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## How Collective Bargaining Shapes Poverty: New Evidence for Developed Countries

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DISCUSSION PAPER SERIES

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# How Collective Bargaining Shapes Poverty: New Evidence for Developed Countries

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## ABSTRACT

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# How Collective Bargaining Shapes Poverty: New Evidence for Developed Countries

Although many studies point to the significant influence of collective bargaining institutions on earnings inequalities, evidence on how these institutions shape poverty rates across developed economies remains surprisingly scarce. It would be a mistake, though, to believe that the relationship between earnings inequalities and poverty is straightforward. Indeed, whereas earnings inequalities are measured at the individual level, poverty is calculated at the household level using equivalised (disposable) incomes. Accordingly, in most developed countries poverty is not primarily an issue of the working poor. This paper explicitly addresses the relationship between collective bargaining systems and working-age poverty rates in 24 developed countries over the period 1990-2015. Using an up-to-date and fine-grained taxonomy of bargaining systems and relying on state-of-the-art panel data estimation techniques, we find that countries with more centralised and/or coordinated bargaining systems display significantly lower working-age poverty rates than countries with largely or fully decentralised systems. However, this result only holds in a post-tax benefit scenario. Controlling for country-fixed effects and endogeneity, our estimates indeed suggest that the poverty-reducing effect of collective bargaining institutions stems from the political strength of trade unions in promoting public social spending rather than from any direct effect on earnings inequalities.

**JEL Classification:** C23, C26, I32, I38, J51, J52

**Keywords:** collective bargaining systems, poverty rates, social security expenditures, panel data, advanced economies

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## 1. Introduction

How do collective bargaining systems affect inequality and poverty in developed countries? The answer to this question is still largely uncertain and much debated. Some scholars argue that the upward trend in inequality and poverty observed since the 1980s is mainly due to skill- and task-biased technical change, globalisation and specific economic reforms, leaving a marginal role for trade unions and collective bargaining (Blank *et al.* 2007; DiNardo and Lee 2004; Moller *et al.* 2009). However, other studies come to quite a different conclusion and attribute a more central role to the characteristics of collective relations (Brady 2009; Eichhorst and Marx 2015; Kristal 2010; Piketty *et al.* 2014; OECD 2018). It should be noted, however, that although the impact of collective bargaining on wage inequalities has been widely studied, surprisingly few studies have explicitly focused on the impact of collective bargaining systems on poverty rates.

There is a widespread view that centralised and coordinated collective bargaining systems are associated with less wage dispersion and greater job security. This idea is often justified by the fact that, in countries with such bargaining systems, workers can increase their bargaining power by grouping together within companies and/or sectors, and that social partners can achieve a higher degree of synchronisation thanks to defined strategies and objectives. (Berg 2015; Bosch 2015; Hayter 2011; OECD 2017; Visser 2016). Furthermore, it is argued that these systems reduce earnings disparities by compressing the wage structure of workers covered by collective agreements and by raising the earnings of low-paid workers (Garnero *et al.* 2015; Teulings *et al.* 1998; Wallerstein 1999). Many empirical studies corroborate these premises (Antonczyk *et al.* 2010; Busemeyer and Iversen 2012; Domínguez and Gutiérrez 2020; Garnero 2021; Golden and Londregan 2006; OECD 2018).

Another strand of the literature suggests that even though greater collective bargaining coverage may increase the earnings of the population covered by the agreements, a so-called ‘excess’ coverage (relative to union density)<sup>1</sup> may also increase unemployment, thus leading to greater inequality (Aidt and Tzannatos 2008; Bouis *et al.* 2012; Chang and Hung 2016; Jaumotte and Osorio 2015). The argument is that, in this set-up, trade unions would limit employers’ discretion in hiring and firing decisions and fail to internalise the macroeconomic effects of

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<sup>1</sup> ‘Excess’ bargaining coverage has been defined as the difference between the proportion of workers covered by collective agreements and the proportion of workers who are members of a trade union (Bouis *et al.* 2012).

their decisions. In other words, unions would be strong enough to strengthen employment protection and secure wage increases, but not sufficiently encompassing to ensure that these gains do not come at the expense of overall employment levels.<sup>2</sup> In the same vein, the insider-outsider theory argues that collective bargaining can produce greater inequalities by exclusively addressing the interests of the employed (i.e. by raising minimum wages or granting wage increases for specific job titles and sectors), thus hindering access to the labour market for outsiders (i.e. the unemployed) and decreasing total employment in equilibrium (Bertola 1999; Lindbeck and Snower 2001). Some empirical papers do support these predictions, but other studies provide a more nuanced view by highlighting the role of bargaining coordination for employment performance (Boeri and van Ours 2021; Bouis *et al.* 2012; Devicienti *et al.* 2019; Jaumotte and Osorio 2015; Laroche *et al.* 2019; OECD 2018).

Overall, many empirical studies point to a significant influence of collective bargaining institutions on earnings inequalities in developed countries (Garnero 2021; OECD 2018). However, these studies alone are insufficient to draw clear conclusions about the potential effects of these institutions on poverty rates. Indeed, the relationship between earnings inequalities and poverty is not straightforward (Lohmann and Marx 2018; McKnight *et al.* 2016). This is mainly due to differences in measuring: earnings inequalities are measured at the worker level, whereas poverty rates (*after* transfers and taxes) are calculated at the household level on the basis of equivalised disposable incomes.<sup>3</sup> Since the incomes of other household members, family composition and net social transfers are also taken into account when calculating equivalised disposable incomes, many low-paid workers are actually not recorded as poor (Marx and Nolan 2012; Salverda 2016). The relationship between collective bargaining systems and poverty is therefore not straightforward and requires careful attention.

To our knowledge, the link between collective bargaining systems and poverty has been studied in only six empirical papers so far: four papers adopting a cross-country perspective and two

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<sup>2</sup> The argument is thus similar to that developed earlier by Calmfors and Driffill (1988) for intermediate systems (i.e. sectoral-level bargaining) as opposed to centralised and decentralised systems. It should however be recalled that empirical studies have not provided much support for Calmfors and Driffill's hypothesis and have led to a reconsideration of the OECD stance on sectoral bargaining in the 2006 (OECD 2006) and, even more so, in the 2018 Jobs Strategy. The empirical evidence on the employment consequences of 'excess' bargaining coverage is also not that robust (Jaumotte and Osorio 2015). For a review of the literature on the interaction between collective bargaining systems and employment performance, see for example Garnero (2021).

<sup>3</sup> The equivalised disposable income refers to the total income of a household, after transfers and taxes, that is available for spending or saving, divided by the number of household members converted into equalised adults. Household members are equalised or made equivalent by weighting each according to their age, using the so-called 'modified OECD equivalence scale' (Eurostat 2021).

papers focusing on the United States (Brady 2003; Brady 2009; Brady *et al.* 2013; Lohmann 2009; Plasman and Rycx 2001; VanHeuvelen and Brady 2021). These empirical studies suggest that collective bargaining is a crucial determinant of poverty reduction because of its positive role in encouraging government social spending, particularly on social security, in a post-tax benefit scenario. However, caution is required as almost all studies on the relationship between collective bargaining and poverty focus on rather old, unbalanced data over short periods.<sup>4</sup> Furthermore, to our knowledge, no cross-country study has so far accurately controlled for endogeneity problems and country-fixed effects. Therefore, our study contributes to this literature by providing new empirical evidence on how collective bargaining shapes poverty among the working-age population<sup>5</sup>, using balanced panel data for 24 developed countries over the period 1990-2015 and relying on more robust estimation techniques. We also add to the existing literature by using the new, fine-grained taxonomy of bargaining systems that has been developed by the OECD (2018).<sup>6,7</sup> Taking advantage of this up-to-date taxonomy, we first examine the impact of aggregate collective bargaining systems on poverty and public social expenditure. We then investigate, in a more disaggregated way, how collective bargaining shapes poverty and social expenditure by focusing on its main components, namely bargaining coverage, bargaining centralisation, wage-setting coordination, the favourability principle, the degree of flexibility, and union density. To achieve these objectives, we use a pooled OLS estimator with clustered standard errors at the country level while controlling for the business cycle and relevant macroeconomic covariates. In addition, we use a fixed-effects (FE) estimator to account for country time-invariant unobserved heterogeneity. Finally, we rely on a fixed-effects two-stage least squares estimator (FE-2SLS), along with a bootstrap technique, to deal with both endogeneity issues and country-fixed effects.

The remainder of this paper is organised as follows. The next section provides a brief review of the literature on the relationship between collective bargaining and poverty, which further supports the motivation and contribution of our analysis. Section 3 presents our dataset and

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<sup>4</sup> This is understandable as the data available at the international level were more limited in the early 2000s.

<sup>5</sup> The working-age population includes all individuals aged 18-64, either employed, self-employed, unemployed or not in the labour force.

<sup>6</sup> The countries covered in our study are the following: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, South Korea, Spain, Sweden, Switzerland, the United Kingdom and the United States.

<sup>7</sup> Our analysis focuses only on those economies that show similarities in their labour market structure and business cycles over the study period, in order to facilitate cross-country comparison.

descriptive statistics. Our empirical strategy and the results of our econometric investigation are shown and discussed in Section 4. The last section concludes.

## 2. Motivation and Literature Review

According to Eurofound (2017), in-work poverty is based on three core pillars: i) family, ii) public welfare, and iii) employment.<sup>8</sup> A widespread idea among labour economists is that collective bargaining influences poverty primarily through the employment pillar, by providing wage coordination, training and job protection to workers at the bottom end of the wage distribution. However, the power resource theory argues that collective actors are not only involved in the field of industrial relations where they negotiate better wages and employment conditions but are also mobilised in policies aimed to strengthen the welfare state for the working class and the poor (Brady *et al.* 2016; Crouch 2017; Korpi 2006; Rudra 2002). More precisely, this theory explains that well-organised labour movements (e.g. trade unions) can be driving political forces in the success of welfare states by mobilising workers to vote for political parties that, in turn, promise to implement redistributive policies. This would also apply to liberal regimes, such as the United States, that offer market-based solutions to social problems (Engeman 2021). Moreover, Ingleson (2000) argues that workers turn to trade unions when they can no longer rely on their government for social security in the event of illness, unemployment or retirement. Lobbying for legislation that increases social benefits for workers has thus become a crucial part of the trade unions' tasks (Sen 2012).

In the same vein, the social-democratic corporatist model asserts that organised labour units tend to be actively involved in government decisions in order to promote benevolent policies (Janoski and Hicks 1994). In this respect, Lane and Ersson (2004) state that the pressure to increase social spending on family, disability and unemployment benefits stems from the social partners' strength and interaction with the states. The role of social partners in a country's welfare state can therefore be seen as a key collective bargaining mechanism for poverty alleviation. As an illustration, Table 1 provides a general overview of social partners' involvement in the policy-making process of unemployment benefit schemes (a branch of the social security system) in 24 developed countries. We observe that in some European countries

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<sup>8</sup> The in-work poverty rate refers to the share of people who are at work and have an equivalised disposable income below the 'risk-of-poverty' threshold, which is set at 60 percent of the national median equivalised disposable income (after net social transfers).



and in South Korea, social partners are consulted or involved in bi- or tripartite bodies or committees to discuss the design and development of unemployment benefit schemes<sup>9</sup> (Eurofound 2013; European Commission 2016; Hwang 2013). In addition, trade unions are involved in the management and control of unemployment insurance (i.e. the so-called Ghent system) in Belgium, Denmark, Iceland, Finland and Sweden<sup>10</sup>. Where appropriate, trade unions are also responsible for collecting contributions to finance unemployment funds.

[Insert Table 1 here]

It should be noted, however, that the role of trade unions in social security systems has been under pressure in northern European countries since the early 2000s. Several governments have introduced institutional changes, such as cross-occupational or independent unemployment funds and higher fees to union-controlled unemployment funds. These actions have diminished the number of workers who affiliate with trade unions in pursuit of better social security benefits, which has consequently waned the influence of trade unions on government social affairs (Høgedahl and Kongshøj 2017; Kjellberg and Ibsen 2016). Nevertheless, the active participation of social partners in social security institutions remains, albeit to a lesser extent, an essential component of the European social market economy (Bryson *et al.* 2011; Schnabel 2013).

Despite the growing literature on the social consequences of industrial relation systems, the impact of collective bargaining on poverty rates has been largely overlooked by researchers. This is probably due to the widespread but misleading assumption of a straightforward relationship between earnings inequalities, especially at the bottom end of the distribution, and poverty rates (Lohmann and Marx 2018; McKnight *et al.* 2016). Indeed, evidence shows that in most developed countries, poverty is not primarily an issue of low-paid workers. This is because, unlike wage inequality, which is measured at the individual level, poverty is calculated on the basis of equivalised household incomes *before* or *after* taxes and transfers (e.g. unemployment and disability benefits, pensions and family allowances).

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<sup>9</sup> In some European countries, this involvement of social partners also applies to active labour market policies (e.g. education and training).

<sup>10</sup> The Ghent system refers to arrangements in which trade unions, on behalf of the government, oversee the payment of unemployment benefits, rather than government agencies. This system is named after the Belgian city of Ghent, where it was first implemented.

[Insert Figure 1 here]

To further highlight the difference between inequality and poverty indicators, Figure 1 shows the relationship between the incidence of low-wage employment and working-age poverty *before* taxes and transfers in 2015 in the 24 developed economies covered by our study.<sup>11</sup> As can be seen in Figure 1, the correlation is extremely weak ( $r = 0.02$ ), which illustrates that earnings inequality is a very imperfect proxy for the poverty rate *before* taxes and transfers in OECD countries. In contrast, Figure 2 shows a much stronger correlation ( $r = 0.42$ ) between the incidence of low pay and working-age poverty *after* taxes and transfers, reflecting the role of the welfare state in the interaction between these two indicators. Figure 2 also shows that the incidence of low-wage employment is, on average, 3.5 percentage points higher than the working-age poverty rate in a post-tax benefit scenario.<sup>12</sup> As pointed out by Marx and Nolan (2012) and Salverda (2016), this implies that many low-wage workers are in fact members of non-poor households. In other words, a significant proportion of those workers escape poverty when taking into account the incomes of other household members and net social transfers. Therefore, although several empirical papers suggest that collective bargaining shapes earnings inequality and, in particular, the incidence of low-wage employment, these papers are insufficient for a proper understanding of the impact of collective bargaining systems on poverty rates in developed countries.

[Insert Figure 2 here]

To our knowledge, only six studies have provided an empirical analysis of the relationship between collective bargaining and poverty. Using a panel of 19 OECD countries for the years 1980, 1990 and 1994 ( $N = 43$ )<sup>13</sup> and relying on a pooled OLS estimator, Plasman and Rycx (2001) point out that centralised bargaining, wage co-ordination and union density lower total and working-age poverty rates *after* taxes and transfers because of the positive influence these

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<sup>11</sup> Low-wage incidence refers to the share of full-time workers earning less than two-thirds of the gross median earnings of all full-time workers (excluding apprentices). The definitions of working-age poverty rates, *before* and *after* taxes and transfers, are provided in Table 2.

<sup>12</sup> There are three countries in Figure 2 where working-age poverty *after* taxes and transfers is significantly higher than the incidence of low pay: Belgium, Italy and Sweden. There are two possible, non-exclusive explanations for this observation. The first is that a large proportion of workers at the bottom end of the wage distribution are single parents with dependent children or share a household with a part-time worker or an unemployed person, which increases the probability of being poor (Buffel and Nicaise 2017). The second is that the unemployed and inactive represent the majority of the poor working-age population in these countries.

<sup>13</sup> N indicates sample size, i.e. the total number of observations on which the study in question is based.

variables have on government social security spending.<sup>14</sup> Similarly, Brady (2003) and Brady (2009) find that bargaining centralisation, wage-setting coordination and gross union density combine with the welfare state to alleviate state-mediated poverty and overall headcount poverty using panels of industrialized countries (N = 74 between 1967 and 1997 in Brady (2003) and N = 104 between 1969 and 2002 in Brady (2009)) as well as random-effects (RE) estimators.<sup>15</sup> Moreover, Lohmann (2009) uses micro- and macro-data for 20 European countries in 2003 and 2004 and a RE logit estimator to show that bargaining centralisation influences in-work poverty and the set-up of the welfare state. Finally, two studies, conducted by Brady *et al.* (2013) and VanHeuvelen and Brady (2021), focus exclusively on the United States. Thanks to unbalanced micro-level panel data for the period 1991-2010 and a fixed-effects (FE) logit estimator, Brady *et al.* (2013) find that unions reduce in-work poverty for both unionised and non-union households by increasing labour income and state transfers in the bottom half of the income distribution. In a complementary study, VanHeuvelen and Brady (2021) use individual-level panel data over the period 1976-2015, in combination with a three-way (person, year and state) FE estimator, to show that: i) union membership and state union density are significantly and negatively related to relative and anchored<sup>16</sup> in-work and working-age poverty<sup>17</sup>; ii) the interaction between union membership and union state density has an additional poverty-reducing effect; and iii) higher state union density has a spillover effect that reduces poverty among non-unionised households without being detrimental to their jobs.

To sum up, we can conclude that studies on the link between collective bargaining systems and poverty are scarce, even more so if we consider only those with a cross-country perspective, and that almost all of those studies focus on rather old, unbalanced data over short periods. Moreover, to our knowledge, no cross-country study has so far accurately controlled for country-level, time-invariant unobserved heterogeneity (i.e. country-fixed effects) and potential endogeneity issues (which may result, *inter alia*, from reverse causality).<sup>18</sup> Against this

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<sup>14</sup> In this study, the poverty rate is defined as 50 percent of median equivalised income after net social security transfers.

<sup>15</sup> State-mediated poverty is also referred to as poverty *after* taxes and transfers (see definition in Table 2). Overall headcount poverty is the percentage of the population concerned with less than 50 percent of the median income of the whole population.

<sup>16</sup> Relative and anchored poverty are defined as < 50 percent of median equivalised disposable income in the current year and in 1976 respectively.

<sup>17</sup> Working-age poverty is the poverty rate among households headed by people aged 18-64.

<sup>18</sup> Some cross-country studies use a RE estimator because the greatest variation in their dependent variable is between countries. However, this econometric method probably does not adequately control for country-fixed effects. Indeed, it is not so obvious to assume that all the explanatory variables are uncorrelated with the country-

background, our paper draws on balanced data over the period 1990-2015 for 24 developed countries to provide new, more robust econometric evidence (controlling, inter alia, for country-fixed effects and endogeneity) on how collective bargaining systems, assessed by an updated and fine-grained taxonomy, shape working-age poverty rates and public social spending in a cross-country perspective.

### 3. Data and Descriptive Statistics

Our dataset contains macro-level information collected on a yearly basis for 24 developed countries over the period 1990-2015. The aggregated data used in this research come from the OECD, LIS, ILO and ICTWSS databases (Visser 2019).<sup>19</sup> The precise definitions and sources of all dependent and explanatory variables used in this cross-country analysis are provided in Table 2, and the summary of descriptive statistics is reported in Table 3.

[Insert Table 2 here]

#### 3.1. Dependent variables

To explore the impact of collective bargaining on poverty, we selected three indicators as dependent variables. The first indicator is the working-age poverty rate *before* taxes and transfers.<sup>20</sup> Table 3 shows that, on average, 20.2 percent of the working-age population in our panel of developed countries is considered poor when looking only at the equivalised household market income. The second indicator is the working-age poverty rate *after* taxes and transfers.<sup>21</sup> In a post-tax benefit scenario, only 9 percent of the working-age population, on average, is still considered poor. The welfare state, which includes social protection spending, social security transfers and decommodification, is indeed an important and powerful driver of poverty

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fixed effects and that the latter follow a homogenous empirical distribution, two of the main conditions of the RE model to provide efficient and consistent estimates.

<sup>19</sup> To merge observations over time from different sources, we notably relied on the Standardized World Income Inequality (Solt 2019) and Comparative Welfare States (Brady *et al.* 2014) datasets.

<sup>20</sup> Other poverty indicators have also been considered as dependent variables (e.g. in-work poverty, at-risk-of-poverty, headcount poverty and poverty intensity). However, these indicators were unavailable for some developed countries or only available for a limited number of years, which could lead to biased and/or inconsistent estimates. For these reasons, we decided to focus exclusively on working-age poverty rather than on these other indicators.

<sup>21</sup> Working-age poverty also has a comparative advantage over other poverty indicators when estimating the social consequences of collective bargaining in a post-tax benefit scenario. Indeed, working-age poverty takes into account not only full-time workers, but also part-time workers, the unemployed and people of working age out of the labour force, who are more likely to receive social benefits.

reduction (Brady 2009). Based on this observation and in order to better understand through which channel collective bargaining can shape poverty, our third dependent variable is the level of public social expenditure as a percentage of GDP. This variable can be seen as a proxy for the welfare state of a country, as it mainly includes social expenditure for low-income households and vulnerable groups. On average, public social expenditure represents 20.5 percent of GDP in our panel.

[Insert Table 3 here]

### **3.2. Explanatory variables**

To assess the heterogeneity of collective bargaining systems over time and across countries, we relied on a new, fine-grained taxonomy that has been developed by the OECD (2018). By combining the level of bargaining at which collective agreements are negotiated, the degree of flexibility for firms to change the terms of higher-level agreements and the degree of wage coordination between sectoral (or firm-level) agreements, this taxonomy identifies the following five categories of collective bargaining systems: i) fully decentralised (FD), ii) largely decentralised (LD), iii) organised decentralised and coordinated (ODC), iv) predominantly centralised and coordinated (PCC), and v) rather centralised and weakly coordinated (RCW).<sup>22</sup> By way of illustration, in 2015, Canada, Ireland, Korea, New Zealand, the United Kingdom and the United States were classified as FD; Australia, Greece, Japan and Luxembourg as LD; Austria, Denmark, Germany, the Netherlands, Norway and Sweden as ODC; Belgium and Finland as PCC; and France, Iceland, Italy, Portugal, Spain and Switzerland as RCW.

Besides, we also used the detailed classification of collective bargaining components included in the ICTWSS database (Visser 2019).<sup>23</sup> This classification makes it possible to identify the following six components of collective bargaining: i) bargaining centralisation, which is measured as the level of bargaining scored from 1 to 3, with 3 being high centralisation; ii) wage coordination, which defines how wages are set and synchronised between the social partners, scored from 1 to 3, with 3 being high coordination; iii) flexibility, which is a dummy

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<sup>22</sup> See Table 2 for a more detailed description of these categories.

<sup>23</sup> Our classification of the components of collective bargaining in Table 2 partially differs from the original classification included in the ICTWSS database (Visser 2019) as we have merged some related categories of bargaining centralisation, wage coordination and favourability to facilitate their presentation.

variable equal to 1 if firms have some leeway to derogate (opt-out) from the conditions set by higher-level agreements and to offer less favourable conditions to their workers; iv) favourability, which stipulates the hierarchy between agreement levels and is scored from 1 to 3, 3 being a strictly enforced hierarchy; v) bargaining coverage, which is the percentage of workers covered by collective agreements, reaching 60.5 percent on average; and iv) union density, which is the proportion of unionised wage and salary earners in employment, standing at 35.5 percent on average.

Furthermore, to bring out a more accurate effect of collective bargaining on poverty and public social spending, our database also includes a set of control variables that are consistent with those used in previous studies, namely the unemployment rate, the inactivity rate, the labour productivity growth, the output gap, inflation, the short-run interest rate and the terms of trade.<sup>24</sup> The intuition for the inclusion of these covariates in our model is as follows. Being unemployed or inactive increases the risk of ending up living in a poor household (Martinez *et al.* 2001). Lower productivity often leads to lower earnings for workers, which contributes to poverty (Vandenberg 2004). Inflation can expand poverty if the increase of nominal wages is less than that of the price of goods and services consumed by workers (Cardoso 1992). Finally, the output gap, the short-run interest rate and the terms of trade enable us to account for the impact of the business cycle.

#### **4. Empirical Strategy and Results**

To examine how collective bargaining shapes poverty at a more aggregated level, we first focused on the OECD (2018) taxonomy, which classifies developed countries in five main groups based on their bargaining systems for each year from 1990 to 2015 (see Section 3). Next, to gain a more disaggregated perspective, we relied on the detailed classification of collective bargaining components included in the ICTWSS database (Visser 2019), which provides information on six distinct characteristics of collective bargaining (i.e. centralisation, coordination, flexibility, favourability, coverage and density) in each country for each year. Finally, as a sensitivity test, we retained union density as the main explanatory variable, i.e. the only component of collective bargaining (among the six listed above) with sufficient within-

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<sup>24</sup> The definitions and sources of the control variables are presented in Appendix 1.

country variation to allow the use of more robust panel data estimation techniques, and in particular the FE and FE-2SLS estimators, to account for country-fixed effects and endogeneity.

#### 4.1. Aggregated analysis

We first estimated the relationship between collective bargaining and poverty using a pooled OLS estimator with clustered standard errors at the country level. This methodology allows us to focus on cross-country and historical variation while controlling for heteroscedasticity and serial correlation in the error term. We also added a set of control variables (described at the end of Section 3) and time-fixed effects. Our benchmark specification has thus been defined as follows:

$$Y_{c,t} = \beta_0 + \beta_1 CBSystem_{c,t} + \beta_2 X_{c,t} + \delta_t + \varepsilon_{c,t} \quad (1)$$

where  $Y$  represents either working-age poverty *before* taxes and transfers, working-age poverty *after* taxes and transfers, or public social expenditure as a percentage of GDP in country  $c$  at year  $t$ ,  $CBSystem_{c,t}$  is a dummy variable for each collective bargaining system described in the previous section (with a fully decentralised bargaining system as the reference group),  $X_{c,t}$  is a vector of control variables (see description in Section 3),  $\delta_t$  represents 25 time dummies, and  $\varepsilon_{c,t}$  is the error term clustered at the country level.

[Insert Table 4 here]

Table 4 reports the results for the relationship between collective bargaining systems and working-age poverty. In a pre-tax benefit scenario (see column (1)), there appears to be no difference in poverty rates across the five bargaining systems. In contrast, in a post-tax benefit scenario (see column (2)), we find that working-age poverty rates are significantly lower in countries with neither fully nor largely decentralised systems. Put differently, the estimates show that countries with organised decentralised and coordinated (ODC), predominantly centralised and coordinated (PCC) and rather centralised and weakly coordinated (RCW) systems have lower working-age poverty rates *after* taxes and transfers (between -3.2 and -3.8 percentage points) than countries with a fully (FD) or largely decentralised (LD) system. Notice

that there is no statistically significant difference among the estimates of ODC, PCC and RCW systems in column (2).

In previous studies, collective bargaining and trade unions have been associated with lower poverty rates because of their political role in the development of the welfare state (Brady 2003; Brady 2009; Brady *et al.* 2013; Lohmann 2009; Plasman and Rycx 2001; VanHeuvelen and Brady 2021). Using public social spending, represented as a percentage of GDP, as a proxy for the welfare state, our estimates confirm and extend these earlier results. Specifically, our estimates, presented in column (3), show that countries with ODC, PCC and RCW systems spend significantly more on social policies, between 5.7 and 9.9 percentage points, than countries with a FD or LD system. Furthermore, countries with an ODC system are found to have higher social expenditures than those with a PCC or RCW system.

#### 4.2. Disaggregated analysis

Despite the many strengths of the OECD (2018) taxonomy, its aggregated nature does not allow to compellingly determine the contribution of each collective bargaining component in the relationship between bargaining systems and poverty.<sup>25</sup> Therefore, we modified equation (1) by replacing the “collective bargaining system” variable ( $CBSystem_{c,t}$ ) with the following six components of collective bargaining:

$$Y_{c,t} = \alpha_0 + \alpha_1 Barg_{c,t} + \alpha_2 Coord_{c,t} + \alpha_3 Flex_{c,t} + \alpha_4 Fav_{c,t} + \alpha_5 Cov_{c,t} + \alpha_6 TUD_{c,t} + \alpha_7 X_{c,t} + \delta_t + \varepsilon_{c,t} \quad (2)$$

where  $Barg_{c,t}$  is bargaining centralization,  $Coord_{c,t}$  is wage coordination,  $Flex_{c,t}$  is flexibility,  $Fav_{c,t}$  is favourability,  $Cov_{c,t}$  is bargaining coverage, and  $TUD_{c,t}$  is union density.<sup>26</sup>  $X_{c,t}$ ,  $\delta_t$  and  $\varepsilon_{c,t}$  are defined as in equation (1).

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<sup>25</sup> With regard to the different roles that the components of collective bargaining can play, Traxler *et al.* (2001) and Visser (2016) particularly highlight the difference between bargaining centralization and wage coordination. On the one hand, bargaining centralization concerns the structure or vertical organisation of collective bargaining. More specifically, it determines the relationship between levels (company, sector, cross-industry and central bargaining), the opening clauses and the interaction with non-union actors. On the other hand, the degree of wage coordination represents the horizontal structure of collective bargaining, where the outcomes and bargaining behaviour between union actors are established.

<sup>26</sup> For a detailed description of these six bargaining components, see Table 2. The other variables in equation (2) are the same as in equation (1).



[Insert Table 5 here]

Table 5 presents the pooled OLS estimates of equation (2), with clustered standard errors at the country level. These estimates show that none of the six components of collective bargaining is significantly correlated with working-age poverty *before* taxes and transfers. Conversely, in an after-tax benefit scenario, we find lower working-age poverty rates in countries with a higher proportion of workers covered by collective agreements or affiliated with a trade union. Furthermore, the estimates in column (3) indicate that public social spending is higher in countries with higher levels of unionisation and coverage. A plausible explanation for these correlations is that the influence of social partners, and particularly workers' representatives, on the social policy of governments grows as the number of workers affiliated with trade unions or covered by collective agreements increases. Finally, in column (3), we also observe a positive and significant coefficient associated with the “flexibility” dummy variable. Indeed, expenditure on social policies is found to be much higher in countries where firms have some leeway to derogate (opt-out) from the conditions set by higher-level agreements (and to offer less favourable conditions to their workers). This is not surprising, as by definition opt-out clauses do not exist (or at least are much less frequent) in countries with fully or largely decentralised bargaining systems, i.e. in countries where firm-level bargaining is the dominant (if not the only) form of bargaining and where the welfare state is much less developed overall.

In summary, this more disaggregated analysis suggests that the effect of collective bargaining systems on working-age poverty, *after* taxes and transfers, which was highlighted in the previous subsection, is mainly determined by two components: bargaining coverage and union density. However, this first conclusion should be taken with caution because, despite the inclusion of a wide range of covariates, our model may not fully capture unobserved time-invariant heterogeneity at the country level. In addition, the quality of our estimates may also be affected by possible endogeneity problems, which could be due to reverse causality for instance. These limitations to the interpretation of our results are common to all studies that have so far examined the relationship between collective bargaining and poverty from a cross-country perspective. Nevertheless, we will attempt to go a step further in the following subsection by explicitly taking these limitations into account in order to obtain estimates closer to the causal effects we are looking for.

### 4.3. Sensitivity analysis

To test for the presence of time-invariant, unobserved heterogeneity at the country level and to assess whether these country-fixed effects are correlated with the regressors, we performed a Chow test and a Hausman test, respectively.<sup>27</sup> The results indicate that the null hypotheses of no country-fixed effects and no correlation between these fixed effects and the regressors should both be rejected.<sup>28</sup> We therefore decided to opt for a fixed-effects estimator (FE), that is to estimate the following mean-differentiated version of equation (2):

$$\begin{aligned} (Y_{c,t} - \bar{Y}_c) = & \lambda_0 + \lambda_1(CB\ components_{c,t} - \overline{CB\ components}_c) \\ & + \lambda_2(X_{c,t} - \bar{X}_c) + \delta_t + (\varepsilon_{c,t} - \bar{\varepsilon}_c) \end{aligned} \quad (3)$$

where  $\bar{Y}_c$ ,  $\overline{CB\ components}_c$ ,  $\bar{X}_c$ , and  $\bar{\varepsilon}_c$  represent the average values of the dependent variable ( $Y$ ), the six components of collective bargaining ( $CB\ components$ )<sup>29</sup>, the control variables ( $X$ ), and the error term ( $\varepsilon$ ), respectively, in country  $c$  over all the years studied (i.e. from 1990 to 2015).<sup>30</sup>

Before continuing, it is worth reminding that a fixed-effects (FE) estimator cannot properly assess the effect of regressors that have little within-group variation (Wooldridge 2010). As collective bargaining characteristics generally show little variation over time within countries, we conducted an analysis of variance (ANOVA) for the 6 components of collective bargaining under study to determine which components show sufficient intra-country variation for a meaningful use of the FE estimator. This analysis indicates that trade union density is the only component with an acceptable signal-to-noise ratio (i.e. with a within-country variation greater than the residual variation; Swann 2006) and therefore the only component for which the use of the FE estimator is appropriate.<sup>31</sup> On the basis of these results, we therefore decided to

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<sup>27</sup> The null hypothesis of a Chow test for country-level time invariant, unobserved heterogeneity is that the fixed effects (i.e. the intercepts) are identical across countries. The rejection of this null hypothesis implies that panel data estimations methods, controlling for these country-fixed effects, should be preferred to the pooled OLS estimator. The null hypothesis of a Hausman test is that there is no correlation between the country-level fixed effects and the regressors. The rejection of this null hypothesis implies that the fixed effects (FE) estimator should be preferred to the random effects (RE) estimator.

<sup>28</sup> The results of the Chow and Hausman tests are available on request.

<sup>29</sup> As highlighted in Section 2 and Subsection 4.2, the six components are: bargaining centralization, wage coordination, flexibility, favourability, bargaining coverage, and union density.

<sup>30</sup> A detailed description of the variables included in equation (3) is provided in Subsections 4.1 and 4.2.

<sup>31</sup> The detailed results of the ANOVA analyses and corresponding signal-to-noise ratios are available on request.

estimate equation (3) including all 6 components of collective bargaining (to avoid an omitted variable bias) but to exclusively focus on and interpret the regression coefficient associated with trade union density. As we saw, in Subsection 4.2, that union density appears to be a key variable (along with the coverage rate) in explaining the relationship between collective bargaining systems and working-age poverty (*after* taxes and transfers), we were thus able to extend our analysis further by testing the robustness of this significant finding with a FE estimator.

Besides country-fixed effects, endogeneity is another potential problem that we needed to address. It may notably arise from reverse causality, i.e. the fact that the poverty rate and public social expenditure may themselves influence the unionisation rate. To control for endogeneity, we applied a fixed-effects two-stage least squares (FE-2SLS) estimator. In order to find appropriate instruments, i.e. variables that are correlated with union density but not with poverty or public social expenditure, we drew on existing studies. Following common practice (e.g. Piton and Rycx 2019; Reed 2015), our first instrument is simply the lagged value of trade union density. Our second instrument, inspired by Giuliano *et al.* (2013), is the lagged value of average trade union density in neighbouring countries.<sup>32,33</sup> The assumption underlying the choice of our second instrument is that the average lagged level of union density in neighbouring countries is likely to have a significant impact on the contemporaneous value of union density in the country in question but not on its current level of poverty and public social expenditure.

[Insert Table 6 here]

To assess the soundness of our FE-2SLS approach, we performed an array of diagnosis tests. The results of these tests are reported at the bottom of Table 6. The first-stage estimates indicate that both instrumental variables (IV) are statistically significant. More precisely, they show that the lagged value of trade union density in a country (the lagged value of average trade union density in neighbouring countries) has a positive (negative) effect on the contemporaneous value of trade union density in that country. These first-stage estimates thus suggest that our

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<sup>32</sup> Giuliano *et al.* (2013) use the average level of democracy in neighbouring countries as an instrument to tackle the reverse causality between economic reforms and democracy.

<sup>33</sup> We define neighbouring countries as those countries (excluding overseas territories) that share a common land or maritime border. To identify maritime borders, we used the United Nations Convention on the Law of the Sea.

IVs are not weak, which is also corroborated by the Cragg Donald Wald  $F$  statistic for weak identification. This  $F$  statistic is indeed much greater than 10.<sup>34</sup> As regards the Durbin-Wu-Hausman endogeneity test, the  $p$ -values associated with the Chi-squared statistics are equal to 0.80, 0.00 and 0.02 in columns (2) (4) and (6), respectively.<sup>35</sup> These results suggest that the null hypothesis of no endogeneity should be rejected in columns (4) and (6) but not in column (2). In other words, they suggest that our main explanatory variable, i.e. trade union density, is not endogenous when looking at the impact on poverty *before* taxes and transfers. Consequently, FE estimates should be preferred to those obtained by FE-2SLS in this case. In contrast, the results of the Durbin-Wu-Hausman test indicate that union density is endogenous when using either poverty *after* taxes and transfers or public social spending as the dependent variable. In these two cases, our instrumentation strategy is thus warranted, so that FE-2SLS estimates should be preferred those obtained by FE.<sup>36</sup> Concerning the quality of our instruments, we further find that the  $p$ -values associated with the Sargan-Hansen's  $J$  overidentification test are equal to 0.92 and 0.84, respectively, in the regressions using poverty *after* taxes and transfers and social spending as dependent variables (see columns (4) and (6) of Table 6). This suggests that our instruments are valid.

Our results regarding the impact of union density on poverty and social expenditure are presented at the top of Table 6. Our FE estimates first show that an increase of 10 percentage points in union density leads to an increase of working-age poverty *before* taxes and transfers by 0.83 percentage point on average (see column (1)). This finding is probably related to the compression of the earnings distribution by trade unions (OECD 2018), especially at the bottom end of the distribution, which shifts the poverty line upwards and leads to a higher proportion of people with an equivalised income below this poverty threshold. A related argument is that unions, by raising wages above the competitive level, could have a negative impact on employment (Aidt and Tzannatos 2008; Chang and Hung 2016) and thus increase the pre-tax and transfer poverty rate. However, caution is needed as the relationship between union density

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<sup>34</sup> As suggested by van Ours and Stoeldraijer (2011), we rely on the standard “rule of thumb” that weak identification is problematic for  $F$  statistics smaller than 10.

<sup>35</sup> The Durbin-Wu-Hausman test is based on the difference of two Sargan-Hansen statistics: one for the equation in which trade union density is treated as endogenous, and one for the equation in which it is treated as exogenous. If the null hypothesis of this test cannot be rejected, then instrumentation is actually not necessary, which implies that FE estimates should be preferred to those obtained with the FE-2SLS estimator.

<sup>36</sup> FE-2SLS standard errors may not be correctly measured as their corresponding estimates in the second stage are obtained from estimated regressors. Therefore, we generated 1,000 bootstrap samples to increase the inference power of our FE-2SLS estimates without making strong distributional assumptions (Efron 1987; Wilcox 2010). Bootstrapped standard errors are reported between brackets in columns (2), (4) and (6) of Table 6.

and employment is, as Garnero (2021: 1) points out, “more nuanced than previously suggested”. Our results in a post-tax and transfer scenario are radically different. Indeed, the FE-2SLS estimates presented in column (4) show that working-age poverty *after* taxes and transfers decreases on average by 0.47 percentage point when trade union density increases by 10 percentage points. The reversal of our findings *before* and *after* taxes and transfers is best understood by examining the estimation results presented in column (6). These results, obtained with the FE-2SLS estimator, show that public social expenditure increase on average by 0,97 percentage point when trade union density increases by 10 percentage points.

Overall, controlling for country-level fixed effects and endogeneity, our results do not support the hypothesis that unions reduce working-age poverty *before* taxes and transfers through a direct effect on the earnings distribution. However, they do suggest that higher trade union density leads to a lower poverty rate *after* taxes and transfers and that this impact stems from the influence of unions on public social spending.

## 5. Conclusion

Over the past four decades, inequality and poverty have soared throughout the developed world (Atkinson and Piketty 2007; OECD 2015; Piketty 2013). At the same time, collective bargaining has undergone a continuous process of dismantling and weakening, particularly in English-speaking and Southern European countries (Dustmann *et al.* 2014; Gray 2009; OECD 2017; OECD 2018; Payá Castiblanque 2020; Visser 2016). Although the influence of collective bargaining systems on wage inequality has been widely studied, to our knowledge only six studies have examined the impact of these systems on poverty, and only four of these from a cross-country perspective (Brady 2003; Brady 2009; Brady *et al.* 2013; Lohmann 2009; Plasman and Rycx 2001; VanHeuvelen and Brady 2021). Yet, it would be a mistake to believe that the relationship between earnings inequality and poverty is straightforward. Indeed, whereas earnings inequality is measured at the individual level, poverty is calculated at the household level using equivalised (disposable) incomes. Therefore, in most developed countries, poverty is not primarily an issue of the working poor.

Further research is therefore much needed to better understand the relationship between collective bargaining and poverty. This is especially true as all cross-national studies on this issue rely on rather old, often unbalanced datasets over short periods. Moreover, to our

knowledge, no cross-national study has so far accurately controlled for country-level, time-invariant unobserved heterogeneity (i.e. country-fixed effects) and potential endogeneity issues (which may notably result from reverse causality). Our paper therefore makes a significant contribution to this literature by drawing on balanced data over the period 1990-2015 for 24 developed countries to provide new, more robust econometric evidence (controlling, *inter alia*, for country-fixed effects and endogeneity) on how collective bargaining systems, assessed by an updated, fine-grained taxonomy, shape working-age poverty rates and public social expenditure from a cross-country perspective.

Our results show that countries with more centralised and/or coordinated bargaining systems display significantly lower working-age poverty rates than countries with largely or fully decentralised systems. However, this result only holds in a post-tax benefit scenario. Controlling for country-fixed effects and endogeneity, our estimates indeed suggest that the poverty-reducing effect of trade unions derives from their political strength in promoting public social spending rather than from any direct effect on earnings inequalities. These results are in line with the power resource theory, which explains that unions are not only involved in negotiating better wages and working conditions, but that they can also be driving political forces in the success of welfare states by mobilising workers to vote for political parties that, in turn, implement redistributive policies, and by lobbying for legislation that increases social benefits (Brady *et al.* 2016; Crouch 2017; Engeman 2021; Korpi 2006; Rudra 2002; Sen 2012). Our analysis indeed supports the hypothesis that trade unions reduce poverty by sustaining social expenditure and redistributive policies in favour of the working class and the poor. The involvement of trade unions in the management of social security, which tends to be stronger in countries with more centralised and/or coordinated bargaining systems, should probably not be overlooked in this respect either (Bryson *et al.* 2011; Schnabel 2013).

To sum up, our cross-country study provides robust and up-to-date empirical evidence on the social impact of collective bargaining systems, highlighting the role of trade unions in reducing poverty among the working-age population through the welfare state (i.e. by pushing governments to spend more on social security) rather than through a direct effect on wage formation.

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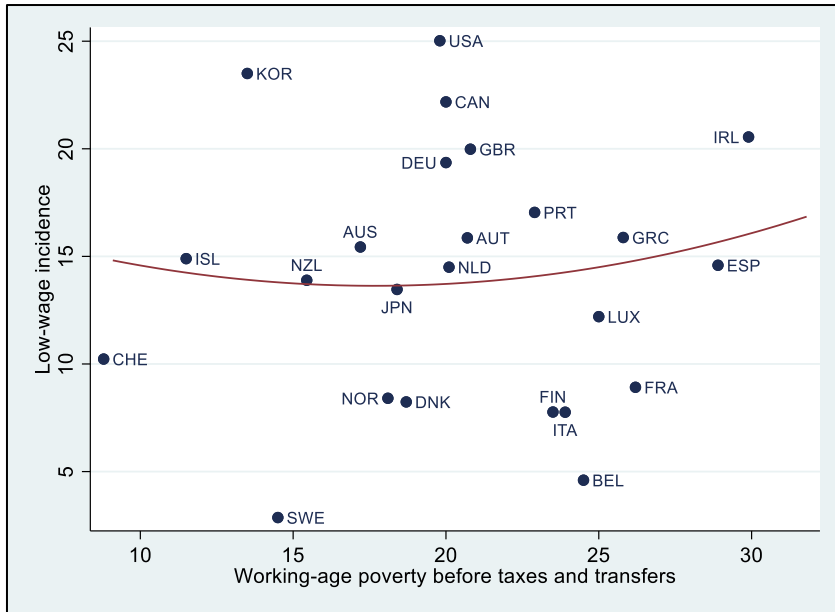
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**Table 1: Social partners' involvement in unemployment benefit schemes**

Policy-making process	Type of involvement	Countries
Involvement in policy designs or reforms	Consultation, elaboration and submission of shared proposals (bipartite social dialogue).	BEL, FRA, FIN <sup>1</sup> ,
	Systematic participation or advisory function in the decision-making process (tripartite social dialogue).	AUT, CHE <sup>2</sup> , DEU, ISL, ESP, NLD
	Information and consultation (tripartite social dialogue).	KOR, LUX, PRT
	Lobbying type role (participation without involvement).	IRL
	No institutional involvement and occasional consultation.	DNK <sup>3</sup> , GBR, GRC, ITA, NOR, SWE
Involvement in administration	Direct involvement in setting general rules and managing the unemployment benefits system (i.e. Ghent system). Where applicable, collecting contributions for the funds.	BEL <sup>4</sup> , CHE, DNK, FIN, ISL, SWE
	Only advisory or coordination functions and no specific role in the management of programmes.	AUT, FRA, DEU, ESP, GRC, ITA, LUX, NLD, PRT,
	No institutional involvement.	KOR, IRL, NOR, GBR
Other	No institutional involvement in any policy-making process (occasionally administrative and/or informational support to apply for and receive unemployment benefits).	AUS, CAN <sup>5</sup> , JAP, NZL, USA

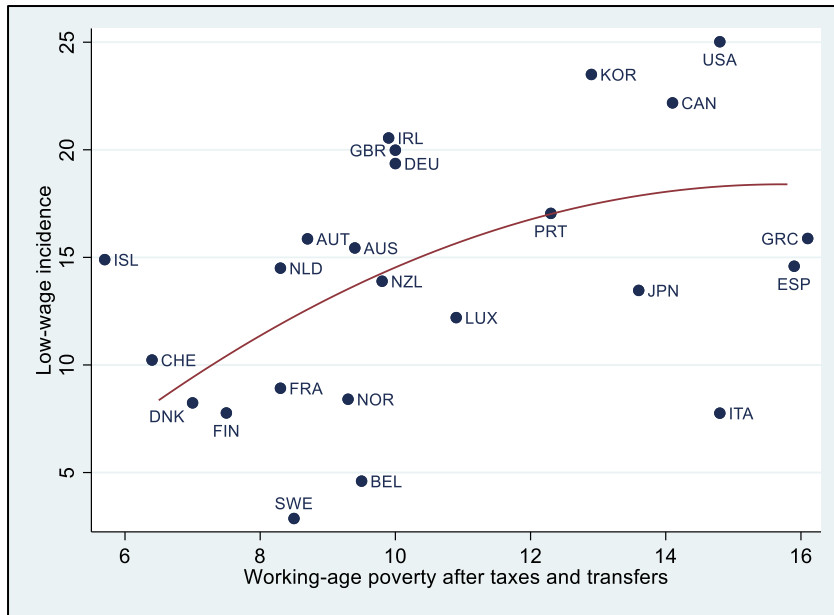
Notes: <sup>1</sup> Systematic involvement in ad hoc tri/bi-partite committees in Finland. <sup>2</sup> Any reform of the Swiss unemployment insurance legislation requires an amendment to the constitution by a vote of a majority of the Swiss electors and the cantons. <sup>3</sup> A reform of the Danish unemployment benefits regime took place in 2010, which has excluded social partners of policy designs or reforms. <sup>4</sup> Belgium has a partial Ghent system where trade unions continue to play a role despite the introduction of compulsory unemployment insurance. <sup>5</sup> Canada abolished the Boards of Referees and Umpire System (tripartite decision-making) in 2013 and replaced it with a Social Security Tribunal, which does not have to transmit information to or consult social partners. Source: Afonso 2013; Aðalsteinsson and Guðlaugsson 2019; Eurofound 2013; European Commission 2016; Hertel-Fernandez 2020; Hwang 2013; Morris and Wilson 2014; New Zealand Productivity Commission 2019; OECD 2017; Schaapman and van het Kaar 2007; Van Rie *et al.* 2011; Wood 2017.

**Figure 1: Low-wage incidence and working-age poverty before taxes and transfers, 2015**



Source: OECD Employment and Labour Market Statistics; OECD Social and Welfare Statistics.

**Figure 2: Low-wage incidence and working-age poverty after taxes and transfers, 2015**



Source: OECD Employment and Labour Market Statistics; OECD Social and Welfare Statistics.

**Table 2: Description of variables**

Variable	Description
<b>Dependent variables</b>	
Working-age poverty rate <i>before</i> taxes and transfers	The ratio of the number of people among the working-age population whose household market income per equivalent household member falls below the poverty line, which is set at 50% of the median equivalised market income of the working-age population. Source: LIS and OECD Databases.
Working-age poverty rate <i>after</i> taxes and transfers	The ratio of the number of people among the working-age population whose household disposable income per equivalent household member falls below the poverty line, which is set at 50% of the median disposable equivalised income of the working-age population. Source: LIS and OECD Databases.
Public social spending as % of GDP	Social expenditure comprises cash benefits, direct in-kind provision of goods and services, and tax breaks with social purposes. Benefits may be targeted at low-income households, the elderly, disabled, sick, unemployed or young persons. Source: OECD Database.
<b>Collective bargaining systems<sup>a</sup></b>	
Fully decentralised (FD)	Bargaining is essentially confined to the firm or establishment level, with no coordination and no (or very limited) influence by the government.
Largely decentralised (LD)	Firm-level bargaining is the dominant form, but sectoral bargaining (or a functional equivalent) or wage coordination also plays a role. Extensions are very rare.
Organised decentralised and coordinated (ODC)	Sectoral agreements play an important role, but they also leave significant room for lower-level agreements to set standards, either by limiting the role of extensions (rare and never automatic or quasi-automatic), leaving the design of the hierarchy of agreements to bargaining parties or allowing opt-outs. Coordination across sectors and bargaining units tends to be strong.
Predominantly centralised and coordinated (PCC)	Sectoral (or cross-sectoral) agreements play a strong role and the room for lower-level agreements to derogate is quite limited. However, wage coordination is strong across sectors.
Rather centralised and weakly coordinated (RCW)	Sectoral agreements play a strong role, extensions are relatively widely used, derogations from higher-level agreements are possible but usually limited or not often used and wage coordination is largely absent.
<b>Collective bargaining components<sup>b</sup></b>	
Bargaining centralisation	<ul style="list-style-type: none"> <li>- Low centralisation: bargaining predominantly takes place at the local or company level (or alternating between company and sector bargaining);</li> <li>- Medium centralisation: bargaining predominantly takes place at the sector or industry level;</li> <li>- High centralisation: bargaining predominantly takes place at central or cross-industry level (or alternating between central and industry bargaining).</li> </ul>
Wage coordination	<ul style="list-style-type: none"> <li>- No coordination: fragmented wage bargaining, mainly confined to individual firms or plants;</li> <li>- Low coordination: wage setting established by major companies, sectors, government wage policies, or procedural negotiation guidelines issued by government, central union and employers' association;</li> <li>- High coordination: Binding norms or recommendations issued by government unilaterally or as a result of centralised bargaining by central union and employers' associations.</li> </ul>
Flexibility	<ul style="list-style-type: none"> <li>- No derogation: it is not possible to derogate from the law;</li> <li>- Derogation: it is possible to derogate from terms established by law (and offer less favourable conditions) by means of collective agreement.</li> </ul>
Favourability	<ul style="list-style-type: none"> <li>- No favourability: single-level bargaining;</li> <li>- Low favourability: hierarchy between levels is undefined and a matter for the negotiating parties (not fixed in law), or favourability is inverted (terms in lower-level agreements take precedence);</li> <li>- High favourability: hierarchy between agreement-levels is strictly applied and defined in law (lower-level agreements can only offer more favourable terms). However, opt-out is possible under defined conditions.</li> </ul>
Bargaining coverage	It is the percentage of employees covered by valid collective (wage) bargaining agreements as a proportion of all wage and salary earners in employment with the right to bargaining, expressed as a percentage, adjusted for the possibility that some sectors or occupations are excluded from the right to bargain.
Trade union density	It is the net union membership as a proportion of wage and salary earners in employment.

Notes: <sup>a</sup>Sources: Garnero (2021) and OECD (2018). <sup>b</sup> Source: ICTWSS Database (Visser 2019).



**Table 3: Selected descriptive statistics, 1990-2015**

	Mean	SD	Min	Max
<u>Dependent variables</u>				
Working-age poverty rate				
<i>Before</i> taxes and public transfers	20.2	5.1	6.6	37
<i>After</i> taxes and public transfers	9	3	3.5	17.9
Public social spending as % of GDP	20.5	5.6	2.6	34.2
<u>Explanatory variables<sup>a</sup></u>				
Bargaining coverage	60.5	30.3	11.8	100
Trade union density	35.5	22.2	8.5	92.5
<u>Control variables</u>				
Unemployment rate	7.2	4.1	1.5	27.5
Inactivity rate	27.2	6.4	11.6	42.1
Labour productivity growth	1.6	1.9	-5.8	14
Output gap	-0.6	3	-15.5	9.7
Inflation	2.5	2.3	-4.5	20.4
Short-run interest rate	4.5	3.8	-0.8	18.3
Terms of trade	7.4	6.0	-13	27.7

Notes: <sup>a</sup> Descriptive statistics relative to the categorical explanatory variables used in our study, not reported here due to space constraints, are available on request.

Source: ILO, ICTWSS, LIS and OECD Databases.

**Table 4: Aggregated analysis: collective bargaining and poverty**

Dependent variable:	Working-age poverty rate, <i>before</i> taxes and transfers	Working-age poverty rate, <i>after</i> taxes and transfers	Public social spending as a % of GDP
	(1)	(2)	(3)
<b>Collective bargaining systems</b>			
Fully decentralised (FD)	Reference	Reference	Reference
Largely decentralised (LD)	-0.240 (1.352)	-0.804 (1.422)	2.642 (1.746)
Organised decentralised and coordinated (ODC)	-0.411 (1.583)	-3.451*** (1.001)	9.879*** (1.679)
Predominantly centralised and coordinated (PCC)	0.983 (1.146)	-3.774*** (1.092)	6.776*** (2.066)
Rather centralised and weakly coordinated (RCW)	-1.688 (2.121)	-3.217*** (0.960)	5.744*** (1.921)
<b>Estimator</b>	<b>Pooled OLS</b>	<b>Pooled OLS</b>	<b>Pooled OLS</b>
Control variables <sup>a</sup>	Yes	Yes	Yes
Year fixed effects <sup>b</sup>	Yes	Yes	Yes
Observations	486	504	624
Adjusted R-squared	0.49	0.54	0.57
Test for equality of coefficients ODC = PCC <sup>c</sup>	/	0.69	0.12
Test for equality of coefficients ODC = RCW	/	0.75	0.07
Test for equality of coefficients PCC = RCW	/	0.49	0.61

*Notes:* \*\*\*/\*\*/\* significant at the 1, 5 and 10% level. Clustered standard errors at the country level are denoted in parentheses. <sup>a</sup> Control variables: unemployment rate, inactivity rate, labour productivity growth, output gap, inflation, short-run interest rate and terms of trade. <sup>b</sup> 25 year dummies. <sup>c</sup> The null hypothesis of the t-test specifies that the estimates are not statistically different from each other. Source: ILO, ICTWSS, LIS and OECD Databases, 1990-2015.

**Table 5: Disaggregated analysis: collective bargaining and poverty**

Dependent variable:	Working-age poverty rate, <i>before</i> taxes and transfers	Working-age poverty rate, <i>after</i> taxes and transfers	Public social spending as a % of GDP
	(1)	(2)	(3)
Bargaining centralisation	0.367 (1.099)	0.213 (0.467)	-0.476 (0.580)
Wage coordination	-0.013 (1.017)	-0.118 (0.562)	-0.671 (0.725)
Flexibility	-0.394 (1.065)	0.076 (0.533)	2.974*** (0.973)
Favourability	-1.513 (1.083)	-0.367 (0.508)	1.060 (0.894)
Bargaining coverage	0.043 (0.047)	-0.043** (0.019)	0.086** (0.037)
Trade union density	-0.006 (0.026)	-0.040** (0.016)	0.069** (0.030)
<b>Estimator</b>	<b>Pooled OLS</b>	<b>Pooled OLS</b>	<b>Pooled OLS</b>
Control variables <sup>a</sup>	Yes	Yes	Yes
Year fixed effects <sup>b</sup>	Yes	Yes	Yes
Observations	468	486	590
Adjusted R-squared	0.48	0.68	0.75

Notes: \*\*\*/\*\*/\* significant at the 1, 5 and 10% level. Clustered standard errors at the country level are denoted in parentheses. <sup>a</sup> Control variables: unemployment rate, inactivity rate, labour productivity growth, output gap, inflation, short-run interest rate and terms of trade. <sup>b</sup> 25 year dummies. Source: ILO, ICTWSS, LIS and OECD Databases, 1990-2015.

**Table 6: Sensitivity analysis: collective bargaining and poverty**

Dependent variable:	Working-age poverty rate, <i>before</i> taxes and transfers		Working-age poverty rate, <i>after</i> taxes and transfers		Public social spending as a % of GDP	
	(1)	(2)	(3)	(4)	(5)	(6)
Trade union density	0.083*** (0.026)	0.064* (0.034)	-0.066*** (0.015)	-0.047** (0.020)	0.114*** (0.021)	0.097*** (0.026)
<b>Estimator</b>	<b>FE</b>	<b>FE-2SLS</b>	<b>FE</b>	<b>FE-2SLS</b>	<b>FE</b>	<b>FE-2SLS</b>
Other collective bargaining components <sup>a</sup>	Yes	Yes	Yes	Yes	Yes	Yes
Control variables <sup>b</sup>	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects <sup>c</sup>	Yes	Yes	Yes	Yes	Yes	Yes
Observations	468	459	486	477	590	569
Within R-squared	0.56	0.57	0.67	0.68	0.73	0.72
<u>First-stage</u>						
Lagged trade union density		0.904*** (0.017)		0.894*** (0.017)		0.894*** (0.017)
Averaged lagged trade union density in neighbouring countries		-0.047*** (0.024)		-0.044*** (0.023)		-0.014*** (0.019)
Weak identification test <sup>d</sup> :						
<i>Cragg-Donald Wald F statistic</i>		1472.47		1503.82		2136.63
Overidentification test <sup>e</sup> :						
<i>p-value of Sargan-Hansen J statistic</i>		0.00		0.92		0.84
Endogeneity test <sup>f</sup> :						
<i>p-value associated with Chi-squared statistic</i>		0.80		0.00		0.02

*Notes:* \*\*\*/\*\*/\* significant at the 1, 5 and 10% level. When using the FE estimator, within standard errors are reported in parentheses. When using the FE-2SLS estimator, within standard errors, calculated by creating 1000 bootstrap samples, are reported between parentheses. <sup>a</sup> Collective bargaining components showing little within country-variation (i.e. centralisation, wage coordination, flexibility, favourability and coverage) have been included as covariates. Corresponding regression coefficients are not reported in this table as their signal-to-noise ratio is too small to enable statistical inference. <sup>b</sup> Control variables: unemployment rate, inactivity rate, labour productivity growth, output gap, inflation, short-run interest rate and terms of trade. <sup>c</sup> 25 year dummies. <sup>d</sup> The Cragg-Donald Wald F-statistic for weak identification is a Wald F statistic testing whether the excluded instruments are sufficiently correlated with the endogenous regressor. The null hypothesis is that the instruments are weak. According to the standard ‘rule of thumb’, weak identification is problematic for F statistics smaller than 10 (as suggested by van Ours and Stoeldraijer (2011)). <sup>e</sup> The Sargan-Hansen J statistic tests the null hypothesis that the instruments are valid, i.e. uncorrelated with the error term. Under the null hypothesis the instruments are considered to be valid. <sup>f</sup> The Durbin-Wu-Hausman endogeneity test is based on the difference of two Sargan-Hansen statistics: one for the equation in which trade union density is treated as endogenous, and one in which it is treated as exogenous. If the null hypothesis of this test cannot be rejected, then instrumentation is actually not necessary, i.e. union density can actually be considered as exogenous. Source: ILO, ICTWSS, LIS and OECD Databases, 1990-2015.

## Appendix 1: Description and sources of control variables

- **Unemployment rate** is calculated by expressing the number of unemployed persons as a percentage of the total number of persons aged between 15 and 64 in the labour force. The labour force (formerly known as the economically active population) is the sum of the number of persons employed and the number of persons unemployed. Source: ILO Database.
- **Inactivity rate** is the proportion of the working-age population that is not in the labour force (i.e. jobless, not available and/or not looking for a job). Source: ILO Database.
- **Labour productivity growth** is the percentage change from a previous year in terms of labour productivity, which is defined as GDP per hour worked. Source OECD Database.
- **Output gap** is the difference between actual Gross Domestic Product (GDP) and potential GDP as a percent of potential GDP. Potential GDP is the level of output that an economy can produce at a constant inflation rate. Source: OECD Database.
- **Inflation** or **consumer price index (CPI)** is defined as the change in the prices of a basket of goods and services that are typically purchased by specific groups of households. Source: OECD Database.
- **Short-term interest rate** (also called “money market rate” and “treasury bill rate”) is the rate at which short-term borrowings are effected between financial institutions or the rate at which short-term government paper is issued or traded in the market. Source: OECD Database.
- **Terms of trade** is defined as the ratio between the index of export prices and the index of import prices. If the export prices increase more than the import prices, a country has a positive terms of trade, as for the same amount of exports, it can purchase more imports. Source: OECD Database.