therefore increase their distrust vis-a-vis workers. Countries with low union density, such as France, are characterized by distrustful labor relations, whereas Nordic countries with their high unionization rates show widespread beliefs in cooperative labor relations.

Table 3 presents the results of the associated OLS regression. Column 1 reports the positive correlation between the quality of labor relation and union density in 2000. We measure the degree of cooperation by the GCR index which provides more observations, even if the correlation pattern is lower than that obtained with the ISSP index. Column 1 shows that the $R^2$ is 0.33, and union density is statistically significant at the one percent level. The second column shows that the correlation between the quality of labor relation and union density remains statistically significant at the five percent level when one controls for the unemployment rate and traditional labor market institutions taken from Nickell et al. (2001). Columns 3 and 4 report the strong negative correlation between the GCR index of the quality of labor relation and our index of state regulation of the minimum wage in the 2000s. The negative correlation is highly statistically significant at the one percent level even when one controls for the unemployment rate and other labor market institutions in Column 4, none of which appear to be statistically significant.
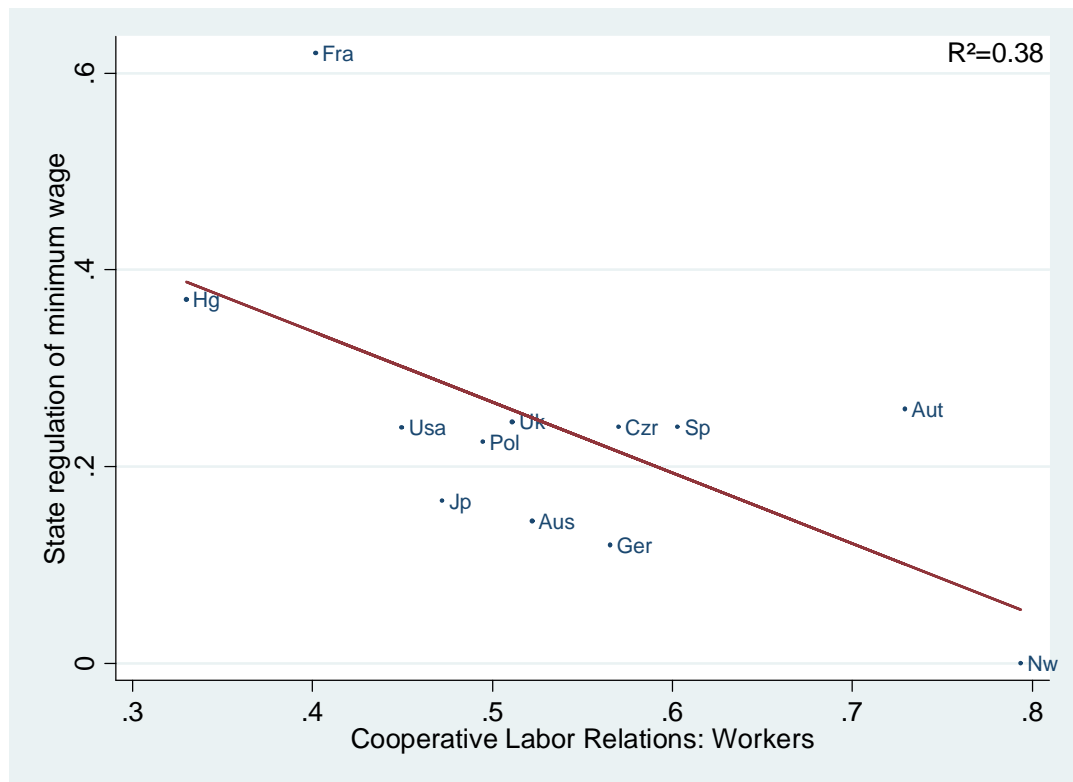
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Figure 6: Correlation between state regulation of minimum wages and workers' beliefs in cooperative labor relations. Source: ILO, OECD, and ISSP 1999 database.

Table 3: Quality of labor relations in OECD countries: 2000s. OLS estimates

| Dependent variable | Quality of labor relation | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Union density | 2.091*** | 2.140** | | |
| | (.716) | (.912) | | |
| State regulation of minimum wages | | | -3.339*** | -2.821*** |
| | | | (.876) | (.827) |
| Unemployment rate | | -7.301* | | -12.625** |
| | | (3.802) | | (4.170) |
| Replacement rate | | .555 | | .422 |
| | | (.941) | | (.860) |
| Benefit duration | | -.466 | | .235 |
| | | (.570) | | (.437) |
| Employment protection | | -.098 | | .152 |
| | | (.289) | | (.259) |
| Tax wedge | | -1.810 | | -.366 |
| | | (1.682) | | (1.052) |
| $R^2$ | .34 | .56 | .46 | .74 |
| Observations | 18 | 18 | 18 | 18 |

## 2.2 Beliefs in the quality of labor relations and the demand for state regulation of wages

The correlation between distrustful labor relations and the extent of state regulation of wages holds not only in the aggregate, but also in individual attitudes. We first document that beliefs in cooperation are influenced by past history. We then show how these beliefs are associated with the demand for state regulation of the labor market.

### 2.2.1 Beliefs in cooperative labor relations

We document how beliefs in cooperative labor relations are shaped by past history. To analyze this time-dependence of beliefs we focus on the attitudes of US-born immigrants. We look at the correlation between their beliefs in the quality of labor relations and the features of their country of origin likely to shape their beliefs. We use the General Social Survey which provides information on both attitudes towards the quality of labor relations and the country of origin of the ancestors. The GSS covers the period 1972-2004 and provides information on the birth place and the country of origin of the respondent's forebears since 1977. The GSS variable for the country of origin reads as follows: *"From what countries or part of the world did your ancestors come?".* Origins cover nearly all European countries. We focus on US-born immigrants and

select country of origins with at least 15 observations.[7] Beliefs in cooperative labor relations of US immigrants are measured by two main questions. The first one reads : "*There will always be conflict between management and workers because they are really on opposite sides*". The answers ranges from 1: "Strongly agree", 2: "Agree", 3: "Disagree", 4: "Strongly disagree". We order the answers to provide an index of *Distrustful labor relations*. The second question, more general, deals with the level of confidence in business: "*Would you say you have a great deal of confidence, only some confidence, or hardly any confidence at all in companies?".* The answers range from 1: "A great deal", 2: "Only some" to 3: "Hardly any". This question provides an index of *Distrust in companies*

Figures 7 and 9 show the correlation between beliefs in cooperation of US-immigrants and the quality of labor relations in the home country. We measure the conditional average of US-immigrants' beliefs by running individual ordered probit regressions controlling for age, education, employment status, gender, level of income and country of origin fixed effects. Denmark is considered as the reference country of origin. Standard errors are clustered at the country of origin level. The two Figures show a substantial heterogeneity in the beliefs in cooperative labor relations depending on the country of origin. Relative to US-immigrants with Danish origins, immigrants from Africa, Latin America, Mediterranean countries and most Eastern European countries have a much higher level of distrust in cooperative labor relations. The gap in distrust is lower among immigrants form other Nordic countries and from UK or Austria. These beliefs are fairly persistent. All the coefficient associated with the country of origins are statistically significant at the 1 percent level (not reported here). Besides these beliefs are strongly correlated with the quality of labor relations in the home country. Between 40 percent and 50 percent of the heterogeneity in US-immigrants' beliefs is associated with differences in the quality of labor relations in the home country.

Table 4 - Row I reports the corresponding ordered probit estimates when we replace the country of origin dummies by the index of the quality of labor relations in the source country. We still control for age, education, employment status, gender, level of income. Standard errors are clustered at the country of origin level. The correlation between US-immigrant beliefs in the quality of labor relations of the US-born immigrants and the quality of labor relations in the home country is statistically significant at the one percent. This correlations suggests a strong inertia of beliefs, influenced by a common history.

Table 4 - Row II explores further the impact of past regulation in the home country on

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[7]This leaves us with a a maximum of 16 country of origins depending on the GSS question: Austria, Belgium, Canada, Czech Republic, Denmark, France, Germany, Ireland, Italy, Mexico, Netherlands, Norway, Poland, Spain, Sweden and United Kingdom

contemporaneous beliefs of US-immigrants. Since minimum wage legislation and the extension of organized labor might be too recent to be related to the attitudes of US-born immigrants, we focus on broader historical variables on state regulation and industrial relations. We rely on Crouch's analysis of the attitudes of the states towards unions in Europe during the 19th century.[8] Crouch documents the evolution of distrustful labor relation depending on the original attitudes of the state towards unions to settle dispute and regulate labor markets.[9] Crouch classifies states in three categories. The first category comprises states that were most hostile to the development of unions and consequently more prone to directly regulate labor market and settle disputes through centralized decisions. This group includes the main catholic strongholds in Europe, namely France, Italy, Spain and Portugal. Crouch account for this fact by stressing that in these countries the central government needed to assert its authority over the Catholic church and to confront all forms of organized interests, including worker organizations. The second category comprises five countries where the state was rather neutral vis-a-vis labor organization and would consequently let them directly with firms. This is the case of Belgium, Denmark, Norway, Sweden, Finland, UK and Ireland. Finally, the third category consists of countries where the State would encourage union involvement in the regulation of labor markets. This category includes Austria, Germany, Netherlands, Switzerland. In particular, the Austrian and German governments were first to set up elected workers commissions to run pensions and social insurance schemes as of the 1880s.

Table 4 - Row II shows that the probability to distrust companies, or to think that managers and workers will always be in conflict, decreases when US-immigrants come from country with neutral or supportive state in favor of unions. Relative to hostile state, the effect is statistically significant at the one (ten) percent when individuals come from country which used to have supportive (neutral) state in favor of unions at the end of the 19th century.

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[8]Blanchard and Philippon (2006) show that these initial attitudes of the states towards union might also explain current unemployment rates.

[9]Crouch stressed that labor relations were fairly hostile in Denmark in the 19th century, and the Great Lock-Out of 1898 is probably the single biggest industrial dispute in Europe over the 19th century. However this dispute led to a social pact between organized labor and firms, whereby unions would recognize the private property of firms by capitalists, and in exchange, capitalists and workers unions would negotiate wages directly on a bilateral basis, without any state intervention. Ever since, the unionization rate has steadily risen in Denmark and this country displays one of the highest quality of labor relation in the 2000s. The same picture holds for Belgium, Austria, Germany, United Kingdom and Sweden. According to Crouch, labor relations in these countries used to be highly conflictual. But precisely this encouraged employers and the state to design institutions aimed at involving unions in the regulation of labor markets in order to contain social disruption. This evolution pattern departs from that of France where central governments, whether from the right or from the left, have remained traditionally suspicious vis-a-vis unions and have therefore privileged centralized negotiations at the government level, for example during the Front Populaire in 1936 or more recently with the Grenelles Agreement in the aftermath of May 1968.

Figure 7: Correlation between US-immigrants' beliefs in labor conflicts and the quality of labor relationships in the home country. Source: GSS 1977-2006 and GCR 1999.

Figure 8: Correlation between US-immigrants' beliefs in labor conflicts and the quality of labor relationships in the home country. Source: GSS 1977-2006 and GCR 1999.

Figure 9: Correlation between US-immigrants' distrust in companies and the quality of labor relationships in the home country. Source: GSS 1977-2006 and GCR 1999.
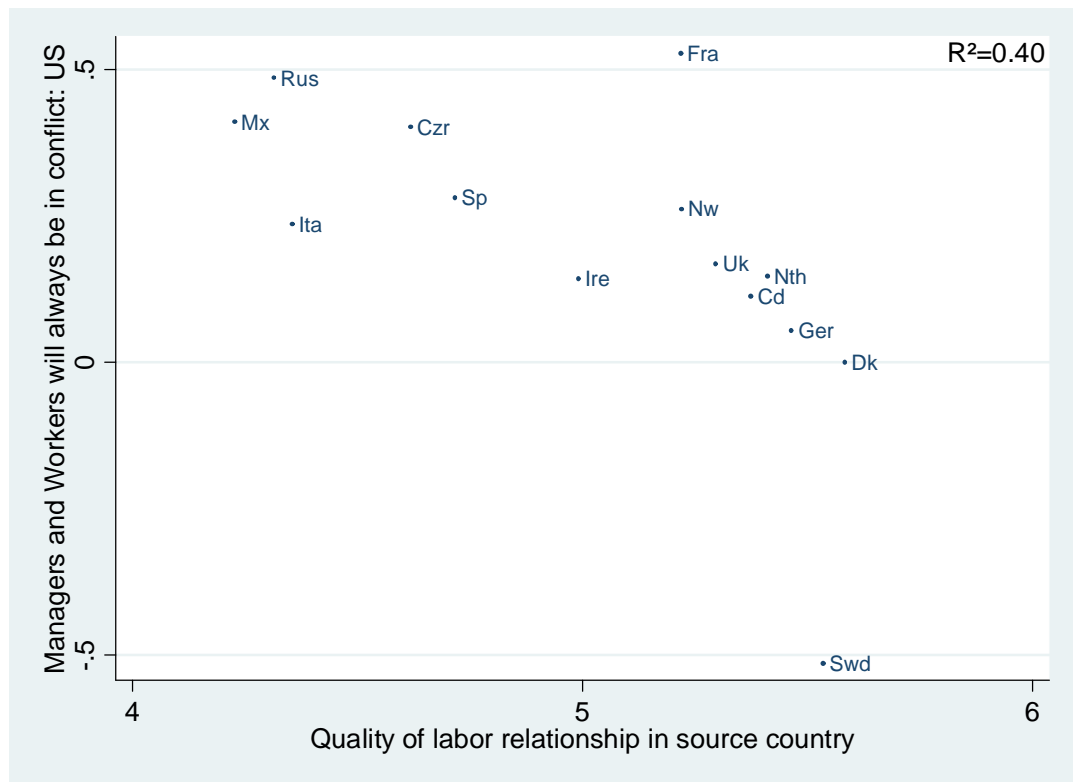
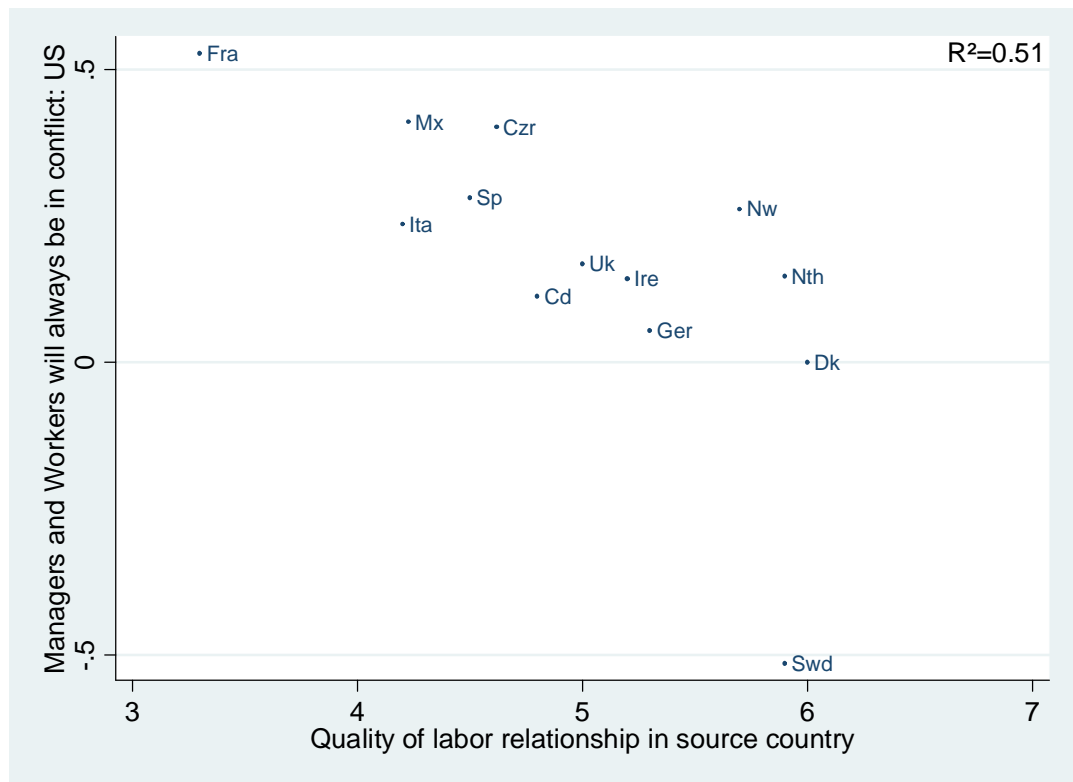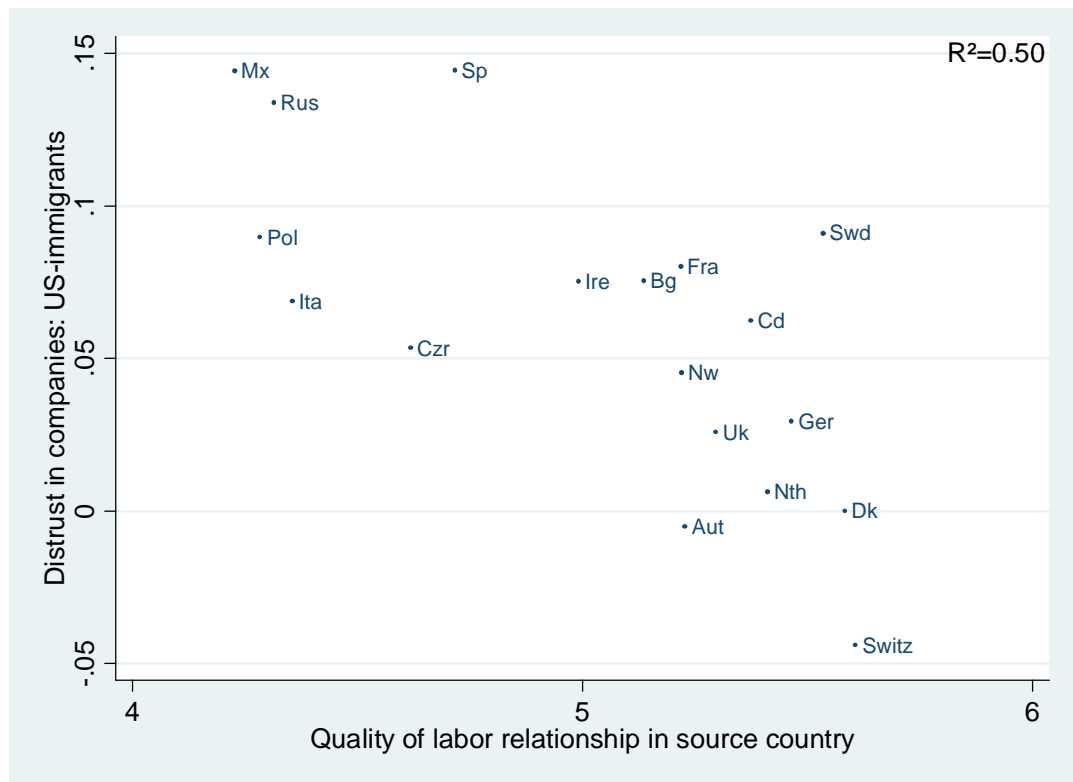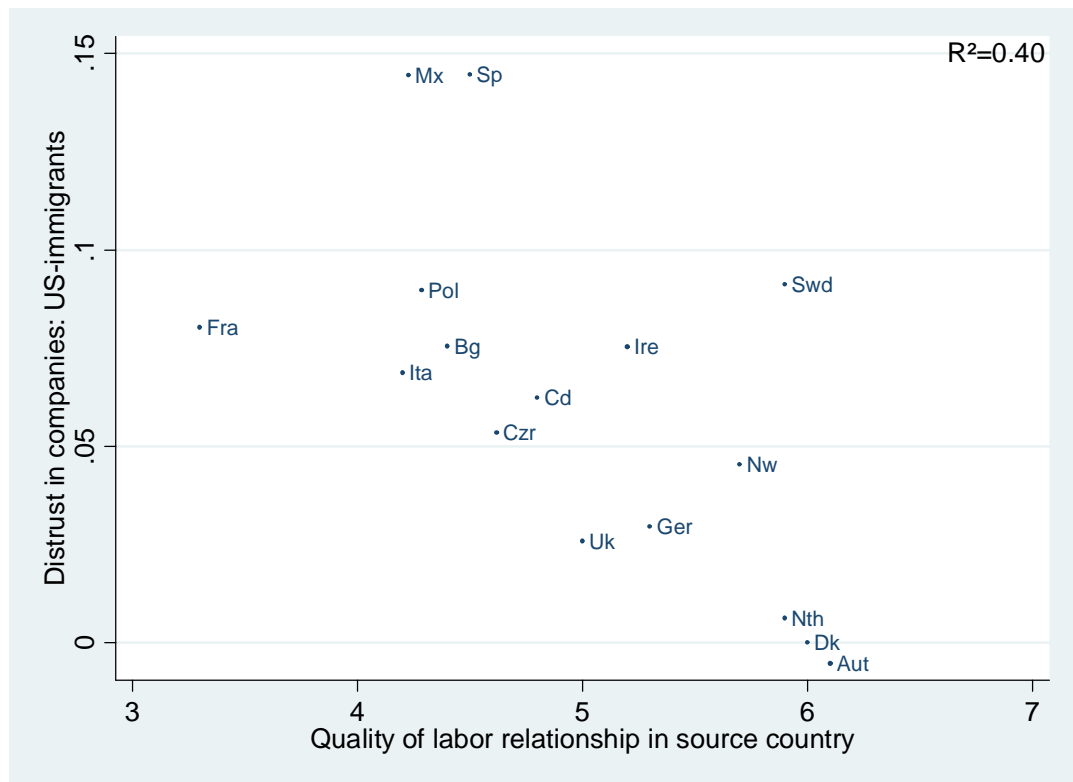Figure 10: Correlation between US-immigrants' distrust in companies and the quality of labor relationships in the home country. Source: GSS 1977-2006 and GCR 1999.

Table 4: Impact of history on beliefs in cooperative labor relationships: Ordered probit estimates on US-immigrants

|  | Distrust companies (1) | Management and Workers will always be in conflict (2) |
|---|---|---|
| Quality of labor relations | -.058*** | -.200*** |
| in home country - (I) | (.013) | ( .053) |
| N | 18164 | 836 |
| $R^2$ | .081 | .082 |
| History of state regulation of organized labor in home country (II) |  |  |
| Hostile | Reference | Reference |
| Neutral | -.049* | -.182* |
|  | ( .030) | ( .102) |
| Supportive | -.099*** | -.250*** |
|  | ( .019) | ( .098) |
| N | 15581 | 708 |
| $R^2$ | .022 | .085 |

Ordered probit effects with robust standard error GSS : ***:1%, **: 5%, *: 10
Additional controls: gender, age, education, income category

### 2.2.2 Beliefs in cooperative labor relations and the demand for regulation

We show that the demand for wage regulation is associated with low beliefs in cooperative labor relations. We still focus on US-immigrants to get rid of reverse causality from differences in institutional environment on the demand for labor market regulation.

Figure 11 documents the demand for wage regulation of US-immigrants depending on the country of origin of the ancestors. The question reads: *"Here are some things the government might do for the economy. Please show which actions you are in favor of and which you are against: control wages by law?"*. The answers ranges from 1, for strongly disagree, to 5 for strongly agree. Figure 11 shows, on the vertical axis the average answer conditional on age, gender, education, employment status and income for each country of origin. The conditional average corresponds the coefficient of the country fixed effect in the ordered probit regression on this question. Denmark is taken as a reference. A strong heterogeneity shows up by country of origins of US-immigrants. Descendants from Nordic countries, Anglo-Saxon countries and Italy tend to be less in favor of wages regulation by law compared to descendants from France or Spain. Figure 11 also shows that this heterogeneity in demand for wage regulation is negatively correlated with the quality of labor relations in the source country.

Table 5 - Column (1) reports the correlation between the demand for wage regulation from
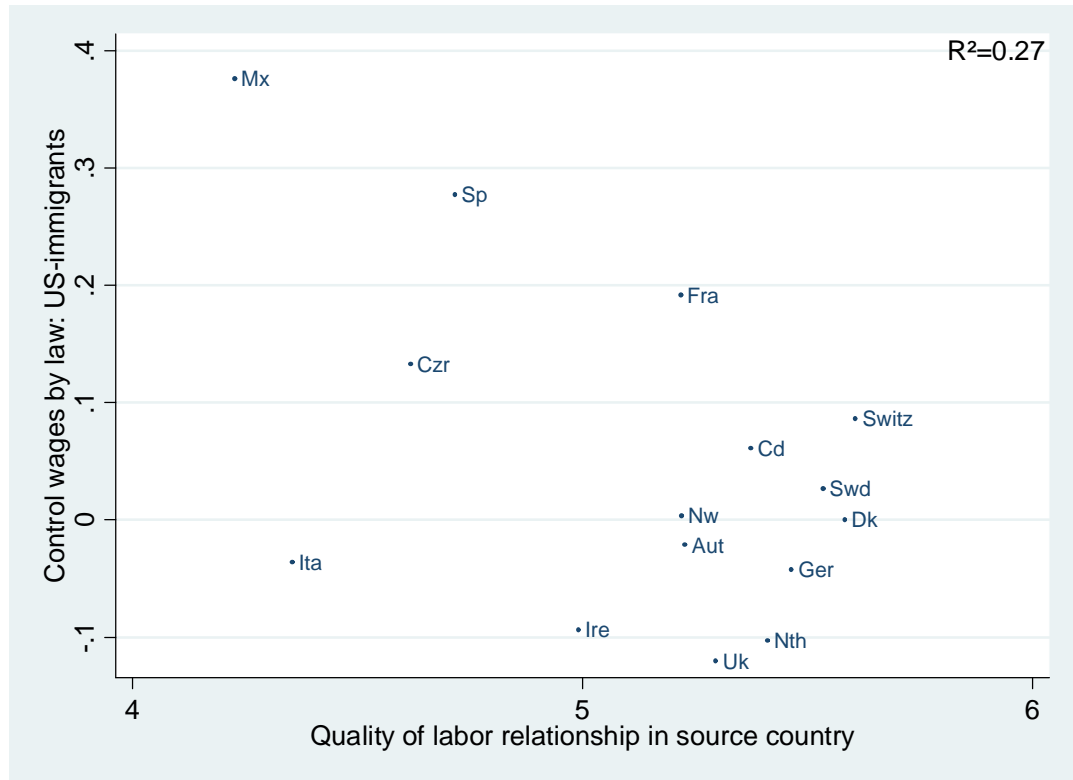
Figure 11: Correlation between US-immigrants' demand for wage regulation by law and the quality of labor relationships in the home country. Source: GSS 1977-2006 and GCR 1999.

US-immigrants and their beliefs in cooperative labor relations, as measured by their level of confidence in business. We run ordered probit regression controlling for the same set of individual controls as before and for country of origin fixed effects. Column (1) shows that the propensity to call for wage regulation by law decreases with the level of confidence in business, the effect being statistically significant at the 1 percent level.

Table 5 - Columns (2) - (4) report the correlation between the demand for regulation of US-immigrants and quantitative indicators of institutions in the home country. Column (2) reports the correlation between the probability for US-immigrants to call for a state regulation of wages and the indicator of labor quality in the source country. The correlation is positive and statistically significant at the 5 percent level. Column (3) reports the correlation with the stringency of state regulation of minimum wage in the home country, based on our synthetic index presented in section 2. The relations is positive and statistically significant at the 1 percent level. Conversely, Column (4) shows a negative correlation between the demand for wage regulation and union density in the home country, averaged over the period 1960-2000.

Table 5: Demand for wage regulation by law - Ordered probit estimates on US immigrants

| | Government should control wages by law | | | |
| --- | --- | --- | --- | --- |
| | (1) | (2) | (3) | (4) |
| Confidence in Business US-immigrants | -.198[***] (.062) | | | |
| Quality of labor relations in home country - Index GCR | | -.117[***] (.044) | | |
| State regulation of minimum wage in home country | | | .387[***] (.123) | |
| Union density in home country | | | | -.368[*] (.202) |
| N | 1191 | 2087 | 1777 | 2087 |
| $R^2$ | .042 | .038 | .043 | .036 |

Ordered probit effects with robust standard error GSS : ***:1%, **: 5%, *: 10

Additional controls: gender, age, education, income category

# 3 The model

We have documented that the stringency of government regulation of minimum wages is strongly negatively correlated with union density and with the quality of labor relations. This relations holds not only in cross-section of countries but also at the individual level. Individual beliefs in cooperative labor relations are history-dependent: they are shaped by past regulation on the labor market. In turn, pessimistic beliefs about the quality of labor relations are associated with higher demand for state regulation. This section seeks to provide a model to rationalize these facts.

## 3.1 Basic framework

We consider an infinite horizon economy populated by a continuum of measure one of risk neutral individuals, each of whom lives for one period. There are two non storable goods in the economy: a numeraire good and labor. Each individual is endowed with one unit of labor. Individuals get utility from their consumption of the numeraire good and they differ in productive ability. In each period $t$, the proportion of individuals who produce less than $y$, $y \geq 0$, with one unit of labor, is defined by the cumulative distribution function $G(y)$. For simplicity, we shall take the $G$ distribution to be uniform on the interval $[0, 1]$.

Individuals may decide to join a trade union. The utility of an individual paid wage $w_t$ in period $t$, is just equal to $w_t$ if the individual is not unionized and to

$$v_t = w_t(1 - c)$$

if she is unionized. The parameter $c \in (0,1)$ is introduced to represent the cost of unionization, equal to $cw_t$. The assumption that the cost of unionization is proportional to the wage has many empirical justifications. In most countries, the cost of membership is a fraction of the wage. The opportunity cost of the time that workers devote to union activity increases with their wage. Employers may also slow the carrer of union members. For the employee, the cost of this behavior of the employer should increase with the wage.

Workers face a monopsonistic representative firm. This assumption is made for simplicity. It is the simplest way to represent monopsonistic labor markets, where workers are paid below their marginal productivity. This property can be derived from many models, in particular from the standard search and matching model which shows that search and matching cost induce wages below marginal productivity (see e.g. Pissarides, 2000). In our framework, the monopsonistic firm makes take-it-or-leave-it offers to non unionized workers. Consequently, non unionized workers cannot get more than the minimum wage $\bar{w}_t \geq 0$ set by the government if their productivity $y$ is higher than the minimum wage, and they get no job offer from the firm otherwise.

Unionization induces collective bargaining over wages and over other dimensions of labor relations. Following Hirschman (1970) and Freeman and Medoff (1984) we consider that unionism provides a "voice" which can improve productivity. Namely, the production of the workers increases from $y$ in the absence of trade union to $(1+\lambda)y$, $\lambda > 0$, when the workers are unionized and when voice succeeds. But voice can also fail. In that case, productivity is not improved by unionization. We assume that the probability that voice succeeds depends on the quality of labor relations, which can be either "high" or "low". The quality of labor relations is not observable. Workers only observe whether voice succeeds or fails.[10] In every period, voice can either be: (i) a success, in which case the productivity of *all* type-$y$ unionized workers is increased by a factor $(1+\lambda)$, (ii) or a failure, in which case productivity is not increased by trade unions. More precisely, in each period $t$, the probability that voice succeeds or fails is:

$$\Pr\left(\text{voice succeeds}\right) = \begin{cases} 1 - \varepsilon & \text{if quality of labor relations is high} \\ \varepsilon & \text{if quality of labor relations is low} \end{cases}$$

$$\Pr\left(\text{voice fails}\right) = \begin{cases} 1 - \varepsilon & \text{if quality of labor relations is low} \\ \varepsilon & \text{if quality of labor relations is high} \end{cases}$$

where $\varepsilon < 1/2$.[11]

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[10]For the sake of simplicity, it is assumed that workers are able to extract the same information independently of the number of employees whose wage is bargained over by the trade union. Alternatively, one could assume that workers observe the outcome of negotiation with a probability that increases with the number of employees whose wage is bargained over in the period. Our results are robust to introducing this additional feature to the model.

[11]That "voice" does not succeed with probability one if the quality of labor relation is high, reflects the fact

Unionization also provides bargaining power to workers. Unionized workers can negotiate their wage once they observe whether voice has succeeded. They get a share $\beta \in (0,1]$ of the surplus that they generate. If a wage agreement is not reached, workers are paid the minimum wage and voice does not work any more. Accordingly, when voice succeeds, the firm gets profits per worker equal to $y(1 + \lambda) - w_t$ if an agreement is reached, and $y - \bar{w}_t$ in the opposite case. Workers get $w_t(1-c)$ if wage negotiation succeeds and $\bar{w}_t(1-c)$ if it fails. Surplus sharing yields the wage[12]

$$w_t(y) = \bar{w}_t + \mu y,$$

where $\mu = \beta\lambda/[1 - c(1-\beta)] > 0$. It turns out that the negotiated wage is equal to the minimum wage plus a share of the increase in productivity generated by voice when voice succeeds. When voice fails, wage bargaining yields the minimum wage $\bar{w}_t$ because unionization does not generate any positive surplus.

*Investment in cooperation and the dynamics of beliefs*

The union can invest to improve the quality of labor relations.[13] We denote the union's specific investment by $i_t$. For simplicity, assume that $i_t$ can take only two values: $i_t = 0$ or $i_t = I > 0$. The investment is publicly observable. When $i_t = 0$, the quality of labor relations is necessarily low. When $i_t = I$, the quality of labor relations is high if the true nature of the economy is cooperative, otherwise, the quality remains low.

Upon deciding whether or not to invest in the quality of labor relations, unionized workers do not know whether they live in a cooperative economy where the investment will indeed lead to high quality of labor relations or if they live in a non-cooperative economy where such investment is pointless. In other words, the investment decision can be seen as a costly experimentation to improve labor relations and discover the true cooperative nature of the economy.

Let $e \in \{C, N\}$ denote the type of the economy: $C$ if the economy is cooperative and $N$ if it

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that the quality of labor relation is not perfect. That it may succeed with positive probability $\varepsilon$ when the quality of labor relation is low, reflects the fact that workers may sometime overcome the non-cooperative nature of the employer and still manage to strike a good deal.

[12]Note that the wages negotiated by the trade union depend upon workers' productivity, whereas the minimum wage is independent of productivity. Here we simply capture the idea that trade unions have a better information about workers' productivity than the government.

[13]Appendix B provides evidence on the effect of union's investment on the quality of labor relations. Union's investment in cooperation is measured in two ways, following Checchi and Lucifora (2002): the degree of workplace presence of unions and the degree of coordination and centralization of union's decisions. Figure 13 reports the correlation between the indicator of workplace presence of unions and the perceived quality of labor relations measured by the *Global Competitiveness Reports 1999*. Figure 14 reports the same correlation pattern between the quality of labor relations and the degree of coordination and centralization of negotiations between trade unions. In both cases, steady positive correlations show up, suggesting that the quality of labor cooperation is strongly associated with investment in cooperation by unions.

is non cooperative. We let

$$\Pr_{t=0} (e = C) = q_0$$

denote workers' prior beliefs as to the cooperative nature of the economy at date zero.

A history $h_t(n, s)$ at the beginning of period $t$ consists in $n \leq t$ past negotiations (between date 0 and date $t - 1$) over which unions have invested in cooperation, $s \leq n$ of which have been successful, and $n - s$ have been unsuccessful. The number $n$ of periods with negotiation and positive investment, may be smaller than $t$ for two reasons. First, the trade union does not necessarily invest in every period. Second, there is no negotiation in the periods where nobody is unionized.

From Bayes' rule, the probability that the economy is cooperative in period $t$ is:

$$q_t = \Pr[e = C | h_t(n, s)] = \frac{(1 - \varepsilon)^s \varepsilon^{n-s} q_0}{(1 - \varepsilon)^s \varepsilon^{n-s} q_0 + (1 - \varepsilon)^{n-s} \varepsilon^s (1 - q_0)}. \tag{1}$$

Finally, using the fact that $\Pr[e = C | h_t(n, s)] = 1 - \Pr[e = N | h_t(n, s)]$, we can compute the probability that voice succeeds in period $t$ when there have been $n$ previous periods with investment and negotiations, $s$ of which have been successful, namely:

$$p(q_t, i_t) = \begin{cases} \varepsilon + (1 - 2\varepsilon)q_t & \text{if } i_t = I \\ \varepsilon & \text{if } i_t = 0. \end{cases} \tag{2}$$

In this framework, by unionizing and by investing in the quality of labor relations, workers manage both to obtain wage increases and also to generate information about the possibility to increase the quality of labor relations. In periods in which the trade union invests and some workers are unionized, the outcome of the negotiation reveals information on the type of economy. This in turn enables workers of the future generation to update their beliefs. When there is no investment or when nobody is unionized in period $t$, workers of generation $t + 1$ cannot update their beliefs.

Bayes' rule immediately implies a positive correlation between beliefs in successive periods as stated by:

**Lemma 1:** *In periods where the trade union invests $I$, the belief $p(q_t, I)$ that bargaining succeeds in period $t$ is non-decreasing with $p(q_{t-1}, i_{t-1})$.*

**Proof**: From the definition (2) of beliefs we know that $p(q_t, I)$ increases with $q_t = \Pr[e = C | h_t(n, s)]$. Let

$$a = \Pr[e = C | h_t(n, s)] ; b = \Pr[e = C | h_{t-1}(n', s')]$$

where $n' = n$, or $n' = n - 1$, and $s' = s$ or $s' = s - 1$. We have:

$$1/a = 1 + (\frac{1 - q_0}{q_0})(\frac{1 - \varepsilon}{\varepsilon})^{n - 2s};$$

$$1/b = 1 + (\frac{1 - q_0}{q_0})(\frac{1 - \varepsilon}{\varepsilon})^{n' - 2s'}.$$

Thus

$$1/a = (1/b)\left(\frac{1 - \varepsilon}{\varepsilon}\right)^{n - n' - 2(s - s')} + 1 - \left(\frac{1 - \varepsilon}{\varepsilon}\right)^{n - n' - 2(s - s')}.$$

In particular $(1/a)$ and $(1/b)$ are positively correlated, and thus so are $a$ and $b$. QED.

*Timing*

At the beginning of period $t = 0$, nature determines once for all the type of economy $e \in \{C, N\}$ which is not observable. Then, in each period $t \geq 0$, the sequence of decisions can be described as follows:[14]

1. The trade union decides whether or not to invest in the quality of labor relations.

2. Individuals vote to elect a government that sets a minimum wage $\bar{w}_t \geq 0$.

3. Workers decide whether or not to join the trade union.

4. Wages are set by employers for non unionized workers and by wage negotiation for unionized workers.

We first analyze the outcome of the wage negotiation and the decision to invest in labor relations and to unionize when the minimum wage is exogenous. This first step will allow us to shed light on the relations between the minimum wage, unionization and investment behaviors and beliefs. Then, we endogeneize the minimum wage by making it a choice variable by the elected government.

## 3.2 The effect of minimum wage on the dynamics of cooperation and beliefs

Unionization behavior and investment in labor relations are influenced by beliefs about the efficiency of the investment and by the minimum wage. Beliefs are themselves influenced by past unionization and investment experience. In this section, we first analyze how the minimum wage influences unionization and investment behavior within each period $t$, taking beliefs are given. Then, we proceed to analyze the impact of the minimum wage on the dynamics of beliefs and unionization.

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[14] Here it is assumed that the trade union invests before the government sets the wage. This assumption has been chosen because investment in the quality of labor relations can be interpreted as a commitment device. However, it should be noticed that our main result of multiplicity of steady states, some with investment, others without, also holds when the wage is set before investment and when investment and wage are chosen simultaneously.

### 3.2.1 Short run equilibrium

Here we analyze unionization and investment in labor relations within any period $t$, with given belief $q_t = \Pr\left[e = C | h_t(n, s)\right]$ and given minimum wage $\bar{w}_t$. All workers whose productivity is lower than the minimum wage $\bar{w}_t$ are unemployed. Non unionized workers with productivity $y \geq \bar{w}_t$ obtain the minimum wage $\bar{w}_t \geq 0$. Unionized workers with productivity $y \geq \bar{w}_t$ expect to get the wage $w_t(y) = \mu y + \bar{w}_t$ with probability $p(q_t, i_t)$ and the minimum wage with probability $1 - p(q_t, i_t)$.

*Unionization decision*

Workers decide to join unions in period $t$ if and only if the utility derived from union membership, equal to $\{p(q_t, i_t)w_t(y) + [1 - p(q_t, i_t)]\bar{w}_t\}(1 - c)$, is larger than the utility obtained without union membership, equal to the minimum wage $\bar{w}_t$.[15] Therefore, all workers whose productivity lies above the threshold

$$\hat{y}_t = \frac{c\bar{w}_t}{\mu(1 - c)p(q_t, i_t)} \tag{3}$$

decide to become union member. The share of workers who decide to join a union in period $t$ is therefore equal to:

$$\pi_t = 1 - G\left(\frac{c\bar{w}_t}{\mu(1 - c)p(q_t, i_t)}\right). \tag{4}$$

In particular the share of unionized workers decreases with the minimum wage, the reason simply being that the gains from unionization are lower when the minimum wage is higher. More pessimistic beliefs about the chance of success of bargaining also lead to lower union density.

*Investment/experimentation decision*

The trade union's objective is to maximize the sum of the rents of its members, equal to the difference between what they get when they are unionized and the minimum wage they get for sure when not unionized, namely:

$$\int_{\frac{c\bar{w}_t}{\mu(1-c)p(q_t, i_t)}}^{1} [p(q_t, i_t)(1 - c)\left[w_t(y) - \bar{w}_t\right] - c\bar{w}_t]\, \mathrm{d}G(y). \tag{5}$$

Recall that if there is investment in the quality of labor relations (i.e. if $i_t = I$), the negotiation succeeds with probability $p(q_t, I)$ equal to $\varepsilon + (1 - 2\varepsilon)q_t$, whereas the probability of success falls down to $p(q_t, 0) = \varepsilon$ in the absence of investment.

$$\Delta(\bar{w}_t, q_t) = \int_{\frac{c\bar{w}_t}{\mu(1-c)[q_t(1-2\varepsilon)+\varepsilon])}}^{1} \{[q_t(1 - 2\varepsilon) + \varepsilon](1 - c)\mu y - c\bar{w}_t\}\, \mathrm{d}G(y) - \int_{\frac{c\bar{w}_t}{\mu(1-c)\varepsilon)}}^{1} [\varepsilon(1 - c)\mu y - c\bar{w}_t]\, \mathrm{d}G(y)$$

---

[15]Note that the decision to join the trade union is motivated here by individual gains only and not by social custom as in the approach developed by Akerlof (1980), Booth (1985), Booth and Chatterji (1993), Corneo (1995), Naylor (1989) and Naylor and Crips (1993) and Naylor and Raaum (1993).

Let $\Delta(\bar{w}_t, q_t)$ denote the difference between the value of the rents when investment takes place and the value of the rents when there is no investment.[16] There is investment in labor relations if and only if

$$\Delta(\bar{w}_t, q_t) > I. \tag{6}$$

It is easily checked that $\Delta$ is increasing in $q_t$ and decreasing in the minimum wage $\bar{w}_t$. More precisely, we get

$$\frac{\partial \Delta(\bar{w}_t, q_t)}{\partial \bar{w}_t} = \frac{-\bar{w}_t c^2 q_t (1 - 2\varepsilon)}{(1 - c)\mu\varepsilon [q_t(1 - 2\varepsilon) + \varepsilon]} < 0, \tag{7}$$

$$\frac{\partial \Delta(\bar{w}_t, q_t)}{\partial q_t} = \int_{\frac{c\bar{w}_t}{\mu(1-c)[q_t(1-2\varepsilon)+\varepsilon])}}^{1} [(1 - 2\varepsilon)(1 - c)\mu y] \, \mathrm{d}G(y) > 0. \tag{8}$$

Thus the trade union is more likely to invest when the minimum wage is lower and when workers are more optimistic about the returns of the investment. In particular investment will never occur if the investment cost $I$ is higher than the maximum expected gains which arise when the minimum wage is equal to zero and people are the most optimistic, i.e. when $q_t = 1$. In order to avoid such situations we assume henceforth that

$$\Delta(0, 1) > I, \tag{9}$$

or equivalently $I < \frac{\mu(1-2\varepsilon)(1-c)}{2}$

*The minimum wage policy and the no experimentation trap*

Investment and unionization decisions depend upon beliefs and the minimum wage. Workers unionize more when they are more optimistic about the chance of success of negotiation and when the minimum wage is lower. And the trade union invests more to improve labor relations when workers are more optimistic about the returns to the investment and when the minimum wage is lower.

Figure 12 describes the short-run equilibrium for investment and unionization given $(q_t, \bar{w}_t)$ (the details underlying Figure 12 are presented in the appendix). Three regions, corresponding to three different type of equilibria, show up:

*i*) when workers are optimistic and the minimum wage is low, then there is positive union density and positive investment;

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[16]Simple calculation shows that

$$\Delta(\bar{w}_t, q_t) = \int_{\frac{c\bar{w}_t}{\mu(1-c)[q_t(1-2\varepsilon)+\varepsilon])}}^{1} \{[q_t(1 - 2\varepsilon) + \varepsilon](1 - c)\mu y - c\bar{w}_t\} \, \mathrm{d}G(y) - \int_{\frac{c\bar{w}_t}{\mu(1-c)\varepsilon}}^{1} [\varepsilon(1 - c)\mu y - c\bar{w}_t] \, \mathrm{d}G(y)$$
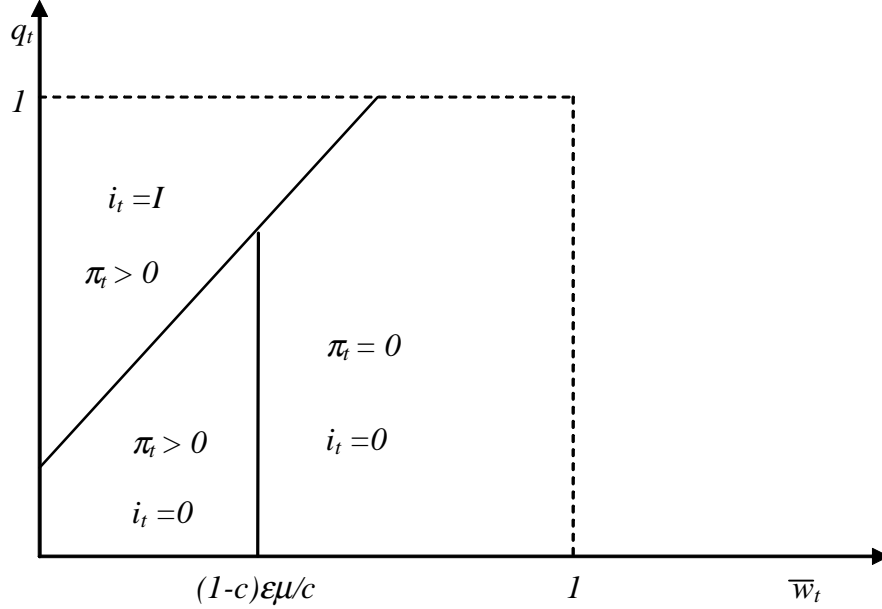
Figure 12: Experimentation and unionization in the $(q_t, \bar{w}_t)$ plane.

$ii$) when the minimum wage is low and workers are pessimistic, there is no investment to improve labor relations, but there is positive union density, albeit lower than in the previous situation;

$iii$) when the minimum wage is high, there is no investment and union density is nil.

Figure 12 illustrates that a high minimum wage can prevent the trade union from investing in the quality of labor relations. This is more likely to occur when workers are more pessimistic about the potential payoff from such investment, i.e on the cooperative nature of the environment.

### 3.2.2 The dynamics of beliefs, unionization and experimentation

We now proceed to analyze the dynamics of beliefs, investment and unionization when the minimum wage is exogenously fixed at some level $\bar{w}$, for all periods $t \geq 0$. According to figure 12, there are potentially three different possible steady states:

$i$) A steady state where $i = I$ and $\pi > 0$,

$ii$) A steady state where $i = 0$ and $\pi > 0$,

$iii$) A steady state where $i = \pi = 0$.

Suppose first that there is no investment in period $t = 0$. In this case, the economy reaches its steady state immediately since beliefs are never revised thereafter. This case occurs if the

initial value of the belief, $q_0$, is such that the net gain of investment is negative in period zero, i.e. if $\Delta(\bar{w}, q_0) \leq I$, or equivalently if

$$q_0 < \bar{q} = \{q | \Delta(\bar{w}, q) = I\}$$

since $\Delta(\bar{w}, q)$ is increasing in $q$. As shown in figure 12, two possible steady states are possible in this situation, corresponding to cases $i)$ and $ii)$. If the minimum wage is sufficiently low, i.e. if $\bar{w} < 1 - \frac{c}{\varepsilon}$, the economy is stuck in a steady state where the share of unionized workers is positive, equal to $1 - \frac{c}{\varepsilon} - \bar{w}$. If the minimum wage is above $1 - \frac{c}{\varepsilon}$, the economy is stuck in a steady state with zero union density.

Now suppose that

$$q_0 > \bar{q}.$$

and that the minimum wage is sufficiently low that experimentation occurs in period $t = 0$. In this case, the dynamics of experimentation *may* lead the economy to converge towards a steady state with positive union density and investment. However, such optimistic beliefs in period zero are not sufficient to insure that the steady state with positive investment will indeed be reached.

More specifically, when $q_0 > \bar{q}$, the economy converges toward such steady state with a positive probability, which will be shown below to depend both upon the minimum wage $\bar{w}$ and upon $q_0$.

Note first that if negotiation succeeds in period zero, then we must have: $q_1 = \Pr_{t=1}(e = C) > 0$ and $p_1(1,1) > p_0$. This implies that the expected return from investment at date 1, $\Delta(\bar{w}, q_1)$, is higher than in period zero. Thus

$$q_1 > q_0.$$

The same rise in workers' optimism occurs between periods $t$ and $t+1$ when negotiation succeeds in period $t$.

The dynamics of beliefs when there is investment, is fully described by:

$$q_{t+1} = \begin{cases} q_t & \text{if } q_t \leq \bar{q} \\ \frac{(1-\varepsilon)q_t}{(1-\varepsilon)q_t + \varepsilon(1-q_t)} > q_t & \text{with probability } 1 - \varepsilon & \text{if } q_t > \bar{q} \\ \frac{\varepsilon q_t}{\varepsilon q_t + (1-\varepsilon)(1-q_t)} < q_t & \text{with probability } \varepsilon & \text{if } q_t > \bar{q}, \end{cases} \tag{10}$$

if the economy is type-$C$, and

$$q_{t+1} = \begin{cases} q_t & \text{if } q_t \leq \bar{q} \\ \frac{(1-\varepsilon)q_t}{(1-\varepsilon)q_t + \varepsilon(1-q_t)} > q_t & \text{with probability } \varepsilon & \text{if } q_t > \bar{q} \\ \frac{\varepsilon q_t}{\varepsilon q_t + (1-\varepsilon)(1-q_t)} < q_t & \text{with probability } 1 - \varepsilon & \text{if } q_t > \bar{q}, \end{cases} \tag{11}$$

if the economy is type-$N$.

A first implication of the updating equation (10) is that as the experimentation history expands, the reference type ends up being learned with probability 1. More formally, the continuous mapping theorem (see Acemoglu et al, 2007) implies that $s \to (1-\varepsilon)t$ as $t \to \infty$ when experimentation occurred in all periods $0, 1, ..., t-1$, which in turn implies that

$$\lim_{t \longrightarrow \infty} \Pr\left[e = C | h_t(t,s)\right] = \lim_{t \longrightarrow \infty} \frac{q_0}{q_0 + (\frac{\varepsilon}{1-\varepsilon})^{t(1-2\varepsilon)}(1-q_0)} = 1.$$

However, as we shall see below, experimentation may not occur in all periods even when the economy is cooperative ($e = C$). And as a result the economy will not avoid falling into a no investment/ no experimentation trap with probability one. The continuous mapping theorem also yields that $\lim_{t \longrightarrow \infty} \Pr\left[e = C | h_t(t,s)\right] = 0$ if $e = N$, which this time will imply that with probability one the economy falls into a no experimentation/no investment trap. From now on we shall concentrate on the case where the economy is truly cooperative (type-$C$).

A second implication of the updating equation (10), is that the probability of uninterrupted experimentation (and therefore of convergence toward full learning) increases with the value of the initial beliefs $q_0$. For example, if $q_0$ is larger than the threshold value $\bar{q}$ below which there is no investment, but close enough to $\bar{q}$, the probability that there is investment in period zero, but then no investment in subsequent periods, can be high. To see this, imagine that $q_0 > \bar{q}$ but that negotiation fails in period zero (this occurs with probability $\varepsilon$). Then, equation (10) implies that $q_1 < q_0$. If $q_1$ is smaller than $\bar{q}$, which will occur if $q_0$ is close enough to $\bar{q}$, investment is equal to zero in period one. In that case, the economy falls in a no-investment/no-experimentation trap in period 1, after one period of experimentation, and from period zero this case is perceived to occur with probability $\varepsilon$.

For higher values of $q_0$ it will take more than one failure to bring the economy to a no-investment/no-experimentation trap. Such a scenario can occur after period 1 when there are successive failures for higher values of $q_0$. More precisely, we can show:

**Proposition 1:** *If the economy is of the cooperative type ($e = C$) and if $q_0 > \bar{q}$, then the economy avoids the no-investment/ no-experimentation trap with probability $Q(q_0, \overline{w})$ which is increasing in $q_0$ and decreasing in $\overline{w}$.*

**Proof:** Let $T(q_0, \bar{q})$ be defined by

$$\varphi(T, q_o) = \bar{q},$$

where:

$$\varphi(T, q_o) = \frac{1}{1 + (\frac{1-q_0}{q_0})(\frac{1-\varepsilon}{\varepsilon})^T}.$$

Since $\varphi$ is decreasing in $T$ and increasing in $q_0$, then $T(q_0, \bar{q})$ is increasing in $q_0$ and decreasing in $\bar{q}$.

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Now the ex ante expected probability that $q_t$ will eventually fall below $\bar{q}$, which in turn will lead to a no-investment/no-experimentation trap, is equal to:[17]

$$\bar{P}(q_0, \bar{q}) = \frac{\sum_{n \geq 0} \sum_{s \leq \frac{n - T(q_0, \bar{q})}{2}} \binom{n}{s}(1-\varepsilon)^s \varepsilon^{n-s}}{\sum_{n \geq 0} \sum_{s \leq n} \binom{n}{s}(1-\varepsilon)^s \varepsilon^{n-s}}.$$

In particular it is easy to see that $\bar{P}(q_0, \bar{q})$ is decreasing in $T$, and therefore decreasing in $q_0$ and increasing in $\bar{q}$, and therefore

$$Q(q_0, \overline{w}) = 1 - \bar{P}(q_0, \bar{q})$$

is increasing in $q_0$ and decreasing in $\bar{q}$ and therefore in the minimum wage $\overline{w}$. QED.

Thus, when the economy is truly cooperative, the economy is more likely to converge toward a steady state equilibrium with positive investment and union density if initial beliefs are sufficiently optimistic and the minimum wage is sufficiently low. Moreover, we can state that:

**Result 1:** *In steady state, aggregate welfare of workers is higher in the equilibrium with positive investment in the quality of labor relations than in the equilibrium without investment.*

**Proof:**

Aggregate welfare of workers in period $t$ is equal to the sum of wages minus the unionization costs and the investment costs in the quality of labor relations:

$$W_t = \left[ G\left( \frac{c\bar{w}}{\mu(1-c)p(q_t, i_t)} \right) - G(\bar{w}) \right] \bar{w} +$$
$$\int_{\frac{c\bar{w}}{\mu(1-c)p(q_t,i_t)}}^{1} (1-c)\left\{ p(q_t, i_t)w(y) + [1 - p(q_t, i_t)]\bar{w} \right\} \mathrm{d}G(y) - i_t.$$

When $\frac{c\bar{w}}{\mu(1-c)p(q_t,i_t)}$ is greater than 1, then aggregate welfare is equal to:

$$W_t = [1 - G(\bar{w})]\bar{w} - i_t. \tag{12}$$

A steady state equilibrium with positive investment in the quality of labor relations can exist only if the economy is truly cooperative and if $\frac{c\bar{w}}{\mu(1-c)(1-\varepsilon)} < 1$. Assuming that these two conditions are fulfilled, the probability $p(q_t, i_t)$ that voice succeeds at date $t$, is equal to $1 - \varepsilon$ if there is investment in the quality of labor relations. Then, steady state welfare is

$$W^I = \left[ G\left( \frac{c\bar{w}}{\mu(1-c)(1-\varepsilon)} \right) - G(\bar{w}) \right] \bar{w} + \int_{\frac{c\bar{w}}{\mu(1-c)(1-\varepsilon)}}^{1} (1-c)\left[ (1-\varepsilon)\mu y + \bar{w} \right] \mathrm{d}G(y) - I.$$

---

[17]Here we use the fact that

$$q_t = \Pr\left[ e = C | h_t(n, s) \right] = \frac{1}{1 + \left( \frac{1-q_0}{q_0} \right)\left( \frac{1-\varepsilon}{\varepsilon} \right)^{n-2s}}.$$

If there is no investment, then $p(q_t, i_t)$ is equal to $\varepsilon$ and steady state welfare amounts to

$$
W^0 = \left\{
\begin{array}{ll}
\left[ G\left( \frac{c\bar{w}}{\mu(1-c)\varepsilon} \right) - G(\bar{w}) \right] \bar{w} + \int_{\frac{c\bar{w}}{\mu(1-c)\varepsilon}}^{1} (1-c)(\varepsilon\mu y + \bar{w}) \mathrm{d}G(y) & \text{when } \frac{c\bar{w}}{\mu(1-c)\varepsilon} < 1 \\
\left[ G\left( \frac{c\bar{w}}{\mu(1-c)\varepsilon} \right) - G(\bar{w}) \right] \bar{w} & \text{otherwise.}
\end{array}
\right.
$$

Using the two last equations and the definition of $\Delta(\bar{w}, q)$ given in footnote 16 it can easily be checked that $W^I > W^0$ since $\Delta(\bar{w}, 1) > I$. QED.

## 3.3 Optimal minimum wage and the multiplicity of steady-state social regimes

In this section we analyze the reverse causality from current beliefs about cooperation to the minimum wage optimally chosen by a utilitarian government. We begin to define the optimal minimum wage set by the government in every period. Then, we proceed to analyze the short-run equilibrium, when the belief about the efficiency of the investment in labor relations is taken as given. Finally, we study the dynamics of beliefs and investment and we show that the model generates multiple (long-term) social regimes.

### 3.3.1 The ex-ante social welfare function and the optimal minimum wage

It is assumed that the government, contrary to the trade union, does not observe the productivity of each individual. This assumption is meant to capture in a simple way the fact that trade unions gather information, thanks to the bargaining process, that is not available to the government. The cost of unionization and/or the cost of investment in labor relations can be interpreted as the cost of information obtained by the trade union.

Since the government does not observe productivity, the minimum wage can only be the lowest bound of the wage distribution. The election process is represented by a probabilistic voting model which implies, under some assumptions assumed to be fulfilled, that the elected government maximizes the sum of the utilities of the workers.[18]

We assume that the government chooses the minimum wage after the union has chosen its investment $i_t$. As shown previously, the trade union's investment choice satisfies:

$$
i_t = \left\{
\begin{array}{ll}
I & \text{if } \Delta(\bar{w}_t, q_t) > I \\
0 & \text{if } \Delta(\bar{w}_t, q_t) \leq I.
\end{array}
\right.
$$

where $\bar{w}_t$ is the minimum wage the union anticipates to be set by the government in period $t$.

---

[18]This outcome can be derived from the simple case in which individuals are heterogeneous with respect to ideological biases towards the candidates. Then, following Persson and Tabellini (2000) it turns out that the outcome of the elections maximizes the utilitarian criterion if the ideological bias is represented by an additive term in the utility function and is distributed with a uniform distribution independent of the distribution of productivities.

Given $q_t$ and $i_t$, the government chooses the minimum wage $\bar{w}_t = \bar{w}(q_t, i_t) \geq 0$ that maximizes the social welfare function equal to the sum of the gains of the workers minus the investment costs:

$$W_t = \left[ G\left(\frac{c\bar{w}_t}{\mu(1-c)p(q_t, i_t)}\right) - G(\bar{w}_t) \right] \bar{w}_t +$$
$$\int_{\frac{c\bar{w}_t}{\mu(1-c)p(q_t,i_t)}}^{1} (1-c) \{p(q_t, i_t)w(y) + [1 - p(q_t, i_t)]\bar{w}_t\} \, \mathrm{d}G(y) - i_t \qquad (13)$$

where $p(q_t, i_t)$ is given by

$$p(q_t, i_t) = \begin{cases} \varepsilon + (1 - 2\varepsilon)q_t & \text{if } i_t = I \\ \varepsilon & \text{if } i_t = 0. \end{cases}$$

When $\frac{c\bar{w}_t}{\mu(1-c)p(q_t,i_t)}$ is greater than 1, then social welfare is equal to:

$$W_t = [1 - G(\bar{w}_t)]\bar{w}_t - i_t. \qquad (14)$$

Maximizing welfare over the choice of minimum wage $\bar{w}_t$, we can establish the following

**Proposition 2:** *The optimal minimum wage $\bar{w}(q_t, i_t)$ at date $t$ is equal to:*

$$\bar{w}(q_t, i_t) = \begin{cases} \frac{p(q_t,i_t)\mu(1-c)^2}{2\mu(1-c)p(q_t,i_t)-c^2} & \text{if } p(q_t, i_t) \geq \frac{c}{2\mu(1-c)} \\ 1/2 & \text{if } p(q_t, i_t) \leq \frac{c}{2\mu(1-c)}. \end{cases} \qquad (15)$$

**Proof**: Consider first the case when the welfare maximization program has an interior solution $\bar{w}_t > 0$ such that

$$\frac{c\bar{w}_t}{\mu(1-c)p(q_t, i_t)} < 1.$$

Then the optimal minimum wage satisfies the first order condition:

$$\frac{\partial W_t}{\partial \bar{w}_t} = 0, \text{ or equivalently: } \bar{w}_t = \frac{p(q_t, i_t)\mu(1-c)^2}{2\mu(1-c)p(q_t, i_t) - c^2}. \qquad (16)$$

The solution $\bar{w}_t$ is truly interior if

$$\frac{c(1-c)}{2\mu(1-c)p(q_t, i_t) - c^2} < 1,$$

or equivalently

$$p(q_t, i_t) > \frac{c}{2\mu(1-c)}.$$

Now suppose that

$$p(q_t, i_t) \leq \frac{c}{2\mu(1-c)},$$

then the optimal minimum wage $\bar{w}_t$ maximizes

$$W_t = [1 - G(\bar{w}_t)]\bar{w}_t.$$

Note that in this case

$$\frac{\partial W_t}{\partial \bar{w}_t} = 1 - 2\bar{w}_t,$$

which is positive if $\bar{w}_t < 1/2$ and negative otherwise. Thus in this case the optimal minimum wage is simply

$$\bar{w}_t = \frac{1}{2},$$

which establishes the proposition. QED.

### 3.3.2 Short run equilibrium, for given current beliefs about cooperation

We now proceed by backward induction. Consider first the government's choice of minimum wage for given beliefs and union investment. Proposition 2 gives us the answer, namely:

If $i_t = 0$, then the probability that bargaining succeeds is $p(q_t, 0) = \varepsilon$ and the government sets

$$\bar{w}(q_t, 0) = \begin{cases} \frac{\varepsilon\mu(1-c)^2}{2\mu(1-c)\varepsilon - c^2} & \text{if } \varepsilon \geq \frac{c}{2\mu(1-c)} \\ 1/2 & \text{otherwise.} \end{cases}$$

If $i_t = I$, the government will choose

$$\bar{w}(q_t, I) = \begin{cases} \frac{[\varepsilon + (1-2\varepsilon)q_t]\mu(1-c)^2}{2\mu(1-c)[\varepsilon + (1-2\varepsilon)q_t] - c^2} & \text{if } \varepsilon + (1-2\varepsilon)q_t \geq \frac{c}{2\mu(1-c)} \\ 1/2 & \text{otherwise,} \end{cases} \tag{17}$$

which is decreasing in $q_t$ since $c < 1$.

Now, moving back one step, the union will choose to invest, i.e $i_t = I$, whenever

$$D(q_t) > I; \tag{18}$$

where

$$\begin{aligned} D(q) &= \int_{\frac{c\bar{w}(q,I)}{\mu(1-c)[q(1-2\varepsilon)+\varepsilon]}}^{1} (1-c)\left\{[q(1-2\varepsilon) + \varepsilon]\mu y - \bar{w}(q,I)\right\} \mathrm{d}G(y) \\ &\quad - \int_{\frac{c\bar{w}(q,0)}{\mu(1-c)\varepsilon}}^{1} (1-c)\left[\varepsilon\mu y - \bar{w}(q,I)\right] \mathrm{d}G(y). \end{aligned}$$

Using the fact that $D(q)$ is increasing in $q$, the above inequality defines a lower bound

$$\tilde{q} = \{q | D(q) = I\}$$

on beliefs,[19] below which the union does not invest and therefore does not experiment. Obviously, an equilibrium with positive investment cannot exist if the investment cost is higher than the

---

[19]It can be checked that $\tilde{q}$ is larger than the threshold value of $q$ below which the wage $\bar{w}(q_t, I) = 1/2$. This is because nobody is unionized if the wage is equal to $1/2$ and it is then never worth investing in the quality of labor relations.

expected gains from investment when people are most optimistic, i.e. when $q_t = 1$. To avoid this possibility, we henceforth assume that

$$D(1) > I.$$

Then, either $q_t < \tilde{q}$, in which case the union does not invest and therefore the government sets minimum wage $\bar{w}_t = \min\{1/2, \frac{\varepsilon\mu(1-c)^2}{2\mu(1-c)\varepsilon-c^2}\}$, or $q_t > \tilde{q}$ in which case the union invests, the government sets

$$\bar{w}_t = \frac{[\varepsilon + (1 - 2\varepsilon)q_t]\,\mu(1 - c)^2}{2\mu(1 - c)\,[\varepsilon + (1 - 2\varepsilon)q_t] - c^2} < 1/2,$$

and the union experiments at date $t$. Since the minimum wage is lower in the second case, union density is higher in that case.

### 3.3.3 Comparative static results

Using Proposition 2 and plugging the equilibrium value of the minimum wage back into the expressions for welfare, employment and output, we can establish interesting comparative static results on how these three measures of aggregate performance vary with workers' belief on the type of the economy.

.

**Result 2:** *Employment and aggregate output are non-decreasing with the previous period's belief in the cooperative nature of the economy.*

**Proof**: Note that aggregate employment is simply given by

$$E_t = \begin{cases} 1 - G(\bar{w}_t) = \frac{\mu p(q_t, i_t)(1-c^2)-c^2}{2\mu p(q_t, i_t)(1-c)-c^2} & \text{if } p(q_t, i_t) \geq \frac{c}{2\mu(1-c)} \\ \frac{1}{2} & \text{otherwise.} \end{cases}$$

Thus $E_t$ is non-decreasing in $p(q_t, i_t)$ and thus in $p(q_{t-1}, i_{t-1})$ according to Lemma 1 and to Corollary 1. Similarly, aggregate output

$$Y_t = \int_{\bar{w}_t}^1 y \mathrm{d}G(y)$$

is non-decreasing in $p(q_{t-1}, i_{t-1})$ since $\bar{w}_t$ is non-increasing in $p(q_{t-1}, i_{t-1})$. QED.

When many workers were unionized in the previous generation and when the trade union has just invested to improve the quality of labor relations, the government can set a low minimum wage because current expected gains of unionization are high. This situation, which is favorable to employment and output, is also good for aggregate welfare which is equal to total wages net of total unionization and investment costs if the true nature of the economy is cooperative:

**Result 3:** *When the economy is type-C, aggregate workers' welfare is non-decreasing with the previous generation's belief.*

**Proof**: Past belief has no impact on current welfare if $q_t$ is such that there is no investment in the current period, i.e. if $q_t \leq \tilde{q}$. Let us now suppose that $q_t > \tilde{q}$ and that there is an equilibrium with positive investment in period $t$. Then, using the envelop theorem the derivative of $W_t$ (defined equation (13)) at the optimal value of $\bar{w}_t$ reads

$$\frac{dW_t}{dp(q_t, i_t)} = \begin{cases} \int_{\frac{c\bar{w}_t}{\mu(1-c)p(q_t,i_t)}}^{1} (1-c)\mu y dG(y) > 0 & \text{if } p(q_t, i_t) \geq \frac{c}{2\mu(1-c)} \\ 0 & \text{otherwise.} \end{cases}$$

Since from Lemma 1 $p(q_t, i_t)$ increases with $p(q_{t-1}, i_{t-1})$ when the trade union invests, $W_t$ also increases with $p(q_{t-1}, i_{t-1})$ if $p(q_t, i_t) \geq 2c$. QED.

Thus, when the true nature of the economy is cooperative, more optimistic past beliefs about the cooperative nature of the economy and the efficiency of investment, favor current involvement in collective action, and leads to higher social welfare because the action of trade unions is more efficient than the minimum wage to fight against the monopsony power of employers.

### 3.3.4 The dynamics of union density, minimum wage and investment in cooperation

This section analyzes the joint dynamics of union density, minimum wages and investment in the quality of labor relations. We are particularly interested in the existence of multiplicity of steady-state equilibria: equilibria with positive investment in the quality of labor relations, low minimum wage and high unionization (a "Scandinavian" equilibrium) and equilibria without investment in the quality of labor relation, and with low unionization and high minimum wage ("French" equilibrium).

*"French" equilibrium*

When initial beliefs about the nature of the economy, $q_0 = \Pr_{t=0}(e = C)$, are pessimistic, the economy can be stuck in a situation with zero investment. This occurs for sure if $q_0 \leq \tilde{q}$. This situation persists over time since the absence of experimentation in period $t = 0$ prevents the updating of beliefs in period 1, and then in the subsequent periods $2, .., \infty$. The minimum wage remains high, equal to

$$\bar{w} = \min\{1/2, \frac{\varepsilon\mu(1-c)^2}{2\mu(1-c)\varepsilon - c^2}\},$$

and union density is equal to[20]

$$\pi = \max\{0, \frac{2\mu(1-c)\varepsilon - c}{2\mu(1-c)\varepsilon - c^2}\}.$$

---

[20] By using the value of $\bar{w}_t$ defined in equation (15) into equation (4), we see that the unionization ragte at date $t$ in equilibrium is given by:

$$\pi_t = \begin{cases} 1 - \frac{c(1-c)}{2\mu p(q_t, i_t)(1-c) - c^2} & \text{if } p(q_t, i_t) \geq \frac{c}{2\mu(1-c)} \\ 0 & \text{if } p(q_t, i_t) \leq \frac{c}{2\mu(1-c)}. \end{cases} \tag{19}$$

*"Scandinavian" equilibria*

When initial beliefs are sufficiently optimistic, i.e. when $q_0 > \tilde{q}$, investment in period zero is positive. Then, social experimentation takes place. From our analysis in the previous subsection, we know that with ex-ante probability

$$\bar{P}(q_0, \tilde{q}) = \frac{\sum_{n \geq 0} \sum_{s \leq \frac{n - T(q_0, \tilde{q})}{2}} \binom{n}{s}(1 - \varepsilon)^s \varepsilon^{n-s}}{\sum_{n \geq 0} \sum_{s \leq n} \binom{n}{s}(1 - \varepsilon)^s \varepsilon^{n-s}},$$

the economy will end up in a "French" trap, but with probability $\left[1 - \bar{P}(q_0, \tilde{q})\right]$ it will converge toward the "Scandinavian" steady state.

If the economy reaches the "Scandinavian" steady state, the economy had to be of a cooperative type (otherwise, the economy could not have converged toward this steady state by the Continuous Mapping Theorem). The probability of success of voice is then equal to $1 - \varepsilon$. The minimum wage and the trade union density are consequently given by

$$\bar{w}^* = \frac{(1 - \varepsilon)\mu(1 - c)^2}{2\mu(1 - c)(1 - \varepsilon) - c^2} < \frac{1}{2}, \pi^* = \frac{2\mu(1 - c)(1 - \varepsilon) - c}{2\mu(1 - c)(1 - \varepsilon) - c^2} > \pi \geq 0.$$

*Welfare comparison*

Consider a type-$C$ economy so that the steady state with positive investment can be reached when the initial beliefs satisfy $q_0 > \tilde{q}$. Then, we know from Result 2 that aggregate welfare is increasing with $p(q_t, i_t)$. Since $p(q_t, i_t)$ is higher in the equilibrium with positive investment than in the equilibrium with zero investment, aggregate welfare is higher in the "Scandinavian" steady state equilibrium than in a "French" one.

The following proposition summarizes the above discussion:

**Proposition 3:** *Assume a type-C economy. Then, there exists a steady state equilibrium with positive investment in the quality of labor relations, high unionization rate and low minimum wage. There also exist steady state equilibria with zero investment, low union density and high minimum wage. In the steady state with positive investment, welfare is higher than in the steady-state without investment.*

*If initial beliefs $q_0$ that the environment is cooperative are lower than $\tilde{q}$, the economy is stuck in a bad equilibrium with higher minimum wage $\bar{w}_t = \min\{1/2, \frac{\varepsilon\mu(1-c)^2}{2\mu(1-c)\varepsilon - c^2}\}$, lower unionization rate, and no investment in the quality of labor relations.*

---

In particular we see that:
$$\partial \pi_t / \partial p_t \geq 0.$$
In other words, the more optimistic workers are about the quality of labor relations at date $t$, the more they unionize at that date.

*If $q_0 > \tilde{q}$, the economy converges towards the equilibrium with positive investment in the quality of labor relations, lower minimum wage $\bar{w}^* = \frac{(1-\varepsilon)\mu(1-c)^2}{2\mu(1-c)(1-\varepsilon)-c^2}$, higher unionization rate, with probability $1 - \bar{P}(q_0, \tilde{q})$ that increases with $q_0$.*

It is worth stressing that the dynamics of investment in cooperation, of unionization and of the minimum wage, are all driven by the updating of workers' beliefs. A high current minimum wage policy favors convergence towards the "low" equilibrium with no unionization and investment, as it deters experimentation and thereby leads to future minimum wage increases.

Our model yield an explanation for the fact that the stringency of government regulation of minimum wages is strongly negatively correlated with union density and with the quality of labor relations. Beside explaining these relations, our model also leads to two important predictions. First, it shows that beliefs about the quality of labor relations are shaped by past unionization, past beliefs and past minimum wages. Second, it predicts that there is more demand for state regulation of minimum wages when people believe that the quality of labor relations is low. These findings thus provide a rationale for the evidence of section 2.

# 4    Conclusion

In this paper we have argued that in countries with highly cooperative labor relations and high unionization rates, the state is less prone to regulate the minimum wage. In such countries, there is no need for a legal minimum wage because social partners negotiate wages directly. Conversely, in countries with strong state regulation of the minimum wage, incentives for social dialogue are low and so is union density, as strong state regulation of the minimum wage crowds out social experimentation and learning about cooperation. This crowding out effect progressively undermines cooperation and leads economies towards steady-state equilibria with bad labor relations and high minimum wage regulations.

This in turn suggests that state regulation of the minimum wage can have long run costs that have been largely disregarded by the economic literature so far. The importance of the contrast between Scandinavian countries, which display good labor relations and good labor market performance on the one hand, and Mediterranean countries with poor labor relations and poor labor market performance on the other hand, suggests that such costs might actually be large.

The analysis in this paper raises a broader question concerning the link between regulation and distrust. Cross-country evidence show that regulation is higher even when distrust in government is high. Aghion et al. (2008) show and rationalize this puzzle in the political economy literature: why it is that people in countries with bad governments want more government

intervention?

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# A   Typology of short run equilibria in the $(q_t, \bar{w}_t)$ plane

Let us assume that $q_t = \Pr\left[e = c | h_t(n, s)\right]$ and $\bar{w}_t$ are exogenous.

From equations (2) and (4), we know that the measure of unionized workers is positive if and only if

$$
\begin{array}{ll}
1 - \frac{c\bar{w}_t}{\mu(1-c)\varepsilon} > 0 & \text{when } i_t = 0, \\
1 - \frac{c\bar{w}_t}{\mu(1-c)[q_t(1-2\varepsilon)+\varepsilon]} > 0 & \text{when } i_t = I.
\end{array}
\tag{A1}
$$

From equation (6) we know that there is investment in labor relations if and only if

$$
\Delta(\bar{w}_t, q_t) > I.
\tag{A2}
$$

Since function $\Delta$ is decreasing with $\bar{w}$ and increasing with $q$, condition (A2) defines an area in the $(q_t, \bar{w}_t)$ plane whose frontier is upward sloping. There is positive investment for values of $(\bar{w}_t, q_t)$ above the frontier and no investment for values of $(\bar{w}_t, q_t)$ below the frontier.

For values of $(\bar{w}_t, q_t)$ below the frontier, there is zero investment and condition (A1) implies that the measure of unionized workers is positive if and only if $\bar{w}_t < \frac{\mu(1-c)\varepsilon}{c}$.

For values of $(\bar{w}_t, q_t)$ above the frontier, there is positive investment and (A1) implies that the measure of unionized workers is positive if and only if $\bar{w}_t < \frac{\mu(1-c)[q_t(1-2\varepsilon)+\varepsilon]}{c}$. Since it turns out that

$$
\Delta(\frac{\mu(1-c)\left[q_t(1-2\varepsilon) + \varepsilon\right]}{c}, q_t) = 0,
$$

union density is necessarily positive for values of $(\bar{w}_t, q_t)$ compatible with positive investment.

# B   Investment in cooperation and the quality of labor relations

This section documents on the relation between unions' investment in cooperation and the quality of labor relations. The model predicts a strongly positive correlation between the two. We measure the investment in cooperation by using two main indicators. The first indicator is the degree of workplace presence of unions. The workplace appears indeed to be the main location for service provision to union members and for providing protection and support during the negotiation with management. Strong workplace representation thus directly affects the benefits from union membership and also the extent to which voice and cooperation prevail over exit in labor relations. We measure the workplace presence of unions by using the indicator of Checchi and Lucifora (2002) for the 1990s. The indicator ranges from 0 to 1, with a higher score suggesting a higher representation of unions in all workplaces. The second indicator of investment in cooperation is the degree to which unions try to coordinate and centralize their decisions. We expect that beliefs in cooperation and union membership are higher wherever unions have been able to create and defend centralized institutions of collective bargaining with employers. We

measure this using the coordination index of Checchi and Lucifora (2002) for the 1990s. The index combines information about the degree of centralization in wage bargaining and wage coordination across the main workers unions, on a quinquennial base. The indicator include two vertical and horizontal dimensions in negotiations. The vertical dimension captures how bargaining is divided between different levels (national, industry, firm) within a union confederation. The horizontal dimension captures the number of union confederations. The index is ranked between 0 and 1, a higher score indicating a greater level of centralization/coordination. According to this criteria, France has a low score because workers union confederations are highly divided and enterprise bargaining has greater importance than sectorial and national bargaining. In contrast, Nordic countries have a much greater score. This is not necessarily due to more centralization, since a trend towards decentralization has occurred in these countries since the eighties. But the degree of coordination between unions confederations is much greater compared to other countries.

Figure 13 reports the correlation between the indicator of workplace presence of unions and the perceived quality of labor relations measured by the *Global Competitiveness Reports 1999*. Figure 14 reports the same correlation pattern between the quality of labor relations and the degree of coordination and centralization of negotiations between trade unions. In both cases, steady positive correlations show up, suggesting that the quality of labor cooperation is strongly associated with investment in cooperation by unions. Approximately 40-50 percent of the cross-country heterogeneity in the quality of labor relations could be associated with differences in the unions' efforts to be present in firms locally and to coordinate and centralize negotiations nationally.

# C   Minimum wage regulations in OECD countries

The data on minimum wages come from the OECD database and Neumark and Wascher (2004) for the levels, and from the International Labor Organization (ILO) for the legislation.

- *Minimum wage legislations*

The legislation differs mainly depending on the existence of a legal statutory minimum wages, and the dispersion of minimum wages. These distinctions are documented below.

1. Method of setting

    We first measure the extent to which minimum wages are directly set by law or by collectively agreed minimum wages negotiated between social partners. Column 2 of table 6 indicates whether wage floors are set by statutory rules defined by the law or by collective negotiation. Column 3 of table
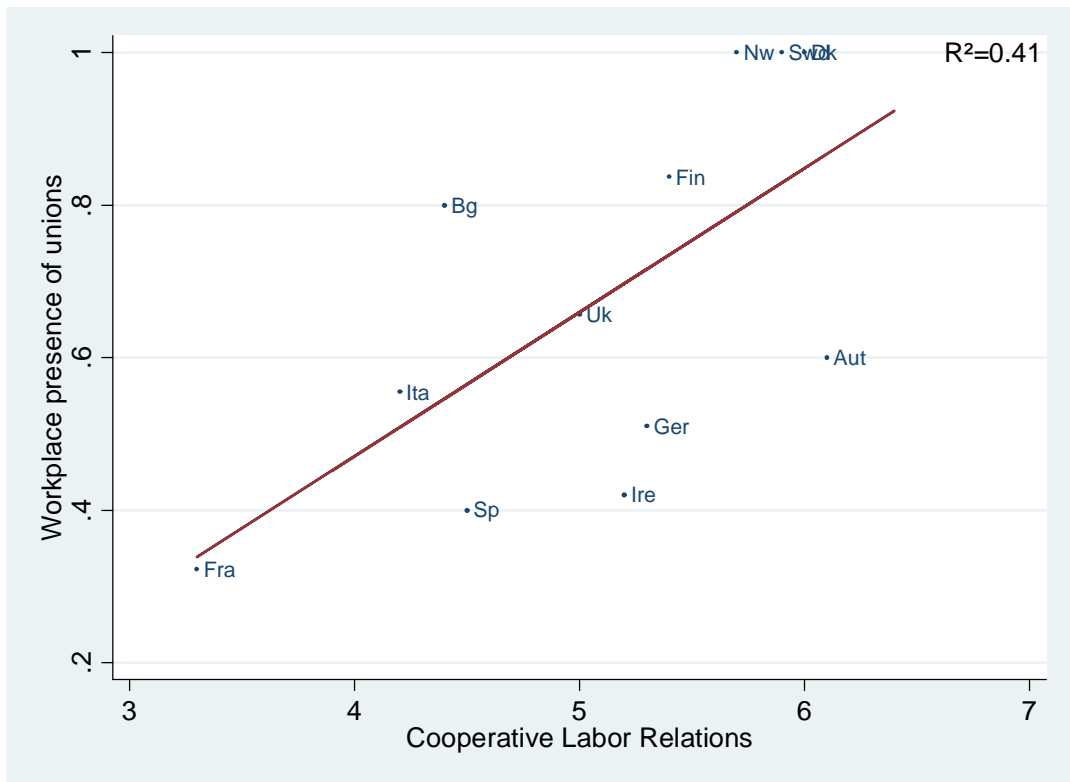
Figure 13: Correlation between the workplace presence of unions and the quality of labor relations. Sources: Checchi and Lucifora (2002) and CGR (1999).
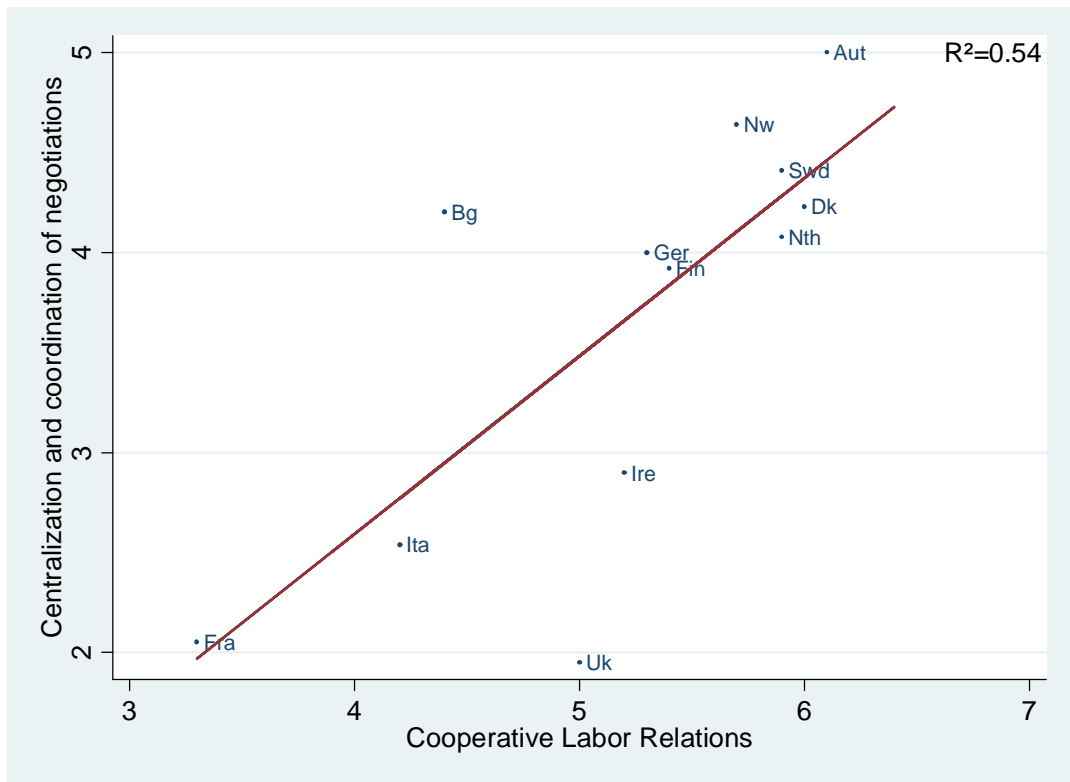
Figure 14: Correlation between the centralization and coordination of negotiation and the quality of labor relations. Sources: Checchi and Lucifora (2002) and CGR (1999).

6 indicates the coverage of the minimum wage. This coverage is equal to one when the minimum wage is set by law. However, it can be smaller than one when there is no statutory minimum wage. In some countries the wage floor is negotiated at the sectorial level, but it is automatically extended in other countries. As a matter of fact, the coverage rates of collectively agreed minimum wage reach 70 percent in Norway, 80 percent in Sweden 81 percent in Denmark while they are equal to 99 percent in Austria and Italy. Eventually, almost all Anglo-Saxon countries have a statutory minimum wage. The United States recognized a statutory wage floor in 1938 by the Fair Act while United Kingdom established a national minimum wage in 1999 after having abolished the system of Wage Councils in 1993.

Table 6: Method of wage setting. Source: ILO.

|  | Determination | Coverage |
|---|---|---|
| Australia | Statutory, Provincial level | 1 |
| Austria | Negotiation, National extension | .9 |
| Belgium | Negotiation, National level | 1 |
| Canada | Statutory, Federal and provincial levels | 1 |
| Czr | Statutory, National level | 1 |
| Denmark | Negotiation, Industry level | 0.8-0.9 |
| Finland | Negotiation, Industry level | 0.9 |
| France | Statutory, National level | 1 |
| Germany | Negotiation, National extension | 0.9 |
| Greece | Statutory, National level | 1 |
| Hg | Statutory, National level | 1 |
| Italy | Negotiation, National extension | 1 |
| Japan | Statutory, Prefectures | 1 |
| Mexico | Statutory, National | 1 |
| Netherlands | Statutory, National | 1 |
| Norway | Negotiation, Industry level | 0.7 |
| Poland | Statutory, National | 1 |
| Portugal | Statutory, National | 1 |
| Spain | Statutory, National | 1 |
| Sweden | Negotiation, Industry level | 1 |
| Uk | Negotiation, industries, Statutory, 1999 | 1 |
| Usa | Statutory, Federal, States | 1 |

2. Variation in wage floors

Wage floors can vary in five main dimensions: age, qualification, regions, sectors and occupations. Tables 7 indicates whether the minimum wage is set at the national level. It shows that most countries with a statutory minimum wage opt to set a single wage at the national level. Exceptions

are Canada and the United States which sets minimum wages at both the federal and the regional level. In the United States, some States, mainly in the South, do not implement the Federal law and others set the minimum wage above the federal floor. In Canada, each province sets its own minimum wage, leading to a wide gap in statutory minimum wages. In Japan, the minimum wage is set at the prefecture level, with some different wages for different industries in a given prefecture. Mexico lies in between, the minimum wage being set at the regional level, but with only three broad regions and a quite narrow gap between different regional levels.

We also report the potential existence of sub-minimum rates for young workers and trainees. Such sub-minimum rates are quite common in OECD countries since they concern around half of them. Countries which exclude such provisions are: Czech Republic, Greece, Hungary, Japan and Mexico. But significant differences exist among countries authorizing sub-minimum wage provisions. The first difference lies in the range of ages covered by the provision. Basically provisions would extend until 24 years old in Sweden or 22 years in Netherlands while such reductions are permitted only for workers younger than 17 years in France and 18 years in Ireland. The second difference is the extent of reductions. United-Kingdom stands as a polar case with no minimum wage for people younger than 21 years. The Netherlands accepts a reduction up to 40 percent of standard minimum wage at 17 years old while the wage floor is set at 80 percent of the standard minim wage in France or Spain for this age.

- *Minimum wage levels*

The level of the minimum wages measured by the OECD refers in general to a full-time workers in the industry. The data for countries without statutory minimum wage floors correspond to the same definition, borrowed from Neumark and Wascher (2004).

*Australia*

The federal minimum weekly wage divided by the median gross weekly earnings of full-time workers. Prior to 1997, the federal minimum is extrapolated based on Metal Industry Award C14 wages and National Wage Case decisions. Source: OECD Minimum Wage Database. Method of setting: An independent Commission (Australian Industrial relations Commission or AIRC) is responsible for setting the federal minimum wage via an annual Safety Net Review. Although some state-level legislation also exists, the federal minimum wage is applicable to the majority of Australian workers. Other provisions: Minimum wages may differ by industry and occupation if the AIRC approves applications to vary minimum award rates from the federal level. There is also a youth subminimum, with rates ranging from 40

Table 7: Variations in wage-setting. Source: ILO.

|  | Variations by: | Subminimum (Age limits, % of standard minimum wage) |
|---|---|---|
| Australia | Industries,Regions, Occupation, Age | |
| Austria | Industries, Occupation, Age | No |
| Belgium | Age | 20:94%, 19: 88%, 18: 82% 17: 76%, <17: 70% |
| Canada | Industries, regions,occupations | No |
| Czr | Occupation | No |
| Denmark | Industry, Age | <18: 40% |
| Finland | Industries, Age, Occupations | No |
| France | Age | 17: 90%, <17: 80% |
| Germany | Region, Age, Qualifications | Trainees |
| Greece | Age, Marital status, Qualifications | No |
| Hg | No | No |
| Italy | Industry, Age | Trainees |
| Japan | Industry, Age, Occupation | No |
| Mexico | No | No |
| Netherlands | Age | 22: 85%, 21: 72,5%, 20: 61,5%, 19: 52,5%, 18: 45,5%, 17: 39,5%, 16:34,5%, 15: 30% |
| Norway | Industry, age, Occupation | No |
| Poland | No | No |
| Portugal | Age | <18: 75% |
| Spain | Age | <18: 89%, suppressed  in1998 |
| Sweden | Industry,Age, Occupation | <24: 89% |
| Uk | Industry,Age | <21: 0%, Change in 1999 |
| Usa | Age, Job tenure | No |

percent to 85 percent of the adult minimum depending on age.

*Belgium*

The minimum monthly wage for workers aged 21 and over divided by the median gross monthly earnings of full-time workers. Source: OECD Minimum Wage Database. Method of setting: The private-sector minimum wage (Revenue Minimum Mensuel Moyen Garanti) is set via a biennial national collective bargaining agreement between social partners (employers and unions) within the Conseil National du Travail. This minimum wage is then made mandatory for the entire private sector by royal decree. Between collective bargaining agreements, the minimum wage is indexed to the consumer price index, with a formula that adjusts up the minimum two months following a cumulative 2 percent increase in the CPI. Other provisions: The laws provide for a subminimum wage for employees less than 21 years of age. This subminimum wage is 70 percent of the adult minimum for employees aged 16 or under, with the proportion rising by 6 percentage points for each extra year of age.

*Canada*

Weighted average of provincial hourly minimum wage levels (weighted by the size of the labor force in each province) divided by median gross hourly earnings of full-time workers. Source: OECD Minimum Wage Database. Method of setting: Minimum wages are set separately in each province and territory either by minimum wage boards or by the Lieutenant-Governor in Council. Other provisions: In most provinces, a single minimum wage applies to workers aged 16 and over. An exception is Ontario, which allows a slightly lower minimum wage rate to be paid to students under 18 years of age.

*Denmark*

The average hourly minimum wage divided by an average hourly wage. Source: Dolado, et al. (1996). Method of setting: There is no legally-mandated national minimum wage. Instead, minimum hourly wage rates are set via centralized industry-level collective bargaining agreements, which may be supplemented by agreements at the plant level. Other provisions: Minimum wages may vary considerably at the industry level. In addition, workers under 18 years of age are generally subject to a lower minimum wage.

*Finland*

Average monthly minimum wage divided by an average monthly wage. Source: Dolado, et al. (1996). Method of setting: There is no legislated national minimum wage. Instead, minimum wage rates are set via centralized industry-level collective bargaining agreements. The law requires all employers (including non-union employers) to pay the minimum rates contained in these collective bargaining agreements. Other provisions: Minimum wages may vary considerably at the industry level.

*France*

Gross annual equivalent of the annual minimum wage divided by median gross annual earnings of full-time workers in the private and semi-private sector. Source: OECD Minimum Wage Database. Method of setting: The minimum wage (Salaire Minimum Interprofessional de Croissance, or SMIC) is set by the government. Administrative procedures are used to adjust the SMIC each July to reflect both consumer price increases and real wage increases in the hourly wages of manual workers. In addition, the government has sometimes enacted additional increases in the minimum wage. Other provisions: Limited youth subminimum wage rates are applicable to workers under the age of 18. Specifically, workers aged 16 can be paid 80 percent of the adult minimum, while workers aged 17 can be paid 90 percent of the adult minimum for six months.

*Germany*

Average monthly minimum wage divided by an average monthly wage. Source: Dolado, et al. (1996). Method of setting: There is no legislated national minimum wage. Instead, minimum wage rates are set via industry-specific collective bargaining agreements. These agreements can be extended to all employers in the industry if the workforce of the employers directly affected by the agreement comprises at least 50 percent of the total workforce in that industry. In addition, the government may call for a *Hauptausschuβ* commission (consisting of the government, employers, and employees) to set minimum wage levels in industries where unions represent only a minority of employees. Other provisions: Minimum wages may vary considerably at the industry level. Some industry agreements include youth subminimum wage rates.

*Greece*

Minimum daily wage for an unqualified single worker with no work experience (converted to an hourly rate by assuming an 8 hour work day) divided by the mean hourly wage in manufacturing. Source: OECD Minimum Wage Database. Method of setting: The national minimum wage level is negotiated annually by representatives of the General Confederation of Greek Workers and the main employer organizations (facilitated by arbitration if necessary). The negotiated level is routinely ratified by the Ministry of Labor and is applicable to all workers. Other provisions: The minimum wage varies slightly by tenure and by marital status.

*Ireland*

Minimum gross hourly wage divided by median weekly earnings of full-time employees (converted to an hourly rate). Source: OECD Minimum Wage Database. Method of setting: The government enacted a national minimum wage in April 2000. This minimum wage is reviewed annually by the independent Low Pay Commission, which then recommends an increase for consideration by the government. Prior to that legislation, statutory minimum wages were set by Joint Labour Committees in a limited number of low-

wage industries. These Labour Committees consisted of equal numbers of representatives of employers and workers appointed by the Labour Court and a chairman appointed by the Minister for Enterprise, Trade, and Employment. Other provisions: Under current law, workers under the age of 18 can be paid 70 percent of the adult minimum wage.

*Italy*

Average minimum monthly wage divided by an average wage. Source: Dolado, et al. (1996). Method of setting: There is no legislated national minimum wage. Instead, minimum wage rates typically are set via industry-specific national collective bargaining agreements, which then are applicable to all workers in the industry. Other provisions: Minimum wages may vary considerably at the industry level. Some industry agreements include youth subminimum wage rates. Japan Definition of minimum wage variable: Weighted average of prefectural hourly minimum wage levels (weighted by the size of the labor force in each prefect) divided by median gross monthly earnings (converted to hourly basis using average monthly hours worked). Source: OECD Minimum Wage Database.

*Netherlands*

Minimum weekly earnings for persons aged 23 to 64 divided by median gross annual earnings of full-time employees (divided by 52). Source: OECD Minimum Wage Database. Method of setting: The minimum wage (Minimumloon) is set by law and is normally updated in January and July of each year based on the average increase in wages negotiated in the private sector. The government may choose to suspend or alter the increase if the unemployment rate is above a certain level. Other provisions: The laws provide for a subminimum wage for employees less than 23 years of age. This subminimum wage ranges from 85% of the adult minimum for employees aged 22 to 30 percent for those less than 17.

*Norway*

Average minimum hourly wage divided by an average wage. Source: Dolado, et al. (1996).

Method of setting: There is no legislated national minimum wage. Instead, minimum wage rates typically are set via industry-specific national collective bargaining agreements, which can then be extended to cover all workers in the industry. Other provisions: Minimum wages may vary considerably at the industry level.

*Portugal*

Minimum monthly wage for nonagricultural workers aged 20 and over divided by median gross annual earnings of full-time workers (divided by 12). Source: OECD Minimum Wage Database. Method of setting: The minimum wage (Salário Minimo Nacional) is set annually by the government after consultation with the Permanent Commission for Social Cooperation. Other provisions: Under current law, workers under the age of 18 can be paid 75% of the adult minimum wage. Prior to 1987, workers aged 18 and 19

were also eligible for subminimum wage rates.

*Spain*

Minimum monthly wage for workers aged 18 and over divided by median gross annual earnings of full-time workers (divided by 12). Source: OECD Minimum Wage Database. Method of setting: The minimum wage (Salario Minimo Interprofesional) is set annually by government decree, with the amount of any increase determined by the Council of Ministers. Other provisions: Under current law, all workers aged 16 and over are subject to the adult minimum wage. Prior to 1999, workers under the age of 18 could be paid less than the adult minimum wage.

*Sweden*

The average hourly minimum wage divided by an average hourly wage. Source: Dolado, et al. (1996). Method of setting: There is no legislated national minimum wage. Instead, minimum wage rates typically are set via industry-specific national collective bargaining agreements, which then are applicable to all workers in the industry. Other provisions: Private sector agreements typically specify separate minimum wage rates for adult workers (ages 24 and above) and youths.

*United Kingdom*

Beginning in 1999, national hourly minimum wage divided by median hourly earnings of full-time adult employees. Source: OECD Minimum Wage Database. Prior to 1993, the average minimum wage in Wages Council sectors divided by an average wage. Source: Dolado, et al. (1996). There was no minimum wage from August 1993 through March 1999. Method of setting: Under current law, minimum wage levels are reviewed regularly based on recommendations from the independent Low Pay Commission. Prior to 1993, minimum wages were set in 25 certain industries by Wage Councils, which were originally set up to protect low-wage workers who were not covered by collective bargaining agreements. Other provisions: Under current law, workers aged 18 to 21 may be paid about 85 percent of the current adult minimum wage; workers under age 18 are exempt from the minimum wage. Prior to 1993, minimum wage rates differed substantially by industry, age, and region. Beginning in 1986, all workers under age 21 were exempt from minimum wage laws.

*United States*

Federal minimum hourly wage divided by median usual weekly earnings of full-time employees (converted to an hourly rate by assuming a 40 hour full-time workweek). Source: OECD Minimum Wage Database. Method of setting: The national minimum wage level is set by the government and can only be updated by legislative action. Other provisions: States have the ability to set a minimum wage above the federal level. Subminimum wage rates may be paid to selected full-time students and newly-hired youths (for 90 days).