Bureau d'économie théorique et appliquée (BETA)
UMR 7522

Documents de travail

« When union's activity matters: The impact of union centralization on economic growth in OECD countries »

Auteurs

Phu Nguyen-Van, Isabelle Terraz

Document de Travail n° 2017 – 38

Décembre 2017

Bureau d'Économie Théorique et Appliquée
BETA - UMR 7522 du CNRS

BETA Université de Strasbourg
Faculté des sciences économiques et de gestion
61 avenue de la Forêt Noire
67085 Strasbourg Cedex
Tél. : +33 (0)3 68 85 20 69
Fax : +33 (0)3 68 85 20 70
Secrétariat : Géraldine Del Fabbro
g.delfabbro@unistra.fr

BETA Université de Lorraine
Faculté de droit, sciences économiques
et de gestion
13 place Carnot C.O. 70026
54035 Nancy Cedex
Tél. : +33(0)3 72 74 20 70
Fax : +33 (0)3 72 74 20 71
Secrétariat : Sylviane Untereiner
sylviane.untereiner@univ-lorraine.fr

http://www.beta-umr7522.fr

When union's activity matters: The impact of union centralization on economic growth in OECD countries

Phu Nguyen-Van[♣] and Isabelle Terraz[*]

[♣]*BETA, CNRS & Université de Strasbourg*
[*] *BETA, CNRS & Université de Strasbourg*

Abstract

It is nowadays accepted that labor market institutions matter in the economic development. However, empirical studies on unions' effect are not univocal. Besides traditional indicators of unions' presence, this paper uses a new indicator to estimate a growth equation using a recent panel dataset on OECD countries. We provide new insight on the impact of unions on the long-run performance of OECD economies. It is shown that a bargaining coverage lower than average and a high degree of union centralization can be harmful to growth. Our study makes the case for new indicators that capture more accurately the bargaining systems.

Key words: Bargaining indicators, coverage, Economic growth, Union centralization, Wage bargaining.

JEL classification : J51 ; O40 ; O43.

[*] Corresponding author : BETA, CNRS & Université de Strasbourg, 61 avenue de la Forêt Noire, 67000 ; Phone : +33(0)368852083 ; Email : terraz@unistra.fr.

1. Introduction

The idea that institutions matter in the economic progress is well known for a number of years (North, 1990, Acemoglu et al., 2005). According to North (1990), institutions can be defined as "*the rules of the games in a society or, more formally, are the humanly devised constraints that shape human interaction*". They can correspond to either economic or political institutions and modify the incentives to invest in physical capital, human capital or innovation.

We here focus on labor market institutions and especially on collective bargaining institutions. These are closely linked to the emergence of unions at the time of the industrial revolution. Since then, unions, defined as voluntary organizations of workers, are part of the institutional life of industrial countries and intervene in the bargaining process so as to defend workers' employment conditions. If their role has been largely discussed in the context of high persistence of European unemployment in the 90s, their impact on the long-run perspectives of countries remains insufficiently investigated.

Wage bargaining is a common feature of the OECD countries and unions intervene in this process to enhance the purchasing power of workers. But union activity may have a broader impact. Unions may, on the one hand, increase labor productivity by promoting labor-saving technological progress and encourage capital intensive industries. Besides, unions may also stimulate training, increase motivation and commitment. But, on the other hand, unions may reduce the incentive to innovate, promote restrictive work practices or featherbedding (Vernon and Rodgers, 2013). More specifically, union action may reduce profitability, investment and act as a rent-seeker. Theoretically, Grossman and Hart (1986) and Grout (1984) underlined that unions decrease firms' incentive to invest if the union can appropriate the quasi-rent of capital. This situation arises when investment incurs sunk costs and the union captures a part of the investment rent. This rent-seeking behavior is bound to affect the growth process. Empirically, several studies confirmed that unions might deter investment (Bronars and Deere, 1993, Connoly et al., 1986, Fallick and Hasset, 1999, Odgers and Betts, 1997) or research and development (Connolly et al., 1986, Hirsch and Link, 1987, Menezes-Filho and Van Reenen, 2003, Doucouliagos and Laroche, 2013).

More precisely, theoretical articles decomposed the union-economic growth nexus and showed how unions might influence the growth rate. Results then differ depending on the way the growth process is modelled (Peretto, 1998, Palokangas, 1996, 2004, Lingens, 2003, Mortensen, 2005, Chang, 2007). The empirical impact of unions' presence on productivity and growth is

also ambiguous. On a meta-analysis, Doucouliagos and Laroche (2003) found a negative association between unions and productivity, whereas more recent studies underlined a positive relation between these two variables (Asteriou and Monastiriotis, 2004; Storm and Naastepad, 2009, Vernon and Rodgers, 2013). The effect of unions on the growth process is also indeterminate. While Nickell and Layard (1999) did not obtain a significant influence of bargaining on economic growth, Carmeci and Mauro (2003) and Terraz (2009) found a negative relation between union activity and wealth growth.

Besides unions are complex organizations. Their impact on economic performance depends on a range of elements. Traditionally, empirical articles in the 90s (OECD, 1997, Nickell and Andrews, 1999) used three indicators to assess union activity. Union density (percentage of workers unionized), union coverage (percentage of workers covered by bargained agreements) and formal level of bargaining (firm level, industry level or national level). Since then, several papers (OECD, 2004, Traxler et al., 2001, Aidt and Tzannatos, 2008) showed that union influence also depends on the bargaining coordination of unions whatever its form (formal or informal). Indeed, as trade union systems appear to be fragmented in some countries, the issue of coordination of bargaining unit is of crucial importance. More recently, the complexity of bargaining structures and the need to go beyond usual indicators has been underlined (Addison, 2016, Visser, 2016, OECD, 2017). To sketch a more precise picture of bargaining systems, we then consider an additional indicator of union's activity which is a union centralization index. It captures the capacity of bargaining units to express one voice in the social dialogue (Visser, 2015).

Our aim in this paper is therefore to deepen the analysis between union activity and economic growth. For this purpose, we estimate a growth equation by considering, besides the usual determinants of the growth process, different collective bargaining indicators and possible interactions between them. We take into account the issue of endogenous regressors by using the system-GMM method of Blundell and Bond (1998) in order to obtain consistent estimations. We here find that below than average bargaining coverage and union centralization are both factors that can harm the growth process. Our new indicator, i.e. union centralization, appears to be crucial to assess the long-term economic performance of OECD countries.

The remainder of the paper is organized as follows. Section 2 provides an overview of the literature on the nexus between collective bargaining, productivity and economic growth. Section 3 describes the dataset and the variables of interest. Section 4 describes the

methodology and Section 5 presents the estimating results and a discussion. Finally, Section 6 concludes.

2. Background on the nexus between collective bargaining and economic growth

What is the dynamic impact of unions on economic activity? The literature on this subject is rather scarce. Some existing works relate to labor productivity but very few is known on the impact of unions on GDP growth. Before turning to a review of the literature, we begin with a description of usual indicators of union activity.

2.1 Union power and bargaining structure

Assessing the impact of collective bargaining and trade union activity is not an easy task. Unions take part in collective bargaining but the way they influence the economy depends on a set of complex elements. Unions' power is related to the number of firms covered by bargained agreements and to the number of unions' members. Unions' influence also differs according to the bargaining's structure. The industrial relation literature usually considers different indicators of union activity. Each of them conveys some information while exhibiting some limits. We shall describe them hereafter. The first two indicators correspond to unions' power and the next two are related to the bargaining structure while the last one is the union centralization index on which this paper focuses.

i) *Union density*. What drives union power in the bargaining process? According to the European commission this is related to the right to strike, to be financially independent and to have a sufficient number of union members. The latter is often considered as an indicator of the strength of unions. Moreover, the trade union density, as the percentage of unionized workers in the labor force, can help to determine the "balance of power" according to union leaders. Nevertheless, it does not convey the same information in all countries as it depends on the institutional context. It also seems to be highly dependent on the history of countries.

ii) *Collective bargaining coverage*. The percentage of employees which are covered by collective agreements (collective bargaining coverage) also matters. It is key to understanding how workers are actually influenced by collective agreements. Bargaining coverage gives an idea of the potential influence of bargained outcomes.

Following Visser (2013), the bargaining coverage however gives a measure of union presence instead of union pressure.

How are these two indicators related? If only union members benefited from the collective agreements, the coverage should be closed to union density. But non-union members can also benefit from agreements when there is no discrimination between union and non-union members and/or when government can extend bargained outcomes to firms and sectors which were not part of the negotiation beforehand. These mechanisms widely vary and the incentive to unionize differs between countries. It is low in countries where discrimination is prohibited and extension mechanism applies. On the opposite, it is high in Ghent countries where unions partly administrate unemployment benefits (Fazekas et al., 2011, Ebbinghaus et al., 2011). Hence, union density and bargaining coverage might differ and could be considered as two complementary indicators. The first one is a measure of potential union power whereas the second one corresponds to a measure of the potential scope of bargained outcomes.

iii) *Level.* Formally, depending on countries, bargaining mainly occurs at the national, sector or firm level. Calmfors and Driffill (1988) underlined that countries with firm- or national-level bargaining experienced lower unemployment rates than countries with sectoral bargaining. They argued that firm level bargaining is subject to competitive pressure and that unions tend to internalize the consequences of their wage demands in a case of national level bargaining. In both cases, these two bargaining structures tend to lower wage demands. In a case of sectoral bargaining, instead, no such limiting mechanism applies. Hence, the relation between bargaining structure and unemployment can be non-monotonic.

iv) *Coordination.* The Calmfors-Driffill or "Hump-shape" hypothesis was very influential in the 90s and early 2000s (OECD, 2017). Since then, the result has been discussed. Based on a meta-analysis, Calmfors et al. (2001) showed that results depend on the indicators of bargaining centralization and on the countries included in the analysis. Aidt and Tzannatos (2008) also underlined that the period of analysis matters. More recent analysis put the role of coordination on the forefront (Soskice 1990, OECD, 2004; Aidt and Tzannatos, 2008; OECD, 2012). Indeed, the number of trade union involved in social dialogue varies between countries and multi-level bargaining may occur. Hence, a crucial issue for wage-bargainers is how they coordinate their action. One particular case of coordination is centralized

bargaining. Another way to achieve coordination is for unions to follow the lines of a particular bargaining (pattern-bargaining). Coordination also appears when unions accept common rules and/or share common targets as could be the case when there is a Social Pact. Coordinated systems of bargaining are then said to achieve good results by allowing economies to adjust to macro-shocks. According to the European Commission (2006, p. 155) "*There is consensus on one decisive principle: low coordination has usually led to poorer results than high coordination or no coordination at all*".

v) *Union centralization.* Finally, countries differ in terms of number of confederations and number of trade unions belonging to each confederation. In the case of multi-unionism, confederations may have difficulties in enforcing their agreements (Addison, 2016, Visser, 2016, OECD, 2017). We consider a union centralization index which is a combination of two indicators, union authority and union concentration. The idea is that the enforcement of agreements is easier when union concentration is high. In the case of fragmented unions, confederations may need authority to coordinate their actions. Thus, dimensions of union concentration and authority may be two alternative ways to coordinate unions' actions.

Unions are complex structures and the way they influence economic performance may vary with their power and their structure. In this paper, we take into account different indicators of union's activity and consider a new indicator of union centralization. Moreover, these indicators may jointly act in a manner which appears favorable or not favorable for economic performance. For instance, Layard et al. (1991, p.138) stressed that "*the impact of bargaining coverage may depend on bargaining centralization*". In the evaluation of the Jobs Strategy (2006), the OECD also underlined complementary effects in the bargaining indicators arguing that inclusive models of bargaining (high coverage/coordination/rates of unionization) were as efficient as exclusive ones. We therefore include interaction terms of union indicators in our regressions in order to analyze these complementary impacts.

2.2 Unions and economic performance: theoretical literature

What is the influence of bargaining on economic performance? Theoretically, results are not univocal. In a product variety model, Peretto (1998) found a negative effect of union power on research and development and hence on the growth process as union power lowers the profit margin of firms. By introducing bargaining procedures in a Romer (1990) growth model,

Palokangas (1996, 2004) found that a higher bargaining power of the union can enhance growth by increasing the qualified-labor share in the R&D sector. This result occurs because unions internalize their influence and try to avoid unemployment of skilled labor. Lingens (2003) showed however an ambiguous effect of union power. On the one hand, the bargaining power of workers diminishes the profits of the intermediate sector. On the other hand, it raises the employment of high-skilled labor in the R&D sector. The overall effect depends on the elasticity of substitution between low and high-skilled labor in the intermediate sector. Mortensen (2005) also found an ambiguous effect of union power on the growth rate. The framework considered is a combination between a matching model and schumpeterian growth. Lingens (2007) extended his analysis to a more general model and showed that the result depends on the structure of the bargaining process (decentralized or centralized bargaining). Chang et al. (2007) also obtained a growth rate varying with unions' characteristics, whether the union is employment- or wage-oriented. Introducing search frictions in a model of endogenous growth, Terraz (2016) showed that the growth rate of the economy may be durably altered in the presence of investment irreversibility and wage bargaining power of workers. Thus, the overall effect of union action is theoretically ambiguous, depending on the model considered and the way the growth process is derived.

The impact of bargaining structure is also of importance. Theoretically, an increase in coordinated wage may push less efficient firms out of the market and improve the general level of productivity (Agell, 1999). The literature also highlighted that company-level bargaining allows firms to respond more quickly to international economic integration and competitive pressure of product markets, which can enhance economic growth. On the opposite, bargaining at the sectoral or cross-industry agreements can remove wage disputes from the firm level, leading to a more peaceful social climate at the workplace. Assessing the impact of bargaining power and structure becomes then a matter of empirical studies.

2.3 Unions and economic performance: empirical literature

Union power and union bargaining structure have mainly been considered in the empirical literature on wages and labor productivity. However, their impact on the growth process are unclear. More precisely, Doucouliagos and Laroche (2003) reported in a meta-analysis that the effect of unions on productivity depends on the context. A majority of US studies concluded to a positive effect of unions on labour productivity whereas the effect is negative or inconclusive in British and Australian studies. Asteriou and Monastiriotis (2004) obtained a positive effect

of union density on labor productivity using a pooled dataset of 18 OECD countries during the period 1960-1992. By using data covering approximately the same period, Vernon and Rodgers (2013) showed that the impact of union on hourly labor productivity depends on the type of unionism (i.e industrial unionism, craft or general unionism, and enterprise unionism). In countries with craft/general unionism (Australia, Denmark, United Kingdom), union density exerts a deleterious impact on productivity whereas the effect is positive in countries with industrial unionism (Belgium, Finland, France, Italy, Netherlands, Norway, Sweden and West Germany). No significant effect was found in countries with an enterprise unionism (Canada and United States).

Regarding the growth rate of GDP per capita, results also diverge. Nickell and Layard (1999) did not obtain a significant influence of union density on economic growth while other studies found a negative relation between the two variables (Carmeci and Mauro, 2003, Terraz, 2009). These two studies were conducted on OECD countries, the first one using GMM estimation techniques and the second one based on a panel data analysis. Finally, using regional data Ajdemian et al. (2010) found that coordination alters the growth rate of GDP of capita.

3. Data

Assessing the union-growth nexus in industrialized countries requires mobilizing an international comparative data. We use the Penn World Data to derive measures of economic growth rate and obtain variables related to investment, government consumption, and trade openness. Due to data availability on human capital notably, our paper concerns a sample of 22 OCDE countries (Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Luxemburg, Netherlands, New-Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom and United States). Indicators of union activity are taken from an international comparative dataset provided by Visser (2015). As they are provided since 1960, our analysis is carried out on the 1960-2010 period. Following the empirical growth literature, we use the five-year averages for all our explanatory variables in order to reduce the business cycle effects so that the time dimension of the analysis is T=10. As the latter is relatively small in a panel data framework, the issue of nonstationarity is not crucial here. Furthermore, following previous panel empirical works and as recommended by Bond et al. (2010), we include time dummies (one for each five-year period) in our regressions to capture the common trend that can exist between variables and to ensure no cross-country correlation in the model residuals.

3.1. Economic variables

We use the Penn World Table to have internationally comparative measures of GDP per capita. These data are adjusted for international differences in price level to account for discrepancies in living standards across countries. They are taken in PPP terms and in 2005 constant prices.

Table 1

To assess properly the impact of unions on the growth rate, we introduce well established determinants of growth (Levine and Renelt, 1992, Bassanini and Scarpetta, 2001, Durlauf et al., 2005). Following these studies, we consider in our growth equation an investment ratio (Dowrick and Nguyen, 1989, De Long and Summers, 1991), government consumption share of GDP (Barro, 1991), and trade openness as the ratio of exports and imports over GDP. These variables are considered in constant 2005 prices. The population growth rate is also taken into consideration. Among other determinants of growth, measures of research and development expenses (as percentage of GDP), human capital (Barro and Lee, 1993, 2001) and inflation variability are included. More precisely, the human capital variable is the average years of schooling of the adult population as computed by De la Fuente and Doménech (2015) and the inflation variability is the standard deviation of the consumer price index (Bassanini and Scarpetta, 2001).

3.2. Indicators on union power and bargaining structure

Our indicators of union activity are obtained from an international comparative dataset on union activity (Visser, 2015). The Database on Institutional Characteristics of Trade Unions, Wage Settings, State Intervention and Social Pacts (ICTWSS) provides information on trade unionism, wage setting, state intervention and social pacts for 51 countries observed between 1960 and 2014. Due to data availability on economic variables, we restrict our sample to 22 OECD countries. We describe the main indicators of union's activity hereafter.

Union density: Union members are usually working but they could also be unemployed and retirees. We here consider the net trade union density as the ratio of union working members (excluding unemployed and retirees) to the number of wage earners. In 2010, trade union density widely differs across countries, going from 7.6% in France to 70.0% in Finland. Moreover, trade union density declined in the last decades (Checchi and Lucifora, 2002; OCDE, 2004; Visser, 2006), a phenomenon linked to institutional factors (Ebbinghaus and Visser,

1999; Scruggs, 2002), structural factors (Schnabel and Wagner, 2007), and cyclical factors (Jaoul-Grammare and Terraz, 2013).

Table 2.

Collective bargaining coverage: The potential scope of bargained outcomes is assessed by the percentage of employees covered by bargained agreements. This depends on the level of bargaining and on the number of firms members of employers' organizations (European Commission, 2004). In 1960 the coverage was lowest in the US (30%), highest in Austria (95%). In 2010, these two countries always occupied extreme positions but the gap widened (13.1% - 99%). Moreover, the median value of coverage is declining. It went from 70% in 1960 to 64% at the end of the period. In our analysis, four dummy variables were introduced to account for range of coverage (1: 0-25%; 2: 26-50%; 3:51-75%; 4: 76% and more).

Level (The predominant level at which bargaining takes place): Wage bargaining structure varies between countries. Yet, depending on countries unions principally bargain at the firm level, the sector/ industry level or at the national level. But they can also combine different levels of bargaining. The level indicator (shown in Table 3) goes from 1 (firm level bargaining) to 5 (mainly cross-industry bargaining) and takes intermediate value to assess for the existence of multi-level bargaining. Some countries depicted a stable model of bargaining: Canada, Japan and the United States for instance mainly bargain at the firm level along the whole period. Other countries experienced big changes. In Ireland bargaining mainly occurred at the company level until the 1970s. Later, social pacts framed wages until the financial crises and wage bargaining is back to the company level since then. In the later decades, the general trend is to bargain closer to the firm level. This might be explained by growing international economic integration and diversification in product market (Visser, 2013).

Table 3.

Coordination: As bargaining involves numerous actors, the way they coordinate their action is another crucial point. Coordination generally refers to the capacity of actors to coordinate between different levels of bargaining (vertical coordination) and/or between different bargaining units at a given level of bargaining (horizontal coordination). Several indicators have been developed in the literature (Crouch 1985, Bruno et Sachs 1985, Soskice 1990, Layard et al. 1991). We here rely on a coordination indicator proposed by Kenworthy (2001), coded from

1 (low coordination) to 5 (high coordination) and described in Table 4. It refers to 'the degree rather than the type of coordination' (Visser, 2015).

Table 4

Union centralization: Finally, an index has been introduced in the literature defined as 'a measure that combines the dimension of unity (number of and cooperation between federations and unions) and authority (capacity to make joint decisions and gain the compliance from lower-level units in the movement or organisation)' (European Commission, 2008, p.21). We here employ the union centralization index defined by Visser (2015) which is a composite index made of two components:

$$cent = \sqrt{\frac{Cfauth*Hcf}{DEME} + \frac{Unauth*Haff}{DEMI}} \quad (1)$$

- A first component is increasing with the authority of the confederations on unions' members (Cfauth) and the concentration of unions' members at the central or confederal level (Hcf).[1] It is decreasing with the cleavages between union confederations (DEME).
- The second component is increasing with the authority of unions on their members (Unauth) and with the concentration of members at the industry level (Haff). It is decreasing with the cleavages within union confederations (DEMI).

Table 5

This index of centralization is then increasing with union authority and union concentration, two alternative ways to coordinate actions. It is decreasing with cleavages between unions.

This index varies between 0 and 1. In 2010, it is low in the UK (0.11) and in the US (0.18), countries in which bargaining principally occurs at the company level. It takes its maximum value in Austria (0.93) where 'wage bargaining takes place at the industry level and decisions made by the trade union confederation and the employers affect all employees' (European Commission, 2008, p.75). It is high in Netherlands (0.57), Ireland (0.51), Sweden (0.51) and Germany (0.48). In the latter country for instance, it comes from a high concentration of the union movement. During the period of study, the average level of centralization has been declining in Denmark and Sweden as they abandoned cross-country bargaining. But all

[1] See Appendix 1

countries considered together, there is only slight decreasing trend in the last decades with an index varying from 0.41 in 1965 to 0.39 in 2010.

4. Empirical strategy

Following Islam (1995), Caselli et al. (1996), Durlauf et al. (2005), the growth equation can be written in a panel data framework as

$$lny_{it} = \rho lny_{i,t-1} + X'_{it}\beta + Z'_i\gamma + \mu_i + \varepsilon_{it} \quad (2)$$

where lny_{it} is to log of income per capita of country i at period t, X_{it} is the vector of usual determinants of growth (including private investment, trade openness, public investment, human capital, R&D expenditure, inflation variability, population growth rate), μ_i represents country-specific fixed effects, and ε_{it} is the usual error terms. It should be noted that all factors related to our variables of interest, labor market indicators and their interaction terms with other regressors, are included in Z_i. The model in (1) corresponds to a dynamic panel data fixed effects model.

In estimation, as underlined in the previous section, we add time dummies in the model to account for some common time effects, helping to alleviate the nonstationary issue (Bond et al., 2001). Including time dummies also helps to ensure no correlation across individuals in the idiosyncratic disturbances, which is often required by such a dynamic panel model (Roodman, 2009).

We notice that some economic variables are potentially endogenous, such as the lag of log income, private investment, trade openness, public investment, human capital, R&D expenditure, inflation. The presence of country-specific effects naturally makes lag of log income an endogenous regressor. Moreover, the endogeneity of economic regressors may stem from the reverse effect of current economic activity (proxied by current log income) on these variables or omitted economic factors that are not observed in the data. Bargaining indicators can be also endogenous. Indeed, some unobserved factors such as institutions, legal aspects, social and cultural factors may be correlated with structure and intensity of bargaining of unions regarding labor market. For example, the bargaining structure varies greatly between European countries, which are either members or non-members of the European Union. Furthermore, like

endogenous economic regressors, bargaining indicators is potentially endogenous because of the reverse effect of economic activity.

The literature has largely recourse to GMM to estimate the dynamic panel data fixed effects model as presented in equation (1). We employ the system-GMM method of Blundell and Bond (1998) to estimate the coefficients of the model. As recommended by the econometric literature (Blundell and Bond, 1998; Bond et al., 2001), we perform the one-step system GMM estimator (which has more reliable properties than the two-step estimator in the case of finite sample) and compute the corresponding bootstrap covariance matrix (with 100 replications) to make robust inference.[2]

5. Estimation results and discussion

Table 6 reports estimation results of four models based on the system GMM for the growth equation where union density is one of our variables of interest. Each model corresponds to one of the other four indicators of union's activity (degree of centralization of unions, coverage, formal level of bargaining, and coordination). The specification passes all specification tests: (i) the null hypothesis of AR(1) residuals is rejected whereas the null hypothesis of AR(2) residuals is not rejected by the Arellano-Bond test, (ii) the Sargan and Hansen overidentification tests do not rejected the current specification, and (iii) tests for exogeneity of instruments do not reject the validity of instruments defined within the GMM framework.[3] Table A in Appendix 2 provides estimation results using coverage mean and coordination mean as two other indicators of collective bargaining.

The economic determinants of long-run economic growth are in line with the literature. As our dependent variable is log of income per capita, the estimated value of the coefficient on the lagged variable (positive and lower than one) is compatible with a conditional convergence process. The private share of investment is positive and significant at the 10% level in two of four specifications. Human capital has a positive effect on growth in accordance with the literature (Bassanini et al., 2009; Bouis et al., 2011). Trade openness is growth enhancing in two specifications whereas inflation volatility has a detrimental effect (Bassanini et al. 2009).

[2] We also computed cluster-robust standard errors and other bootstrap standard errors (with 50 and 200 replications) and obtained similar qualitative results. Data, estimation code based on the Stata command xtabond2 (see Roodman, 2009), and bootstrap procedure written in Stata are available from the authors upon request.
[3] Detailed informations are available from the authors.

Union power and bargaining structure indicators appear to have mixed effects on growth. We introduced density rate and its squared term in our equations so as to take into account the nonlinear effect of this variable. Considered alone, the rate of unionization does not play a significant role in the growth process. Other traditional indicators of bargaining structure such as the formal bargaining level and coordination do not appear to significantly affect the economy.

We also find that the index of union centralization has a negative and significant impact on the growth process. Trade unions hence appear to affect the long-run situation of countries. More centralized unions might be more powerful and achieve to bargain more efficiently. They can obtain the results as they expected (i.e. a wage increase) but at a cost of a decrease in the growth process.

An intermediate level of bargaining coverage (25-50%) also has an adverse effect on GDP per capita growth compared to a lower coverage. On the contrary, a bargaining coverage higher than 50% does not impact the growth process. This may be related to the structure of bargaining since firms are compelled to apply agreements even if they were not involved in bargaining beforehand. An intermediate level of coverage may be harmful to firms' relative competitiveness. In a case of higher coverage, more firms are compelled to apply agreements letting lower possibility for competition between firms. This issue does not appear to harm the growth process.

In the case of intermediate coverage (25-50%) a higher density rate has a positive effect on economic growth. Indeed, the interaction term (Union density*coverage) has a positive sign. In this situation, a higher union density reduces the negative effect of union coverage without fully offsetting it. Put another way, union density has a small positive effect for countries with a relatively low coverage (25-50%).

Table 6.

The impact of bargaining depends on a set of complex and imbricated elements that should be well identified. After a rigorous analysis, we find that two indicators of bargaining can hamper growth: a below-than-average-coverage rate and union centralization.

Bargaining coverage is a usual bargaining indicator considered in a number of researches (OECD, 1997, 2004, 2006; Nickell and Andrews, 1999). It is closely linked to the formal level

of bargaining, the coverage of employers' organizations and to the existence of extension or opt-out clauses (Visser, 2016). We examine these three components:

According to our data, a majority of workers are covered by bargained agreements when multi-employer bargaining occurs at the sectoral, regional or national level. On the opposite, less than half of employees are covered in case of single employer bargaining (firm level) or mixed bargaining between firm and sector. Bargaining coverage is also related to the organization rate of employers. Indeed, in a case of multi-employer bargaining, employers' organizations negotiate and sign agreements for their affiliated firms. The coverage of bargaining is then higher, the higher the organization rate of these employers (European Commission, 2010, 2012, 2014).

But, given the level of bargaining and employers' organizations, large discrepancies may appear between countries. Indeed, the existence of extension procedures and opening clauses also impact this bargaining coverage. On the one hand, extension procedures apply agreements to employers which were not part of the bargaining beforehand and hence extend the bargaining coverage of agreements. For instance, these extensions are nearly automatic in France and the coverage is one of the highest in OECD countries. On the opposite, opening clauses or hardship clauses allow some individual firms to withdraw from sectoral agreements. These clauses were widely used in Germany and ended up with a strong declining coverage. According to Addison et al. (2016), 46.5% of German establishments and 61.5% of those bound by a collective agreement resort to opening clauses in 2013.

It is often argued that sectoral bargaining or extension procedures can "level the playing field across firms and ensure a fair competition" as firms are subject to the same bargained agreement and then the same constraints. It helps reducing transaction costs for individual firms as potential conflicts are removed from the firm-level (Blanchard et al., 2014). Nevertheless, extension procedures may hurt some firms and drive them out of the market (Haucap et al., 2001; Magruder, 2012; Martins, 2014) if bargained agreements are highly influenced by larger firms which can endure a greater wage increase. We here apply the same kind of argument to a below-than-average coverage. This could then push some firms out the market as some firms are subject to bargained agreements while others are not. Consequently, growth can be negatively affected.

A higher union density rate can mitigate this effect. Since Freeman (1984), two faces of unionism have been discussed: the "monopoly face", by which unions increase wages, and the

"voice effect" by which unions express grievances of workers and foster the diffusion of information and hence workers' productivity. As a result, a higher density rate may increase this latter effect and mitigate the adverse effect of coverage.

The impact of bargaining centralization has been discussed for more than half a century. In the 80s, the corporatist literature argued that centralized bargaining allows to obtain a lower unemployment and a greater competitiveness as unions internalize the adverse effect of wage increases (Cameron, 1984). Subsequently, Calmfors and Driffill (1988) developed what was called the "hump-shape thesis", arguing once again for the superiority of some levels of bargaining. More recent studies however question the validity of these theories, at least for the last decades (OECD, 2006) and insist on the coordination issue. Neither the formal level of bargaining nor the coordination indicators employed in our study have a significant effect on the growth process. One could then argue that these indicators are far too rudimentary to grasp the complexity of the bargaining process (OECD, 2017).

The main message of the literature relates to the idea that "strong, central and inclusive trade unions internalize the potential negative systemic effects of their actions" (OECD, 2006). Our union centralization index combines two components related to this idea (authority and concentration). It also takes into account political and religious demarcations between and within confederations. These demarcations tend to decrease the effective centralization of unions. This union centralization index represents the capability of unions to enforce collective agreements. Our result then shows that highly centralized unions deter growth. Indeed, this could be justified if centralization can help unions to obtain higher wages, act as a rent-seeker and/or reduce efforts devoted to research and development. It is often argued that centralized unions could be inclusive and help internalizing the negative effects of their actions. However, our result which is based on a more elaborate indicator of bargaining (union centralization) indicates that the total effect is not positive as usually underlined by the literature. This finding encourages a further research in this direction by using even more detailed indicators of unions' activity.

6. Conclusion

Existing empirical studies showed that the impacts of union's activity and bargaining structure on economic performance are mixed. We revisit the union-economic growth relation by consistently estimating a growth equation using a recent data set on 22 OECD countries over

the period 1960-2010. Besides the traditional indicators that are usually employed in previous studies, we propose to use a new indicator on union centralization.

The results show that a bargaining coverage lower than average and a high degree of union centralization can be harmful to growth. It implies that reforms of labor markets should appropriately guard against the impacts of these factors on economic growth. As a below than average coverage is statistically associated with firm level bargaining, usual recommendations of international institutions in favour of decentralized bargaining should be considered with caution and analysed in interaction with bargaining coverage. We also show that more centralized unions (combining dimensions of authority and concentration of unions) deter growth, an effect which may associated with their rent-seeking behavior and would require more investigations.

More generally, unions are complex organisations and further study should focus on indicators that represent more accurately union's activity and labor institutions. Moreover, it would be promising to include these factors in theoretical model which can help to analyze the impacts of labor policy.

References

Acemoglu, Daron, Simon Johnson, and James Robinson. 2005. "Institutions as a Fundamental Cause of Long-run Growth." In *Handbook of Economic Growth*, volume 1, edited by Philippe Aghion and Stephen Durlauf, pp. 385-472. Amsterdam: North-Holland.

Addison, John. 2016. "Collective Bargaining Systems and Macroeconomic and Microeconomic Flexibility: the Quest for Appropriate Institutional Forms in Advanced Economies." *IZA Journal of Labor Policy* 5 (1): 19.

Agell, Jonas. 1999. "On the Benefits from Rigid Labour Markets: Norms, Market Failures, and Social Insurance." *Economic Journal* 109 (453): F143-F164.

Aidt, Toke, and Zafiris Tzannatos. 2008. "Trade Unions, Collective Bargaining and Macroeconomic Performance: A Review." *Industrial Relations Journal* 39 (4): 258–295.

Ajdemian, Stéphane, François Langot, and Coralia Quintero-Rojas. 2010. "How do Labor Market Institutions affect the Link between Growth and Unemployment: the Case of the European Countries." *European Journal of Comparative Economics* 7 (2): 347-371.

Asteriou, Dimitrios, and Vassilis Monastiriotis. 2004. "What Do the Unions Do at the Large Scale? Macro-economic Evidence from a Panel of OECD Countries." *Journal of Applied Economics* 7 (1): 27-46.

Barro, Robert. 1991. "Economic Growth in a Cross Section of Countries." *Quarterly Journal of Economics* 106 (2): 407-443.

Barro, Robert, and Jong-Wha Lee. 1993. "International Comparisons of Educational Attainment." *Journal of Monetary Economics* 32 (3): 363-394.

Barro, Robert, and Jong-Wha Lee. 2001. "International Data on Educational Attainment: Updates and Implications." O*xford Economic Papers* 53 (3): 541-563.

Bassanini, Andrea, and Romain Duval. 2009. "Unemployment, Institutions and Reform Complementarities: Re-assessing the Aggregate Evidence for OECD Countries." *Oxford Review of Economic Policy* 25 (1): 40-59.

Bassanini, Andrea, and Stephano Scarpetta. 2001. "The Driving Forces of Economic Growth: Panel Data Evidence for the OECD Countries". *OECD Economic Studies*, 33: 9-56.

Blanchard, Olivier, Florence Jaumotte, and Prakash Loungani. 2014. "Labor Market Policies and IMF Advice in Advanced Economies during the Great Recession." *IZA Journal of Labor Policy* 31 (1): 2.

Blundell, Richard, and Stephen Bond. 1998. "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models." *Journal of Econometrics* 87 (1): 115-43.

Bond, Stephen, Anke Hoeffler, and Jonathan Temple. 2001. "GMM Estimation of Empirical Growth Models." Discussion Papers n°3048. London: Center for Economic and Policy Research.

Bouis, Romain, and Romain Duval. 2011. "Raising Potential Growth after the Crisis." Working Paper n° 835. Paris: OECD Economics Department.

Bronars, Stephen, and Donald Deere. 1993. "Unionization, Incomplete Contracting and Capital Investment." *Journal of Business* 66 (1): 117–132.

Bruno, Michael, and Jeffrey Sachs. 1985. *Economics of Worldwide Stagflation*. Cambridge MA, Harvard University Press.

Calmfors, Lars and John Driffill. 1988. “Bargaining Structure, Corporatism and Macroeconomic Performance.” *Economic Policy* 3 (6): 13-61.

Calmfors, Lars, Alison Booth, Michael Burda, Daniele Checchi, Robin Naylor, and Jelle Visser. 2001. “The Future of Collective Bargaining in Europe.” In *The Role of Unions in the Twenty-First Century,* edited by Tito Boeri, Agar Brugiavini and Lars Calmfors, pp. 1-155. Oxford: Oxford University Press.

Cameron, David. 1984. “Social Democracy, Corporatism, Labour Quiescence and the Representation of Economic Interest in Advanced Capitalist Society.” In *Order and Conflict in Contemporary Capitalism*, edited by John H. Goldthorpe, pp. 143-78. Oxford: Clarendon Press.

Carmeci, Gaetano, and Luciano Mauro. 2003. “Imperfect Labor Market and Convergence: Theory and Evidence for Some OECD Countries.” *Journal of Policy Modeling* 25 (8): 837-856.

Caselli, Francesco, Gerardo Esquivel, and Fernando Lefort. 1996. “Reopening the Convergence Debate: a New Look at Cross-country Growth Empirics.” *Journal of Economic Growth* 1 (3): 363-389.

Chang, Juin-jen, Ming-fu Shaw, and Ching-chong Lai. 2007. “A “Managerial” Trade Union and Economic Growth.” *European Economic Review* 51 (2): 365-384.

Checchi, Daniele, and Claudio Lucifora. 2002. “Unions and Labour Market Institutions in Europe.” *Economic Policy* 17 (35): 363–401.

Connoly, Robert, Barry Hirsch, and Mark Hirschey. 1986. “Union Rent-seeking, Intangible Capital and Market Value of the Firm.” *Review of Economics and Statistics* 68 (4): 567–577.

Crouch, Colin. 1985. “Conditions for Trade Union Wage Restraint”. In *The Politics of Inflation and Economic Stagnation: Theoretical Approaches and International Case Studies*, edited by Leon N. Lindberg and Charles S. Maier, pp.105-139. Washington, DC: The Brookings Institution.

De la Fuente, Angel, and Rafael Doménech. 2015. “Education Attainment in the OECD, 1960-2010.” *Economics of Education Review* 48: 56-74.

De Long, J. Bradford, and Lawrence Summers. 1991. “Equipment Investment and Economic Growth.” *Quarterly Journal of Economics* 106 (2): 445-502.

Doucouliagos, Christos, and Patrice Laroche. 2003. “What Do Unions Do to Productivity? A Meta-Analysis.” *Industrial Relations* 42 (4): 650-691.

Doucouliagos, Christos, and Patrice Laroche. 2013. “Unions and Innovation: New Insights from the Cross-Country Evidence.” *Industrial Relations* 52 (2): 467-491.

Dowrick, Steve, and Duc-Tho Nguyen. 1989. “OECD Comparative Economic Growth 1950-85: Catch-up and Convergence.” *American Economic Review*: 1010-1030.

Durlauf, Steven, Paul Johnson, and Jonathan Temple. 2005. “Growth Econometrics.” In *Handbook of Economic Growth*, volume 1, edited by Philippe Aghion and Stephen Durlauf, pp. 555-677, Amsterdam: North-Holland.

Ebbinghaus, Bernhard, and Jelle Visser. 1999. “When Institutions Matter: Union Growth and Decline in Western Europe, 1950–1995.” *European Sociological Review* 15 (2): 135–158.

Ebbinghaus, Bernhard, Claudia Göbel and Sebastian Koos. 2011. “Social Capital, “Ghent” and Workplace Contexts Matter: Comparing Union Membership in Europe.” *European Journal of Industrial Relations* 17 (2): 107–124.

European Commission. 2004. *Industrial Relations in Europe.* Luxembourg: Office for Official Publications of the European Communities.

European Commission. 2006. *Industrial Relations in Europe.* Luxembourg: Office for Official Publications of the European Communities.

European Commission. 2008. *Industrial Relations in Europe*. Luxembourg: Office for Official Publications of the European Communities.

European Commission. 2010. *Industrial Relations in Europe*. Luxembourg: Office for Official Publications of the European Communities.

European Commission. 2012. *Industrial Relations in Europe*. Luxembourg: Office for Official Publications of the European Communities.

European Commission. 2014. *Industrial Relations in Europe*. Luxembourg: Office for Official Publications of the European Communities.

Fallick, Bruce, and Kevin Hasset. 1999. "Investment and Union Certification." *Journal of Labor Economics* 17 (3): 570–582.

Fazekas Zoltán. 2011. "Institutional Effects on the Presence of Trade-unions at the Workplace: Moderation in a Multilevel Setting." *European Journal of Industrial Relations* 17 (2): 153–169.

Freeman, Richard, and James Medoff. 1984. *What Do Unions Do?* New York: Basic Book.

Grossman, Sanford, and Oliver D. Hart. 1986. "The Cost and Benefits of Ownership: a Theory of Vertical and Lateral Integration." *Journal of Political Economy* 94 (4): 691–719.

Grout, Paul. 1984. "Investment and Wages in the Absence of Binding Contracts: A Nash Bargaining Approach." *Econometrica* 52 (2): 449–460.

Haucap, Justus, Uwe Pauly, and Christian Wey. 2001. "Collective Wage Setting when Wages Are Generally Binding: An Antitrust Perspective." *International Review of Law and Economics* 21 (3): 287-307.

Hirsch, Barry, and Albert Link. 1987. "Labor Union Effects on Innovative Activity." *Journal of Labor Research* 8 (4): 323–332.

Islam, Nazrul. 1995. "Growth Empirics: A Panel Data Approach." *Quarterly Journal of Economics* 110 (4): 1127-1170.

Jaoul-Grammare, Magali, and Isabelle Terraz. 2013. "A causality Analysis of Economic Growth and Union Density in European Countries." *Labour* 27 (4): 421-442.

Kenworthy, Lane. 2001. "Wage-setting Measures, a Survey and Assessment." *World Politics* 54 (1): 57-98.

Layard, Richard, Stephen Nickell, and Richard Jackman. 1991. *Unemployment: Macroeconomic Performance and the Labour Market*. Oxford: Oxford University Press.

Levine, Ross, and David Renelt. 1992. "A Sensitivity Analysis of Cross-Country Growth Regressions." *American Economic Review* 82 (4): 942-963.

Lingens, Jörg. 2003. "The Impact of Unionized Labour Market in a Schumpeterian Growth Model." *Labour Economics* 10 (1): 91–104.

Lingens, Jörg. 2007. "Unions, Wage Setting and Economic Growth." *Economic Modelling* 24 (1): 167–188.

Magruder, Jeremy. 2012. "High Unemployment yet Few Small Firms: The Role of Centralised Bargaining in South Africa." *American Economic Journal: Applied Economics* 4 (3): 138-166.

Martins, Pedro. 2014. “30 000 Minimum Wages: The Economic Effects of Collective Bargaining Extensions.” IZA Discussion Paper n°8540. Bonn, Germany: Institute for the Study of Labor.

Menezes-Filho, Naercio, and John Van Reenen. 2003. “Unions and Innovation: A Survey of the Theory and Empirical Evidence”. In *International Handbook of Trade Unions*, edited by John Addison and Claus Schnabel, pp. 293–334. Cheltenham, UK: Edward Elgar.

Mortensen, Dale. 2005. “Growth, Unemployment, and Labor Market Policy.” *Journal of the European Economic Association 3* (2-3): 236-258.

Nickell, Stephen, and Richard Layard. 1999. “Labour Market Institutions and Labour Market Performance.” In *Handbook of Labor Economics*, volume 3, edited by Orley Ashenfelter and David Card, pp. 3029-3084, Amsterdam: North-Holland.

North, Douglass C. 1990. *Institutions, Institutional Change and Economic Performance*. Cambridge: Cambridge University Press.

Odgers, Cameron, and Julian Betts. 1997. “Do Unions Reduce Investment? Evidence from Canada.” *ILR Review* 51 (1): 18–36.

Organisation for Economic Co-operation and Development. 1994. *The OECD Jobs Study*, Evidence and Explanation, Part II: The Adjustment Potential of the Labour Market. Paris: OECD.

Organisation for Economic Co-operation and Development. 1997. “Economic Performance and the Structure of Collective Bargaining.” In *Employment Outlook 1997*, pp.63-92. Paris: OECD.

Organisation for Economic Co-operation and Development. 2004. “Wage Setting Institutions and Outcomes.” In *Employment Outlook 2004*, pp.127-181. Paris: OECD.

Organisation for Economic Co-operation and Development. 2006. “Reassessing the Role of Policies and Institutions for Labour Market Performance: A Quantitative Analysis.” In *Employment Outlook 2006*, pp.207-231. Paris: OECD.

Organisation for Economic Co-operation and Development. 2012. “Labour Losing to Capital: What explains the Declining Labour Share ?” In *Employment Outlook 2012*, pp.109-161. Paris: OECD.

Organisation for Economic Co-operation and Development. 2017. “Collective Bargaining in a Changing World of Work.” In *Employment Outlook 2017*, pp.125-188. Paris: OECD.

Palokangas, Tapio. 1996. “Endogenous Growth and Collective Bargaining.” *Journal of Economic Dynamics and Control* 20 (5): 925–944.

Palokangas, Tapio. 2004. “Union-Firm Bargaining, Productivity Improvement and Endogenous Growth.” *Labour* 18 (2): 191–205.

Peretto, Pietro. 1998. “Market Power, Growth and Unemployment.” Working Paper n° 98. Durham: Duke Economics Papers.

Romer, Paul. 1990. “Endogenous Technological Change.” *Journal of Political Economy* 98 (5), S71–S102.

Roodman, David. 2009. “How to do xtabond2: An Introduction to Difference and System GMM in Stata.” *Stata Journal* 9 (1): 86-136.

Schnabel, Claus, and Joachim Wagner. 2007. “Union Density and Determinants of Union Membership in 18 EU Countries: Evidence from Micro Data, 2002/03.” *Industrial Relations Journal* 38 (1): 5-32.

Scruggs, Lyle. 2002. “The Ghent System and Union Membership in Europe, 1970–1996.” *Political Research Quarterly* 55 (2): 275–297.

Soskice, David. 1990. “Wage Determination: the Changing Role of Institutions in Advanced Industrialized Countries.” *Oxford Review of Economic Policy* 6 (4): 36-61.

Storm, Servaas, and C.W. Naastepad. 2009. “Labor Market Regulation and Productivity Growth: Evidence for Twenty OECD Countries (1984–2004).” *Industrial Relations* 48 (4): 629–654.

Terraz, Isabelle. 2009. “Négociations Salariales et Croissance: une Application Empirique aux Pays de l’OCDE après la Seconde Guerre Mondiale.” *Économies et Sociétés* 40 (5): 833–856.

Terraz, Isabelle. 2016. “Economic Growth: The Case of Irreversibility of Investment with Bargaining Power of Workers.” *International Economic Journal 30* (1): 75-86.

Traxler, Franz, Sabine Blaschke, and Bernhard Kittel. 2001. *National Labour Relations in Internationalized Markets, A Comparative Study of Institutions, Change, and Performance*. Oxford: Oxford University Press.

Vernon, Guy and Mark Rogers. 2013. “Where Do Unions Add Value ? Predominant Organizing Principle, Union Strength and Manufacturing Productivity Growth in the OECD.” *British Journal of Industrial Relations*, 51 (1): 1-27.

Visser, Jelle. 2006. “Union Membership Statistics in 24 Countries.” *Monthly Labor Review* 129(1): 38–49.

Visser, Jelle. 2013. *Wage Bargaining Institutions – from Crisis to Crisis*, Economic Papers n°488. Directorate General Economic and Financial Affairs (DG ECFIN). Brussels: European Commission.

Visser, Jelle. 2015. ICTWSS Data base. Version 5.0. Amsterdam: Amsterdam Institute for Advanced Labour Studies AIAS.

Visser, Jelle. 2016. “What Happened to Collective Bargaining during the Great Recession?” *IZA Journal of Labor Policy* 5 (1): 9.

Appendix 1 Definitions of bargaining variables

Cfauth: Confederal authority is a composite index made of five component taking values between 0 and 2

(a) the confederation represents the affiliates politically and is routinely involved in consultation with government through bipartite or tripartite contacts
2=score '2' on routine involvement
1=score '1' on routine involvement
0=score '0' on routine involvement

(b) the confederation has (political) control or influence over the appointment of the leaders of its affiliates
2=confederation appoints or has veto (directly or through government approval)
1=affiliates and confederation share control
0=confederation has no control over appointment process

(c) the confederation negotiates national agreements with employers
2=confederation has mandate to negotiate agreement with employers and/or government on wage issues
1=confederation has mandate to negotiate agreement with employers and/or government on non-wage issues
0=none of the above

(d) the confederation runs a 'joint resistance or strike fund' from which affiliates are reimbursed in case of 'approved' strikes
2=joint strike or resistance fund has significant size
1=joint strike or resistance fund is limited
0=no joint or resistance fund held by confederation

(e) strikes of affiliated unions need prior approval from confederation and/or the confederation can end strikes through central procedures of conflict settlement and arbitration
2=all strikes need prior approval from confederation
1=confederation can end strikes trough central procedures or conflict settlement (arbitration)
0=confederation has no power over strikes organized by its affiliates

Unauth: Union authority is a composite index made of five component taking values between 0 and 2

a) union role in wage bargaining
2=union negotiates enforceable agreements at sector level and has veto power over company agreements
1=union negotiates agreements at sector level allowing enterprise or company branches to vary within limits
0=union does not negotiate sector agreements

b) union control or influence over the appointment of workplace representatives
2=union appoints workplace representatives

1=union can veto candidates for workplace representation
0=union has no control over appointment or election of workplace representatives

c) union finances
2=local and workplace branches are financed by the national union
1=local and workplace branches have autonomous funds from direct members or employers contributions
0=national union is dependent on financial contribution from constitutive branches and local unions

d) union strike fund
2=union has a large strike fund from which striking members are reimbursed at 70% or more on their base wage
1=union has small strike fund from which some reimbursement is guaranteed
0=union has no strike fund

e) union power over enterprise strikes
2=union has veto over enterprise strikes
1=union can end enterprise strikes through central procedures of conflict settlement
0=union cannot veto or end enterprise strikes

Each indicator is made of 5 components varying between 0 and 2 and is divided by its maximum value (10).

Hcf: Membership concentration at central or confederal level (Herfindahl index at central or peak level) and defined as $\sum_{i=1}^{n} p_i^2$ where p is the proportion of total membership by the i^{th} confederation and n is the total number of confederations.

Haff: Membership concentration at the industry level (Herfindahl index at sectoral level) and defined as $\sum_{i=1}^{n} p_i^2$ where p is the proportion of total membership by the i^{th} union and n is the total number of unions. This variable measures the degree of concentration or fragmentation regarding bargaining units at the industry or occupational level.

DEME: External demarcations between union confederations
2=sharp (political, ideological, organizational) cleavages associated with conflict and competition
1.5=moderate (occupational, regional, linguistic, religious) cleavages, limited competition
1=no cleavages – united confederation

DEMI: Internal demarcation within union confederations
2=sharp (organizational, occupational or skill-related) cleavages associated with conflict and competition
1.5=moderate (occupational or skill-related) cleavages, limited competition (multiple unionism in same plant or company)
1=no cleavages (single jurisdictions – industry unions or enterprise unions)

Appendix 2 Additional results

Table A: Estimation results

	Coverage mean		Coordination mean	
Variable	Coef.	t-stat	Coef.	t-stat
Lagged log GDP per cap.	.7786**	12.30	.7545**	11.36
Private investment	.0021	1.50	.0016	1.23
Trade openness	.0005	1.42	.0004	1.34
Government conumption investment	-.0022	-.37	-.0049	-.68
Human capital	.0175*	1.84	.0179**	2.24
R&D expenditure	-.0001	-.01	.0100	.93
Inflation	-.0121**	-2.02	-.0121**	-2.36
Population growth	-1.4211	-.90	-.9839	-.59
Union density	.0032	.76	.0015	.62
Union density squared	-.0000	-.58	-.0001	-1.59
Coverage mean	-.0015	-.57		
Coverage mean squared	.0000	.68		
Union density*Coverage mean	-.0000	-.56		
Coordination mean			-.0399	-1.30
Coordination mean squared			.0023	.37
Union density*Coordination mean			.0007	1.12
Intercept	2.1089**	3.92	2.3815**	3.84
#Obs.	178		183	
#Countries	21		21	
AR(1)	-2.64**	.008	-3.01**	.003
AR(2)	1.34	.179	.96	.336

Notes: Estimations are based on the one-step system GMM. The dependent variable is log of GDP per capita. Regressions also include time dummies to control for common trend. The last two rows corresponding to AR(1) and AR(2) give the statistics and the p-values of Arellano and Bond tests for autocorrelation of order 1 and 2 in the regression residuals. Significant levels: ** 5%, * 10%.

List of Tables

Table 1: Descriptive statistics: Economic variables

Variable	Mean	Std.Dev.	Min.	Max.
GDP per capita	22 808	10 976	3 427	75 590
Private Investment (%)	23.75	4.95	11.61	38.79
Trade openness (%)	50.27	44.25	3.94	308.52
Governement consumption (%)	7.44	2.07	1.72	14.14
Human capital	9.83	2.20	3.58	13.46
R&D expenditure (%)	1.63	0.80	0.18	3.81
Inflation (standard deviation)	1.67	1.39	0.12	9.30
Population growth (%)	0.72	0.56	-0.65	2.78

Table 2: Descriptive statistics: Union and bargaining variables

Variable	Mean	Std.Dev.	Min.	Max.
Union density (%)	40.86	18.48	7.66	84.77
Collective Bargaining coverage (%)	66.84	22.89	13.1	99
Level	2.68	1.19	1	5
Coordination	3.17	1.32	1	5
Centralisation	0.3980	0.1867	0.09	0.98

Table 3: Definition of bargaining level

Level	Definition	Frequency (%)
5	Bargaining predominantly takes place at central or cross-industry level and there are centrally determined binding norms or ceilings to be respected by agreements negotiated at lower levels	6.4
4	Intermediate or alternating between central and industry bargaining	20.0
3	Bargaining predominantly takes place at the sector or industry level	30.2
2	Intermediate or alternating between sector and company level	22.6
1	Bargaining predominantly takes place at the local or company level	20.9

Source: Visser, J. (2015), ICTWSS Data base. Version 5.0

Table 4: Definition of coordination

Level	Definition	Frequency (%)
5	a) Centralized bargaining with peak associations with or without government involvement, and/or government imposition of wage schedule/freeze, with peace obligations b) informal centralization of industry-level bargaining by a powerful and monopolistic union confederation c) extensive, regularized pattern setting and highly synchronized bargaining coupled with coordination of bargaining by influential large firms.	14.3
4	a) Centralized bargaining by peak associations with or without government involvement, and/or government imposition of wage schedule/freeze, without peace obligation b) informal (intra-association and/or inter-associational) centralization of industry and firm level bargaining by peak associations (both sides) c) extensive regularized pattern setting coupled with high degree of union concentration.	37.7
3	a) Informal (intra-associational and/or inter- associational) centralization of industry and firm level bargaining by peak associations (one side, or only some unions) with or without government participation b) industry-level bargaining with irregular and uncertain pattern setting and only moderate concentration c) government arbitration or intervention.	15.2
2	Mixed industry and firm-level bargaining with no or little pattern bargaining and relatively weak elements of government coordination through the setting of basic pay rates (statutory minimum wage) or wage indexation.	16.5
1	Fragmented wage bargaining, confined largely to individual firms or plants.	16.5

Source: Visser, J. (2015), ICTWSS Data base. Version 5.0

Table 5: Index of union centralization by country

	1965	1975	1985	1995	2005	2010
Australia	0.42	0.45	0.60	0.59	0.44	0.36
Austria	0.93	0.98	0.98	0.98	0.88	0.93
Belgium	0.48	0.47	0.46	0.45	0.45	0.46
Canada	0.28	0.29	0.25	0.26	0.30	0.30
Denmark	0.60	0.58	0.53	0.51	0.48	0.45
Finland	0.31	0.43	0.40	0.39	0.39	0.40
France	0.22	0.20	0.21	0.20	0.21	0.21
Germany	0.41	0.48	0.41	0.41	0.49	0.48
Greece	--	--	0.34	0.32	0.34	0.33
Ireland	0.30	0.36	0.35	0.45	0.52	0.51
Italy	0.32	0.28	0.32	0.32	0.35	0.34
Japan	0.18	0.17	0.18	0.29	0.30	0.31
Luxembourg	--	--	--	0.34	0.31	0.31
Netherlands	0.56	0.50	0.53	0.53	0.58	0.57
New-Zealand	--	0.34	0.28	0.17	0.29	0.31
Norway	0.65	0.62	0.57	0.57	0.50	0.51
Portugal	--	--	0.24	0.33	0.34	0.34
Spain	--	--	0.30	0.33	0.35	0.37
Sweden	0.60	0.57	0.54	0.52	0.52	0.51
Switzerland	0.35	0.35	0.34	0.29	0.28	0.35
Great Britain	0.31	0.40	0.09	0.09	0.10	0.11
United States	0.12	0.11	0.12	0.13	0.18	0.18

Table 6: Estimation results

	Centralization		Coverage		Level		Coordination	
Variable	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Lagged log GDP per capita	.7833**	11.97	.7770**	2.24	.7459**	7.13	.7511**	5.27
Private investment	.0024*	1.86	.0030*	1.95	.0023	1.48	.0021	1.49
Trade openness	.0007*	1.67	.0003	1.11	.0007*	1.94	.0005	1.21
Government consumption	-.0045	-.64	-.0003	-.05	-.0029	-.34	-.0051	-.64
Human capital	.0195**	2.68	.0155	1.57	.0204**	2.22	.0212**	2.08
R&D expenditure	-.0013	-.13	.0040	.43	-.0003	-.03	.0042	.35
Inflation	-.0130**	-2.33	-.0146*	-1.71	-.0120**	-2.12	-.0111*	-1.93
Population growth	-1.6633	-1.08	-2.007	-1.14	-.7243	-.39	-1.2567	-.82
Union density	.0024	1.10	-.0054	-1.05	-.0005	-.13	.0013	.38
Union density squared	-.0000	-.91	-.0000	-.53	-.0000	-.95	-.0000	-.92
Centralization	-.4235*	-1.71						
Centralization squared	.3889	1.08						
Union density*Centralization	-.0003	-.078						
Coverage [26% ,50%]			-.2483**	-2.16				
Coverage [51% ,75%]			-.1528	-1.12				
Coverage [76% ,100%]			-.1194	-.93				
Union density*Coverage [26% ,50%]			.0111**	2.97				
Union density*Coverage [51% ,75%]			.0070	1.47				
Union density*Coverage [76% ,100%]			.0061	1.30				
Level 2					-.0543	-.36		
Level 3					-.0801	-.73		
Level 4					-.1146	-1.05		
Level 5					-.1082	-.98		
Union density*Level 2					.0032	.67		
Union density*Level 3					.0027	.76		
Union density*Level 4					.0030	.86		
Union density*Level 5					.0030	.85		
Coordination 2							.0031	.04
Coordination 3							-.0843	-1.02
Coordination 4							-.0859	-1.28
Coordination 5							-.0825	-.92
Union density*Coordination 2							-.0002	-.11
Union density*Coordination 3							.0020	.88
Union density*Coordination 4							.0024	1.17
Union density*Coordination 5							.0020	.81
Intercept	2.1151**	3.49	2.2185**	2.01	2.4312**	3.12	2.3619***	3.02
#Obs.	183		178		183		183	
#Countries	21		21		21		21	
AR(1)	-2.83**	.005	-2.78**	.006	-2.78**	.005	-2.87**	.004
AR(2)	.67	.503	.97	.332	.77	.443	.96	.336

Notes: Estimations are based on the one-step system GMM. The dependent variable is log of GDP per capita. Regressions also include time dummies to control for common trend. The last two rows corresponding to AR(1) and AR(2) give the statistics and the p-values of Arellano and Bond tests for autocorrelation of order 1 and 2 in the regression residuals. Significant levels: ** 5%, * 10%.