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**Working Paper**

# Wage Bargaining Regimes and Firms' Adjustments to the Great Recession

IWH-CompNet Discussion Papers, No. 1/2017

**Provided in Cooperation with:**
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*Suggested Citation:* Ronchi, Maddalena; di Mauro, Filippo (2017) : Wage Bargaining Regimes and Firms' Adjustments to the Great Recession, IWH-CompNet Discussion Papers, No. 1/2017, Leibniz-Institut für Wirtschaftsforschung Halle (IWH), Halle (Saale)

This Version is available at:
https://hdl.handle.net/10419/158029

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CompNet The Competitiveness Research Network

# IWH-CompNet Discussion Papers

No. 1
May 2017

## Wage Bargaining Regimes and Firms' Adjustments to the Great Recession

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IWH-CompNet Discussion Papers are indexed in RePEc-EconPapers and in ECONIS.

## Editor

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ISSN 2513-1303

# Wage Bargaining Regimes and Firms‘ Adjustments to the Great Recession

## Abstract

The paper aims at investigating to what extent wage negotiation set-ups have shaped up firms' response to the Great Recession, taking a firm-level cross-country perspective. We contribute to the literature by building a new micro-distributed database which merges data related to wage bargaining institutions (Wage Dynamic Network, WDN) with data on firm productivity and other relevant firm characteristics (CompNet). We use the database to study how firms reacted to the Great Recession in terms of variation in profits, wages, and employment. The paper shows that, in line with the theoretical predictions, centralized bargaining systems – as opposed to decentralized/firm level based ones – were accompanied by stronger downward wage rigidity, as well as cuts in employment and profits.

*Keywords: productivity, wage bargaining, firm level analysis, global financial crisis*

*JEL Classification: D22, D61, J30, J50*

## Non-Technical Summary

Whether labor market institutions, and more specifically wage setting regimes, shape firms' response to negative economic shocks is a vexed question in labor economics. Standard economic theory (Nickell and Andrews, 1983) predicts that centralized bargaining institutions, by preventing wages to adjust downwards during economic downturns, are likely to hamper the smooth functioning of labor markets and to amplify the impact of shocks on employment. Recently, this theme has retaken center stage in the policy debate, because of the high and persistent unemployment rates following the Great Recession. More specifically, since the start of the economic and financial crisis over 5 million jobs were lost, wiping out the gains from almost ten years of strong job creation. Therefore, understanding to what extent labor market institutions, as defined by the existing wage bargaining regimes, shape the ways in which firms adjust to aggregate shocks is currently at the core of the policy debate (see ECB occasional paper series no. 138, 2012, and no. 159, 2015). However, in the literature, there is little empirical evidence, which could solidly connect different wage setting regimes with unemployment across countries (Flanagan, 1999; Bassanini et al., 2010, Backer (2005)), or – in general – labor market institutions and macroeconomic performance (for a survey see Freeman (2007)). There are two main reasons behind these difficulties. First, because of the lack of comparable firm-level data across countries on both firm's characteristics and on institutional variables measured at the firm-level, the existing microeconomic literature is almost exclusively characterized by single-country studies. The second limitation pertains to the macro-empirical studies literature, which utilizes institutional country-level data. This approach has the advantage of allowing cross countries comparisons. However, such data are normally too aggregated to allow the impact of wage bargaining set-ups – prevailing at the country-level – to be disentangled from other simultaneous macro-economic events. As a result macroeconomic research generally does not find a significant impact of wage bargaining set-ups on macroeconomic performance.

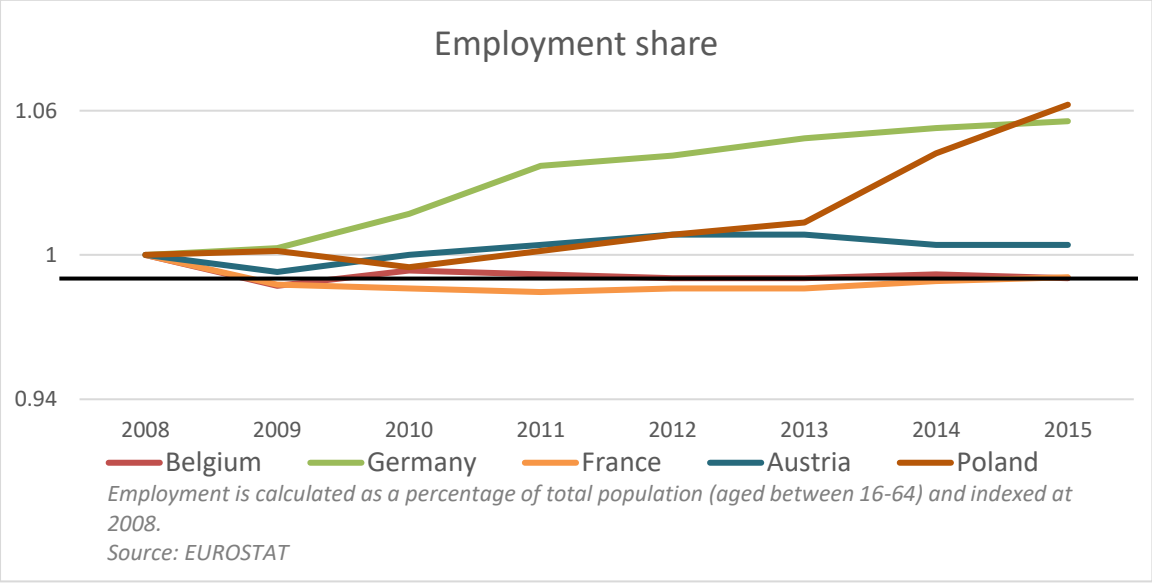
The contribution of this paper, which aims at investigating to what extent wage negotiation set-ups have shaped up firms' response to the Great Recession, is two-fold. First, we construct a novel database by matching two different existing micro-based datasets, one related to firm productivity and other relevant firm characteristics (CompNet), and another (WDN) to labor market structure, as reported by individual firms located in a large set of EU countries. More specifically, to which wage bargaining system the individual firm adheres to is not exclusively based on the country it belongs to, but it comes from the actual replies to the firm-level labour market survey (WDN). Firm heterogeneity is therefore embedded in the database we have constructed and expressly accounted for in the estimation. As far as we know, this is the first attempt of creating such information – at least in terms of the achieved sectoral detail and country coverage. The rich structure of both databases allows us to relate the reaction of firms to the Great Recession in terms of variation in profits, wages, and employment (inferred from the CompNet database) to self-reported features of wage bargaining institutions at the firm level (inferred from the WDN). Second, we test whether and by how much the heterogeneity in the degree of wage flexibility – implicit in the wage bargaining regimes individual firms are confronted with – has impacted on relevant

firms' results following the Great Recession. We show that, in line with the theoretical predictions, the wage bargaining arrangements in place during the time of the analysis (i.e. 2006-2012) play a crucial role in shaping up the response of firms to a negative shock. More specifically, we show that centralized bargaining systems – as opposed to decentralized/firm level based ones – were accompanied by stronger downward wage rigidity, as well as cuts in employment and profits.

# 1. Introduction

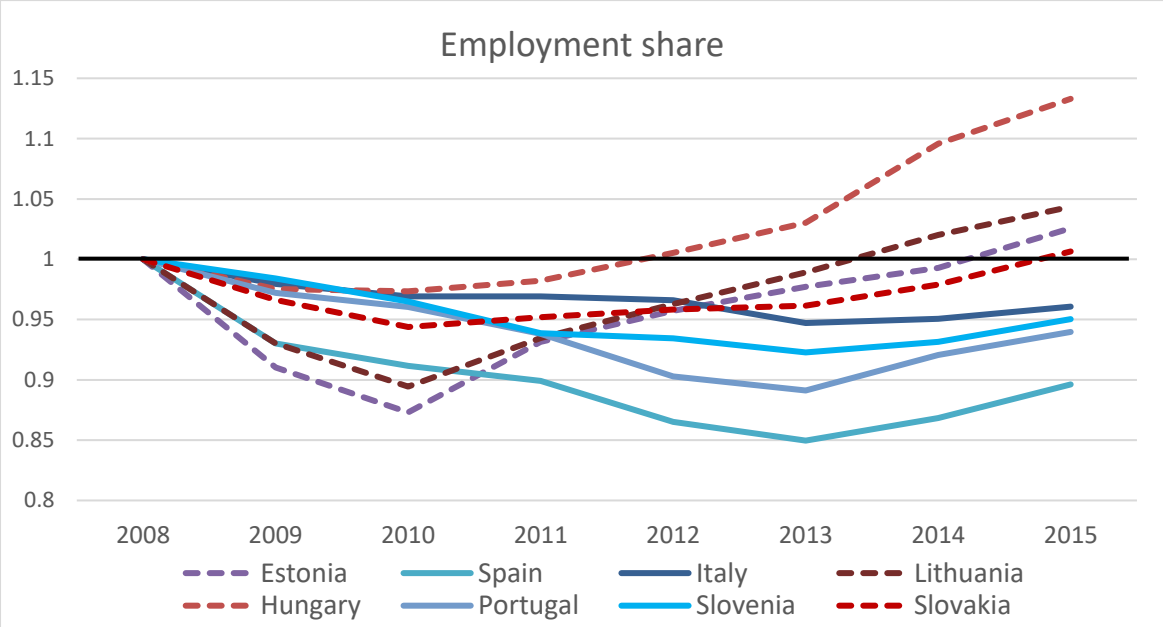
Eemployments patterns were quite bi-modal across Europe in the aftermath of the Global financial crisis (GLOBAL FINANCIAL CRISIS). While for a group of countries employment rate remained virtually unchanged – and, if anything, increased – (Fig 1), for others it decreased dramatically (Fig 2). However, while for a group of countries it eventually returned at the pre-crisis level (dashed lines), for some other countries, it still lies well below its 2008 level (continuous lines).

Figure 1




*Employment is calculated as a percentage of total population (aged between 16-64) and indexed at 2008.*
*Source: EUROSTAT*

Figure 2




*Employment is calculated as a percentage of total population (aged between 16-64) and indexed at 2008.*
*Source: EUROSTAT*

Such patterns have re-opened a long-standing debate among academicians and practitioners on whether and to what extent wage setting regimes have a role to play in shaping up employment developments, particularly following economic shocks. Standard economic theory (Nickell and Andrews (1983)) predicts that centralized bargaining institutions are likely to hamper the smooth functioning of labor markets and to amplify the impact of shocks on employment by preventing wages to adjust downwards during economic downturns. More precisely, on the theory front the "hump-shape" relationship proposed by Calmfors and Driffill (1988) remains still the most common work-horse model. It suggests that, when collective bargaining is taking place at the two extremes – i.e. at the firm level or at the national level – wages tend to be set "appropriately", i.e. in line with productivity (thanks to competitive pressures) and national broad objectives (such as inflation), respectively. However, when collective bargaining takes place at the intermediate level (sectoral or regional, which is the most common setting in Western European countries), negotiations are less restrained, and wages – and therefore unemployment – tend to be higher.

While wage bargaining set-ups vary considerably across European countries, as it concerns the "level" at which bargaining takes place we can group the countries in our sample in two broad categories. [1] The first group comprises the majority of Western European countries (such as Austria, France, Italy, Portugal, Slovenia, and Spain) which have a rather highly regulated and centralized bargaining set-ups (i.e. where wage bargaining takes place mostly at the sector level), which, according to theoretical predictions should also imply a high degree of wage rigidity. The second group includes the majority of Eastern European countries (such as Estonia, Hungary, Poland, and Lithuania), where wages are negotiated at a more decentralized level (i.e. at the plant-level) and can be revised with a higher frequency, particularly in response to shocks.

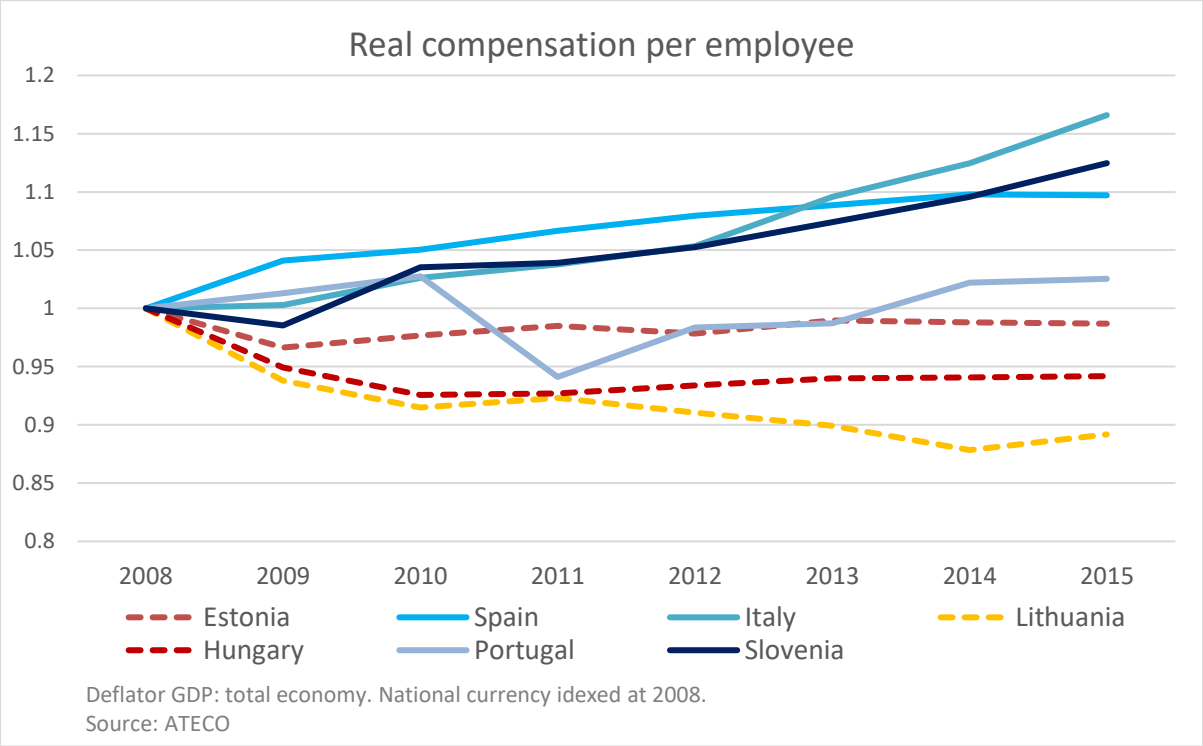
Against this background, preliminary evidence showed in figure 3 seems to confirm that the different degree of centralization of wage bargaining systems is associated with different wage patterns. Given the employment patterns displayed in figure 2, a plausible hypothesis is that such wage developments in turn might explain this heterogeneity in the developments of employment rate. Indeed, in line with the theoretical predictions of Nickell and Andrews, figure 3 shows that real compensation per employee fell in the group of decentralized countries (represented by a dashed line as in figure 2) immediately after the outbreak of the global financial crisis and remained at a lower level than in 2008. In the group of centralized countries (represented by a continuous line as in figure 2) instead, real wages rose and generally remained above the 2008 level throughout the whole period notwithstanding the simultaneous drop in employment. [2] For the above reasons, recent empirical work

[1] Among the characteristics of the labour markets, in what follows we consider only rules and regulations related to wage setting, excluding for instance employment protection rulings and alike.

[2] We could not include Slovakia in the wage graphs as ATECO does not report data on real compensation per employee for this country.

focused on the Great Recession squarely blamed wage bargaining regimes for having contributed to emerging structural unemployment, particularly in selected European countries (see Anderton et al. (2015) and Bertola et al. (2010)).

Figure 3




Deflator GDP: total economy. National currency idexed at 2008.
Source: ATECO

But, how strong is this empirical evidence in the economic literature? Not so much and for a variety of reasons. Overall, the literature was unable to produce robust empirical evidence, which could solidly connect different wage setting regimes with unemployment across countries (Flanagan, 1999; Bassanini et al., 2010, Backer (2005)), or – in general – labor market institutions and macroeconomic performance (for a survey see Freeman (2007)). There are two main reasons behind these difficulties. First, because of the lack of comparable firm-level data across countries on both firm's characteristics and on institutional variables measured at the firm-level, the existing microeconomic literature is almost exclusively characterized by single-country studies. At the country level, however, the wage bargaining regimes tend to be rather stable overtime and with only limited within-country variation in most OECD countries. [3] Empirical estimations lack therefore the needed level of variation in the underlying variables. This makes single country analysis unsuited to test how wages of firms operating under different bargaining systems would react to the same economic shock as well as to check whether different set-ups across countries can explain different macroeconomic performance

[3] One exception is for example Portugal, whose variation in the degree of centralization has in fact been used by a number of studies. See for example Cardoso and Portela (2009) who, in line with theoretical predictions find that centralised wage-setting agreements constrain the capacity of the firms to reflect demand shocks on wage changes as opposed to decentralised ones.

across euro-area states. The second limitation pertains to the macro-empirical studies literature, which utilizes institutional country-level data. This approach has the advantage of allowing cross countries comparisons. However, such data are normally too aggregated and disentangling the impact of wage bargaining set-ups measured at the country-level from other simultaneous macro-economic events is an intimidating exercise. As a result, macroeconomic research generally does not find a significant impact of wage bargaining set-ups on macroeconomic performance.

It is on this empirical dimension – relative particularly to data granularity – that lies the main contribution of our paper. First, we construct a novel database by matching two different existing micro-based datasets, one related to firm productivity and other relevant firm characteristics (CompNet), and another (WDN) to labor market structure, as reported by individual firms located in a large set of EU countries. More specifically, to which wage bargaining system the individual firm adheres to is not exclusively based on the country it belongs to, but it comes from the actual reply to the firm-level labour market survey (WDN). Firm heterogeneity is therefore embedded in the database we have constructed and expressly taken into account in the estimation. As far as we know, this is the first attempt of creating such information – at least in terms of the achieved sectoral detail and country coverage. Second, we use this novel database to study how the wage bargaining environment faced by the firms interacts with three critical firm-level indicators, as measured in CompNet (change in labor costs, in employment, and in profits) in response to negative economic shocks. Third, our strategy in this paper is to use data at the country-industry-firm size level to disentangle the effect of the specific wage bargaining regime from macro factors by using an impressive battery of fixed effects and time trends. We find that better data improve the analysis. Moreover, with our novel database, we are providing a boost to the existing – mostly one country based – empirical micro literature by allowing a cross country comparison. Fourth, since our database comprises matched information on labour market structure and firms' performance up to 2012 we cover the GLOBAL FINANCIAL CRISIS and its aftermath, being able to study the shock absorbing capacity of the labor market for the course of the crisis.

The main result of the paper is that – in a cross as well as within country comparison – centralized wage bargaining limits the firms' ability to maintain competitiveness after a shock – such as the global financial crisis – via cuts in wages, which lead to layoffs and cut in profits.

The structure of the paper is as follows: section 2 presents the existing theoretical and empirical literature analysing how wage bargaining set-ups aaffect firms ability to adjust wages in response to adverse shocks. Section 3 describes the main features of our data, while section 4 covers the empirical framework of the analysis. Section 5 presents the results. In section 6 we present our robustness checks. Finally, section 7 summarizes our findings and concludes.

# 2. Theoretical and Empirical Literature on Wage Bargaining

On a general level, collective bargaining is the process in which workers unions and employers' organizations settle wages and other labor issues. A large economic literature – both theoretical and empirical – has long dwelled on whether and under which circumstances wage bargaining regimes may amplify the impact of a negative shock by limiting downward wage adjustment that could prevent employment cuts and job destruction. In this section we will provide an account of such literature, both theoretical and empirical.

Starting with the theoretical literature, it has been emphasized that the final outcome of collective bargaining depends both on i) the scope of the negotiation – i.e. whether it involves only wages or both wages and employment levels and ii) on the bargaining power of the two parties involved in the negotiation process.[4] Ultimately, the scope of the negotiation depends on the level at which the bargaining takes place, i.e. its degree of centralization. It is on this specific literature that we are going to focus, also to motivate the specification of our empirical analysis. Most notably, we review below the effects on wages and employment of collective bargaining depending on the level at which it takes place, i.e.: i) multi-employer bargaining, typical of centralized systems, and ii) plant-level bargaining, typical of decentralized systems.

Traditionally, collective bargaining negotiations taking place at the multi-employer/sector level follow a right-to-manage structure (Nickell and Andrews (1983)), meaning that the two parties involved in the negotiation bargain only over wages, while single employers decide upon employment levels taking wages as given. Therefore, subject to the wages agreed upon, the resulting level of employment will be the one maximizing the profits of the firm. This model predicts that the stronger the bargaining power of unions, the higher will be the mark-up imposed over the reservation wage and, in turn, the lower the level of employment. In conclusion, centralized bargaining leads to an equilibrium which is Pareto inefficient, as, by imposing that the two parties bargain only over wages, it prevents the possibility of trading over prices and quantity outside the demand curve. As such, all equilibria need to lie on the demand curve of firms, and the bargaining process trades higher wages for less employment. Therefore, the assumption that the bargaining process only negotiates wages, which is typical of multi-employer bargaining situations, rules out the possibility of reaching wage and employment outcomes that would improve the condition of at least one bargaining agent without making the other agent worse off. Efficient contracts (McDonald and Solow, 1981) are instead the outcomes of bargaining processes taking place at the plant-level, where both wages and employment are negotiated together. These contracts are characterized by a higher level of employment and a

[4] The latter ranges from 0 in the competitive equilibrium case, to 1 in the case in which unions have monopoly power in the bargaining process.

lower level of wages with respect to the outcomes of bargaining institutions negotiating over wages only, for any given bargaining power of unions.

Moving to the review of the existing empirical literature, as previously anticipated, cross-country macro evidence is rarely significant and, when it is, it is not robust to variations in the specification of the dependent variable, the composition of the sample, or the time period considered (see Baker et al. (2004) and Blanchower (2001)). More specifically, macro analyses can tell us little about the underlying causal relationship between wage bargaining set-ups and economic outcomes. Indicators are not widely available across the euro area as they are normally available for some OECD countries only, and when so, they are far too aggregate and neglect entirely firms' characteristics. Moreover, in empirical analyses countries are usually ranked according to these indices. Such strategy implicitly assumes that equal differences in ranking stand for the same difference in the wage bargaining structure, which is far too approximate as assumption.

On the contrary, when relying on micro data analyses, bargaining systems are shown to play a very important role in the economy. Available analyses are only applied on individual countries. For instance, Rute Cardoso and Portela (2009) use micro administrative data for Portugal to show that collective bargaining and minimum wage institutions are both related to lower wage flexibility at the firm level. Guimaraes et al. (2014), again using Portuguese data, find that a 1% increase in payroll due to the extension of collective contracts decreases the number of employees in the firm by half percentage point. Using data of similar nature, Díez-Catalán and Villanueva (2015) focus on the degree of downward wage rigidity in Spain and on its impact on job destruction rates during the years 2009 and 2010. Their findings are consistent with the notion that the effect of a nominal shock on employment depends on the speed and the extent at which wages adjust, or, in other word, on the degree of downward wage rigidity. Faggio and Nickell (2005) find that in the UK national collective bargaining is associated with lower responsiveness of wages to labor market conditions. Jimeno and Thomas (2013) build a theoretical model of employment dynamics under plant-level and sector-level bargaining and find that unemployment is lower under plant-level bargaining. Their model would also show that opting-out clauses of sector-level negotiations would be sufficient to attain a level of unemployment which is lower than the one resulting from (the optimal) plant-level bargaining. Calibrating their model with parameters estimated in other studies, the authors conclude that moving from a centralized to a decentralized bargaining set up would decrease the unemployment rate of continental Europe by about five percentage points. In conclusion, while of value for single country analysis, available empirical literature based on firm level data cannot provide reliable results for the international comparison.

Turning finally to survey based analysis, several papers use the WDN survey, the same firm-level source we utilise to build our novel database. For instance, Lawless et al. (2009) find that the influence of wage rigidity is quite substantial in Europe. In their paper the authors relate the

importance of country-specific factors to institutional differences in the level and coverage of wage bargaining regimes and find that firms subscribing to a higher-level bargaining regime are more likely to use non-base wage margins of labor cost adjustment with respect to companies characterized by single-employer negotiations. Similarly, Bertola et al. (2010), find that the observed reduction in the number of workers employed in firms subscribing to centralized bargaining after the outbreak of the crisis is due to the higher wage rigidity, as firms covered by centralized wage bargaining structures are more likely to decrease labor costs by cutting the level of employment than by cutting the level of wages. Fabiani et al. (2015) also focus on European firms' adjustments to the demand and credit contraction of the Great Recession and show that generally labor cost reduction took place through a reduction of quantities rather than prices. However, their analysis also reveals that different combination of adjustment mechanisms critically depends on countries' features of their institutional settings and, specifically, on their wage bargaining regimes. Finally, another study based on the WDN survey is the one by Boeri (2015), who explores the distinctive features and impacts of "multi-level bargaining" structures on wage and employment outcomes, a wage-bargaining set up for which we also account for. As a matter of fact, over the last two decades, some European countries, what we will refer to as "two-tier" countries, have witnessed the development of two-tier bargaining structures, characterized by the coexistence of multi-employer (i.e. bargaining at a level higher than firm-level) wage agreements and firm-level negotiations. Boeri (2015) shows however that the multi-employer bargaining set ups are still characterized by a high degree of pay rigidity, similar to the purely centralized systems.[5] For this reason, in our analysis we classify multi-level bargaining as belonging to the more general category of centralized regimes. The general structure of this regime is one where it is the centralized level of bargaining to dominate, enabling company-level bargaining to operate only "*in meius"*, i.e. to agree on higher wages than those established at the multi-employer level, or – in order words – to influence wages through a "wage drift" with respect to wages set at the multi-employer level.

All in all the WDN papers just reviewed, while providing critical inputs on the functioning of the labour markets in Europe, rely only on survey-based information of a firm's response to a hypothetical cost shock. Therefore they are unable to quantify the impacts of such set-ups on specific firms' relevant variables such as wages, employment and profits. This is instead the objective of this paper which looks at firms' actual responses during the whole global financial crisis thanks to the merge with firm-level balance sheet information included in CompNet.

[5] See also di Mauro and Ronchi (2016) who reach the same conclusion.

# 3. Data

## *3.1 General characteristics*

The database we have constructed for this paper results from the merging of two unique firm-level based datasets in the context of two research networks originated within the EU system of central banks. The first is the **Wage Dynamic Network (WDN**), which has conducted since 2006 three surveys of large sample of firms – based in almost the entirety of EU countries – aimed at: i) identifying the sources and features of wage and labor cost dynamics that are most relevant for monetary policy, as well as ii) clarifying the relationship between wages, labor costs and prices at both the firm and the macroeconomic level. The three surveys include questions related to price and wage rigidity in a number of European countries. While the first survey took place before the global financial crisis, the second one represents a more limited follow-up survey designed to understand firms' reactions to the initial stage of the crisis in a smaller number of countries. Finally, the third wave (conducted in 2014) also looks at how firms have reacted to the crisis trying to identify the impact of labor market reforms that have taken place during 2010-13. The second source is the firm-level base data set of the **Competitiveness Research Network (CompNet)**. Drawing from the balance sheets of a large number of EU firms, the data sets include info on firms' productivity relevant items, such as labor cost, employment, firm size, revenues, financial structure and so on (a detailed account of the dataset can be found in Garcia-Lopez, di Mauro and the CompNet Task Force (2015)). The data set is aggregated at the sector/country/year level and includes annual information for some 20 EU countries from 1995 to 2013.

For this paper, we interface the two datasets along the labor market relevant dimension, trying to maximize the information content despite the very different nature of the data sets. More specifically, from the WDN (a cross-section survey available for three different vintages – covering respectively 2007/08, 2009, 2010-2013) we obtain information on time-invariant wage bargaining institutions. From CompNet (a repeated cross-section database including annual data from 1995 to 2013) we retrieve time-varying firm's characteristics relevant to labor market. As a general rule, we have tried to maximise the number of country/sectors and years available across the two originating datasets. Therefore, for CompNet we have used the 4$^{th}$ vintage (2000-2012)**.** As for WDN, in order to increase country coverage we have used the most recent wave (WDN3) for those countries not undergoing through a labour market reform on the collective bargaining system during the period analysed – 2006-2012. However, as we use the WDN measure of wage bargaining as time-invariant in our analysis, we have used labour market data related to the first wave (WDN1) when a major labour reform took place during the period covered by the third wave and by our analysis.[6] This was done in

[6] See Appendix A which reports the main features of wage bargaining regimes in the sampled countries as well as the timing of the reforms to the wage bargaining systems. We indicate – country by country – which WDN

order to have, for all countries in the sample, information on wage bargaining institutions pre-existing at the time of the global financial crisis and that could be treated as time invariant until 2012, our last year of analysis. Since CompNet data is more aggregated than WDN ones, we had to perform the merge at the country-industry-firm size level (where size is defined in terms of bins depending on the number of employees), which also defines our cell of analysis in what follows. In other words, all our variables are relative to the group of firms belonging to a given cell following the structure of the CompNet database. The rich structure of both databases allows us to relate the reaction of firms to the Great Recession in terms of variation in profits, wages, and employment (inferred from the CompNet database) to self-reported features of wage bargaining institutions at the firm level (inferred from the WDN). The final goal of this matching procedure is to produce a unique cross-country and micro-distributed database that can be used to relate the variation in the level at which bargaining takes place both within and across countries to differences in firm level cost cutting strategies, and, in turn, in country's economic performance following the crisis.

Overall, the merged database includes information on firms of different size operating in 13 different European countries, and 4 different macro-sectors, over the period 2006-2012 (see Table 1). [7] For all our dependent variables, with the exception of changes in employment, we use a sample including only firms with 20 employees or more (the so-called 20E sample in CompNet). We chose as a rule to work with the 20E – rather than the full sample including smaller firms, to i) increase the country coverage and ii) because the 20E sample is more homogeneous across countries, also due to the use of "population-weights".[8]

wave has been used to conduct our analysis in order to ensure that wage bargaining regulations were constant during the period under analysis.

[7] The countries included in the final sample, together with Belgium, Croatia, and Romania are common to both WDN and CompNet; however Belgium was excluded from the analysis because it has data only until 2010, while Croatia has been excluded for a lack of precise information on wage bargaining regulations, similarly to Romania which also undertook wage bargaining reforms during the period under analysis.

[8] This technique implies the use of population (rather than sample) weights to aggregate the firms in each country, year, macro-sector and size class. Weights come from the Eurostat Structural Business Statistics (SBS).

Table 1: Final Sample Coverage

| | 20E | Full |
|---|---|---|
| **Countries** | AT, EE, ES, DE, FR, HU, IT, LT, MT, PL, PT, RO, SI, SK | AT, EE, ES, DE, HU, IT, LT, MT, PT, RO, SI |
| **Sectors** | Manufacturing, Construction, Trade, Business Services | Manufacturing, Construction, Trade, Business Services |
| **Size class** | 20-49 employees , 50-250 e., 250+ e. | 1-9 employees, 10-19 e., 20-49 e. , 50-250 e., 250+ e. |

The only case in which we use the full sample is when we look at employment dynamics, i.e. to the percentage of firms which have been changing size during the period considered. To calculate this, the CompNet database includes the so called "transition matrices", which indicate whether firms observed at time *t* moved to a higher size class, stayed in the same size category, or downsized, over a three year-rolling horizon.[9] The transition matrices are a powerful analytical tool reflecting firms' movements along the distribution of size classes which we use as a (partial) proxy for changes in employment. As we are interested in firms using layoffs as adjustment mechanism to the Great Recession, we focus on the share of firms declining in size. The use of the full sample is justified by the fact that, as it includes five size classes instead of three, we can cover a greater share of firms declining in size.[10]

With respect to previous literature, and as also mentioned above, our database has several novel features. First, in our database, the information related to wage bargaining set-ups is perfectly comparable across countries and sectors as it derives from the same standardized questionnaire (WDN) circulated to several thousand EU firms and managed by 25 national central banks of the European Union.[11] Second, this firm-level information on labour market characteristics is matched –

[9] Similar techniques are used in the DynEmp project undertaken by the OECD (2015). Compared to the above mentioned OECD project, CompNet covers a larger number of countries and sectors. However, it does not include information on firms exiting and entering the market, since transition matrices consider only firms which have been in existence over the three year period considered.

[10] By construction CompNet's transition matrices does not report information on declining firms belonging to the smallest size class, as these firms are exiting the sample. This implies that, when using the 20E sample, we would only have been able to analyse those firms which, starting from the two biggest size classes, have been decreasing in size. This would imply covering firms with 50 employees or more at time *t*. On the contrary, using the Full Sample, we are able to follow firm's trajectories in terms of size of four size classes, covering up until firms employing 10 to 19 workers at time *t*.

[11] By design, the cross-country sample is balanced across firm-size categories within each country and across sector. As a result, its distribution closely follows the distribution of private employment in the country.

at the country-sector-firm's size level – to information on a number of firms' features coming from the CompNet dataset. More specifically, after having established the sectors, years and countries for which information is commonly available in the two datasets, we are able to establish the share of firms operating under the different bargaining set-ups in terms of degree of centralisation, for each firm's size category, macro sector and country in the dataset. Such information allows therefore to control for sector and firm characteristics, a major improvement from previous empirical studies based solely on aggregate country level information on labour markets. In what follows we provide details on the procedure we followed to categories wage bargaining set-ups as well as relevant descriptive statistics for what concerns the variables we use from CompNet.

On the wage bargaining variable side, the WDN survey explicitly asks each firm if it has applied a collective pay agreement; and if so, whether the agreement was bargained and signed within or outside the firm (at the national, regional, sectoral or occupational level). This information allows us to add another dimension (i.e. multi-level bargaining; see Flanagan, 1999 and Boeri, 2015) to the standard classification employed in the literature – which distinguishes only among centralized, intermediate, and decentralized bargaining arrangements.

To summarize, our data base considers a rather articulated variety of bargaining set-ups. To start with the countries defined as subject to a so called two-tier regime we can distinguish between three types of bargaining set-ups: 1) multi-level bargaining, 2) multi-employer bargaining, and 3) not subscribing to any bargaining regime. On the other hand, for countries not engaged in two-tier set-ups we distinguish the following three bargaining set-ups, namely 1) pure firm-level, 2) multi-employer, and 3) no specific wage agreement set-up. All this information is available for each country, sector, and firm's size class. Note that thanks to the way in which information is collected we take distance from the usual empirical practice of ranking countries by their degree of bargaining, which is a procedure that not only raises the dispute about the ranking, but also imposes the unwarranted assumption that equal differences in ranking denote equal differences in structure. Finally, as the classification makes clear, our data allows us to have a neat idea of the exact proportion of firms operating on a completely non-union basis, which is an information always missing for those macro measures that are built as a single number indicating the degree of centralization at the country-level.

However, the sample size varies across countries both in absolute terms and relative to the number of firms in each country. Thus individual weights have been calculated for each firm to make the sample representative of the overall number of firms in each country and to account for the number of workers that a firm represents in a given country. These weights have been used throughout the whole analysis.

### *3.2 Stylised facts*

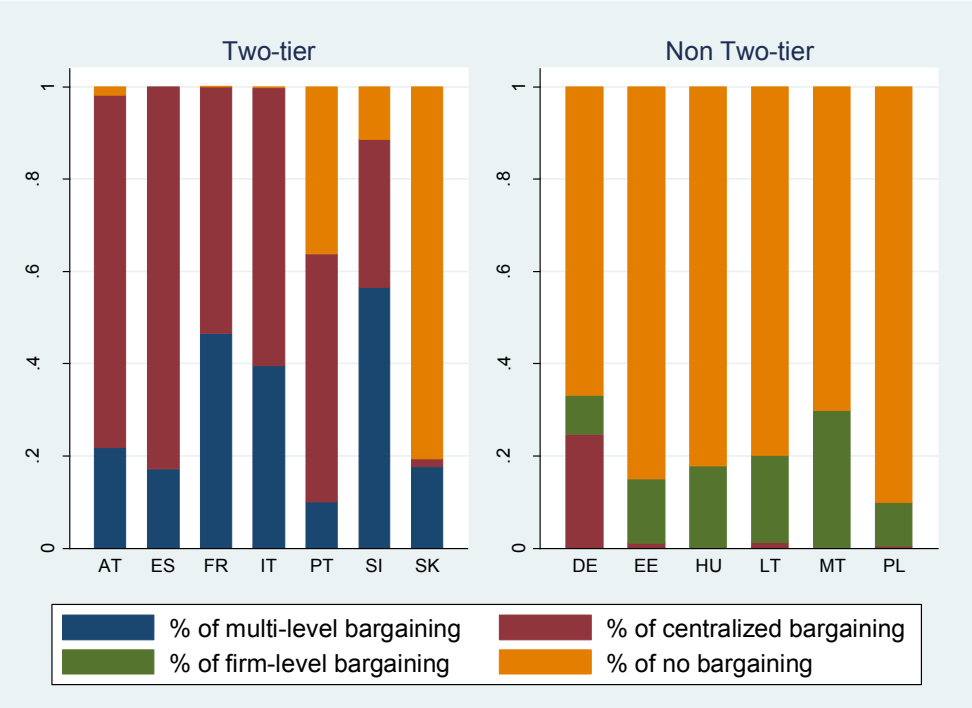
Table 2 reports some basic descriptive statistics on the three key firm level variables of our analysis and on the allocation of firms across the wage bargaining set-ups.

Table 2: Dependent variables descriptive statistics

| Variable | Mean | Median | Std Deviation | Min. | Max. |
|---|---|---|---|---|---|
| Labor Costs per Employee | 25.45 | 20.31 | 15.12 | 4.37 | 64.93 |
| Share of shrinking firms | 0.20 | 0.19 | 0.12 | 0 | 0.65 |
| Profit Margin | 0.031 | 0.031 | 0.024 | 0.00 | 0.123 |
| Share of firms in multi-level bargaining | 0.16 | 0.06 | 0.22 | 0.00 | 0.83 |
| Share of firms in multi-employer bargaining | 0.30 | 0.20 | 0.32 | 0.00 | 0.96 |
| Share of firms in firm-level bargaining | 0.06 | 0.00 | 0.14 | 0.00 | 0.96 |
| Share of firms subject to any regulation | 0.47 | 0.45 | 0.40 | 0.00 | 1.00 |

In figure 4 we cluster the countries in the sample in two groups, i.e. two-tier and non-two-tier countries, in line with the prevailing nature of their respective bargaining systems. Two-tier countries comprise most of the Western European countries (with the notable exception of Germany), having a high share of centralised wage bargaining with some variation between the share of multi-employer bargaining and multi-level bargaining. Non two-tier countries are mainly Central and Eastern Europe countries, where for most of the firms there are no wage bargaining regimes in place, and when there are, they tend to be predominantly at the firm level.

Figure 4: Level of bargaining across countries by degree of centralization




*Note: The percentage of firm operating under multi-level bargaining has been calculating summing up all those firms that in two-tier countries replied that they are doing bargaining both inside and outside the firm. The percentage of firms operating under no bargaining regimes are those firms that indicated not to subscribe to any bargaining regime both outside and inside the firms.*

The overall nature of the bargaining set-ups prevailing at the individual country level tends to be rather similar when we look at the sectors details – within the two groups of countries. (Figure 5; upper panels). However, when we look at variation across different size classes a pattern emerges in both groups of countries. For what concerns two-tier countries, we can notice how the share of firms engaging in multi-level bargaining increases with size. This is probably explained by the fact that smaller firms are characterised by weaker unions which are less likely to manage to impose an additional level of bargaining improving the wage level agreed at the central level. This same argument can be extended to the group of non-two-tier countries with respect to firm-level bargaining.

Figure 5: Level of bargaining by sector and firm size

## 4. Empirical Framework

Our empirical framework follows Blanchard and Wolfers (2000), as we interact the adverse shock and wage bargaining institutions to capture the fact that the degree of centralization of the latter may affect the impact of the crisis on firm's adjustment mechanism. In their analysis, Blanchard and Wolfers (2000) aims at explaining the rise in unemployment starting in the 1960s as well as the heterogeneity of unemployment evolution across countries considering both (i) occurrence of economic shocks, and (ii) labour market structure. They claim that negative shocks can explain a large part of the overall increase in unemployment, but there is not enough heterogeneity in the nature and magnitude of these shocks to explain the different country experiences in unemployment trends. Such heterogeneity could instead potentially be explained by the structure of the labor market, which greatly differs across countries. However, such institutions pre-date the increase in unemployment and have been virtually stable over time therefore they can't explain the increase in unemployment occurred in OECD countries over the last decades. Against this background, using a sample of 20 OECD countries over the period 1960-2000, they find that a specification that allows for shocks, as well as labour market characteristics, and their interactions can account for most of the rise and heterogeneity in the evolution of unemployment in their sample.

Following their insight, we choose a specifications in which we allow for the negative shock to have possibly a stronger and more enduring effect in those cells characterized by a higher share of firms operating under centralization bargaining regimes, i.e. multi-level and multi-employer set ups (indicated with ML and ME in the regression below, while FL stands for the percentage of firms engaging in firm-level bargaining). Differently from Blanchard and Wolfers, we focus on a much shorter period from immediately before to some years after the Great Recession and, within the labour markets characteristics, only on wage bargaining set-ups.[12] Most importantly, our analysis relies on much more granular indicators in relation to wage bargaining set-ups, while they rely on much aggregated measures created by Nickell (1997) using OECD indicators. Finally, the use of granular data allows us to control for time, industry, size and country-industry fixed effects as well as country, industry, and size trends, for which cross-country studies, including Blanchard and Wolfers, can't control.

Our most complete specification is the following:

$$y_{zsct} = \alpha + \eta ML_{zsc} + \vartheta ME_{zsc} + \lambda FL_{zsc} + \beta_1 ML_{zsc} * Crisis_t + \beta_2 ME_{zsc} * Crisis_t + \beta_3 FL_{zsc} * Crisis_t + \tau_t + \varphi_{cs} + \pi_{sz} + \chi_{cz} + (\omega_{zt} + \nu_{st} + \xi_{ct} + \sigma_{szt} + \delta_{cst}) + \varepsilon_{zsct}$$

where $y_{zsct}$ is any of our three dependent variables of interest, i.e. i) the profit margin – constructed as EBIT over turnover -, ii) the labor costs per employee – defined as nominal labor costs (including wages and employers' social security contributions) divided by the number of employees -, or iii) the change in employment – which is calculated using the already mentioned transition matrices -, for firm of size class ***z*** in sector ***s*** and country ***c,*** at time **t**.[13] ***Crisis*** is a dummy variable which indicates whether we are considering the period before or after the Great Recession. It is equal to one for the years following 2008 and zero otherwise.[14] ML, ME, and FL represent respectively the percentage of firms subject to multi-level, multi-employer, and firm-level bargaining within a country-industry-firm size cell (while they don't vary over time). The share of firms not subject to any regulations is used as

[12] This solves a number of caveats present in their analysis. Indeed, in this way, we do not need time series data for our institutions, which is often missing for some countries and year and, even when fully available, is of often of poor quality.

[13] Of course, we are aware that our proxy for employment losses is far from perfect, as it does not convey information on the number of employees, which have been dismissed and on the share of firms exiting the market. Also, it treats all reductions in employment as equal, irrespective of the size class of origin. However, it still allows us to check whether our results on employment are consistent with theoretical predictions.

[14] Even if some countries in our sample started experiencing a recession already in the third quarter of 2008, it was only in the first quarter of 2009 that all the countries in the sample were in a recession. To study differences in the timing of adjustments, we also report results leading the variable crisis by one and two years (which we indicate in regression tables *as Crisis (+1)* and *Crisis (+2)* respectively).

omitted category, as the shares of these four cases sum up to one.

Our parameter of interest are $\beta_1$, $\beta_2$, and $\beta_3$ , i.e. the parameter of the interaction variables, which allows for the impact of the common time effects (i.e. the variable *Crisis*) on our dependent variables to depend on the specific level of centralization of wage bargaining regime in a cell. Note that, as the shares of firms engaging in the different bargaining set-ups sum up to one, we have excluded the share of firms operating under any bargaining regime, which serves as omitted group and category of comparison. The coefficients therefore need to be read as the differential impact of the crisis on the share of firms engaging in multi-level, multi-employer, or firm-level wage bargaining with respect to the share of firms subject to any regulation.

We expect $\beta_1$ and $\beta_2 > 0$ for both labor costs per employee and the share of firms laying off in the aftermath of the great recession. Indeed, according to both the theory and the literature previously reviewed, firms should face a trade-off between these two adjustment mechanisms: once a firm is hit by an adverse shock, if the wage bargaining regulation does not allow to decrease labor costs through cuts in wages, then such firm will be pushed to react through quantities, by laying off a higher number of its employees. On the contrary we expect $\beta_1$ and $\beta_2 < 0$ for profit margin, because an alternative adjustment mechanism to cutting employment for those firms that want to regain competitiveness but cannot react through reduction in wages is to cut prices instead, and in turn profits. We expect this to be true especially for very profitable firms. On the contrary, if the level of wages agreed during the negotiation can be reduced in response to a negative shock, employment reductions could be mitigated. Therefore, our prior on $\beta_3$ (i.e. the coefficient relative to the share of firms engaging in firm-level bargaining) is that it shouldn't be significantly different from the omitted category – i.e. the percentage of firms operating under no wage agreements set-ups – when we look at both labor costs and employment changes in the aftermath of the GLOBAL FINANCIAL CRISIS. With respect to profit margin, given that – as figure 5 shows – engaging in firm-level bargaining regimes appears much more common for very big firms, we could expect a differential effect of the crisis depending on whether a firm is subject to firm-level bargaining or no regulation at all.

Overall this specification captures our hypothesis that the degree of wage flexibility entailed in different bargaining set-ups determines the speed, the nature and the cost of adjustment in the presence of economic shocks in other words, we expect that firms operating in wage bargaining regimes characterized by different degrees of centralization will choose different adjustment mechanisms. Note that we are controlling for a very broad number of fixed effects and controls, which makes our results much more reliable than a simple cross-country analysis using macro-data. In particular, in our baseline specification we begin by including a full set of firm size, sector, country dummies, as well as year dummies, which are intended to capture a variety of important differences across cells, such as the composition of the workforce (skill mix and share of temporary employees), the degree of technological development (capital and labor intensity, productivity), and unobserved

national effects (such as those determined by country-specific EPL). The inclusion of these fixed effects also alleviates concerns on endogeneity as these three factors play a fundamental role in determining the allocation of firms across di different bargaining regimes (see figure 4 and 5). Moreover it is important to notice that firms have only very limited freedom in deciding in which bargaining regime they should operate, especially in centralized countries where virtually all firms are obliged by law to be covered by some form of centralized bargaining regime. Based on this specification, we identify which year represents a break in the data, (performing in other words a placebo test) and we select the appropriate timing of the variable crisis accordingly. This is in contrast with the existing single-country studies as it allows us to draw on a large shock to several economies to identify our parameters.

Once we have selected the appropriate ***Crisis*** variable, i.e. whether the differential effect of the shock on each dependent variable starts in 2009, in 2010, or in 2011, we add to our baseline specification also country-industry, country-size, and sector-size fixed effects. In this way the identification of our parameters of interest comes from the variation across firms of different size classes within a country-industry pair, across industries within a country-firm size class pair, and across countries within an industry-firm size class pair. In this way, the results we obtain are much more convincing than those obtained by the previous cross-country literature. In particular, on top of exploiting within-country variation, when we exploit it across countries, we hold industry and firms' size class fixed. This increases the reliability of the comparison. On top of this complete list of fixed effects, we progressively add size-, industry-, and country-specific time trends. As previously highlighted this is a major novelty with respect to the existing cross-country studies, which cannot control for any of them. These trends are intended to capture important time-varying factors at the firm size-level, such as the fact that firms of different size might have different access to credit, especially during the credit crunch years, or that the different industries and countries have had different TFP shocks over time. Standard errors are clustered at the country-industry level to control for serial correlation.

# 5. Results

The next tables show our main results on the different adjustment mechanisms firms selected in response to the crisis depending on the degree of centralization of the wage bargaining regime under which they were operating. All our specifications include a full set of country, sector, size, and year dummies to which we gradually add country-sector, and sector-firm size fixed effects as well as country, sector, firm-size trends. As previously stressed, the degree of wage flexibility determines, among other factors, the speed, the nature and the cost of adjustment in the presence of economic shocks. In the case of a monetary union, wage flexibility should be particularly relevant. Indeed, cross-country differences in the ability to adjust wages in response to an adverse shock create a situation in which countries characterized by stronger degree of wage rigidity will lose competitiveness relative to others.

Against this background, we start by analyzing labor cost per employees – which we use as a proxy for wages – to check whether firms in centralized regimes were constrained by higher downward wage rigidity and, therefore, were less able to cut labor costs through this channel during the crisis. The results of our baseline specification, aimed at studying the timing of the adjustment process are reported in Table 3. Indeed, to account for the fact that the effect of the crisis on some variables might be delayed in time, all our tables on the baseline specification report also the results for the interaction between the share of firms engaging in the various bargaining regimes and the common time shock Crisis (+1) and Crisis (+2); i.e. a dummy which is equal to one if the year is greater than 2009 and greater than 2010 respectively. For our robustness checks tables we directly select the most appropriate timing of reaction to the crisis for each variable to which we add a full battery of interacted fixed effects and time trends.

In Table 3 our coefficients of interest, i.e. $\beta_1$ and $\beta_2$ respectively represented by the interaction ME*Crisis and ML*Crisis, have the expected sign and are generally significant at 1% across all specifications. The results indicate that wages of firms operating in more centralized regimes, i.e. in multi-level (ML) set-ups and in multi-employer (ME) set-ups are higher than those of firms, which were not subject to any bargaining after the outbreak of the global financial crisis. This difference attenuates over time, remaining however significant. In line with our predictions, the coefficient of the share of firms engaging in firm-level bargaining interacted with the crisis dummy (FL* Crisis) in not statistically significant, meaning that there is no significant difference in the behavior of wages of firms in this wage bargaining regime and of firms in the omitted category. The magnitude of our preferred specification, i.e. column (1), suggests that a standard deviation increase in the share of firms in multi-level bargaining leads to an additional increase in wages of 2.2% with respect to the same increase in the share of firms in the omitted category. The effect of a standard deviation increase in the share of firms engaging in multi-employer bargaining is instead of increasing wages by 2.5%.

In Table 4 we analyze whether our results hold once we include a full set of interacted fixed effects and time trends, on top of country, industry, size, and year dummies included in Table 3. In particular, in column (1) we include country-industry and industry-firm size interactions. In this way, the identification of the beta parameters of interest comes essentially from variation across firms in different size-bins within a country-industry pair, and from variation across countries within an industry-firm size pair. Indeed as showed in figure 4 and 5, this is where the majority of the variation comes from. The contribution of our approach based on more granular data is to be able to exploit such variation by holding constant two out of three structural factors defining the level of variation of our data. This comparison should be more convincing than a purely cross-country one. From column (2) to (5) we keep adding size, industry, and country specific trends as well as industry-firm size trends and country-industry ones. The coefficients of the two centralized bargaining regimes are still of the expected sign, significant and of similar magnitude with respect to results in Table 3. Finally, the coefficient of the share of firms operating in the more decentralized set-up, i.e. at the firm-level, keeps being not statistically significant.

Table 3: Labor Costs per Employee

| Labour costs per employee | (1) | (2) | (3) |
|---|---|---|---|
| Multi-level | -0.477 | -0.0681 | 0.459 |
| | (3.844) | (3.840) | (3.839) |
| Multi-employer | -6.647* | -6.268* | -6.000* |
| | (3.365) | (3.332) | (3.320) |
| Firm-level | 1.225 | 1.985 | 2.047 |
| | (2.929) | (2.560) | (2.489) |
| ML*Crisis | 2.593*** | | |
| | (0.613) | | |
| ME*Crisis | 1.960*** | | |
| | (0.530) | | |
| FL*Crisis | 1.201 | | |
| | (1.528) | | |
| ML*Crisis(+1) | | 2.506*** | |
| | | (0.664) | |
| ME*Crisis(+1) | | 1.741*** | |
| | | (0.466) | |
| FL*Crisis(+1) | | -0.348 | |
| | | (0.976) | |
| ML*Crisis(+2) | | | 1.917** |
| | | | (0.817) |
| ME*Crisis(+2) | | | 1.674*** |
| | | | (0.579) |
| FL*Crisis(+2) | | | -0.756 |
| | | | (1.182) |
| Constant | 48.62*** | 48.38*** | 48.22*** |
| | (3.001) | (2.991) | (2.985) |
| Observations | 934 | 934 | 934 |
| R-squared | 0.963 | 0.963 | 0.963 |
| Country dummy | YES | YES | YES |
| Sector dummy | YES | YES | YES |
| Size dummy | YES | YES | YES |
| Year dummy | YES | YES | YES |

*** p<0.01, ** p<0.05, * p<0.1

Table 4: Labor Costs per Employee – Robustness Checks

| Labour costs per employee | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Multi-level | 1.938 | 1.884 | 1.960 | 1.872 | 2.418 |
| | (4.174) | (4.154) | (4.150) | (4.108) | (4.248) |
| Multi-employer | -3.808 | -3.814 | -3.848 | -3.864 | -3.747 |
| | (3.541) | (3.546) | (3.554) | (3.557) | (3.604) |
| Firm-level | 0.837 | 0.768 | 0.812 | 0.766 | 0.298 |
| | (2.815) | (2.830) | (2.858) | (2.892) | (2.681) |
| ML*Crisis | 2.583*** | 2.662*** | 2.522*** | 2.645*** | 1.614** |
| | (0.640) | (0.687) | (0.692) | (0.703) | (0.689) |
| ME*Crisis | 1.911*** | 1.898*** | 1.953*** | 1.910*** | 1.661*** |
| | (0.539) | (0.539) | (0.533) | (0.544) | (0.524) |
| FL*Crisis | 1.022 | 1.167 | 1.086 | 1.189 | 2.013 |
| | (1.571) | (1.762) | (1.807) | (1.967) | (1.452) |
| Constant | 45.90*** | 45.97*** | 45.80*** | 46.08*** | 44.99*** |
| | (3.227) | (3.246) | (3.199) | (3.185) | (3.310) |
| Observations | 934 | 934 | 934 | 934 | 934 |
| R-squared | 0.982 | 0.982 | 0.983 | 0.983 | 0.984 |
| Country dummy | YES | YES | YES | YES | YES |
| Sector dummy | YES | YES | YES | YES | YES |
| Size dummy | YES | YES | YES | YES | YES |
| Country-Sector | YES | YES | YES | YES | YES |
| Sector-Size | YES | YES | YES | YES | YES |
| Size-trends | | YES | YES | YES | YES |
| Sector-trends | | | YES | YES | YES |
| Sec-Size-trends | | | | YES | YES |
| Country-trends | | | | | YES |
| Country-Sec-trends | | | | | YES |

Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

To complement the results just presented, we move to the impact of the degree of centralization of the bargaining regime on the decision of firms to decrease their labor force as a way to cut labor costs. As shown in figure 2, the majority of the countries in our sample experienced an increase in the level of unemployment right after the Great Recession. What differs between the group of eastern countries, such as Estonia, Lithuania, Hungary, and Slovakia which suffered from a big increase in unemployment right after the crisis and that are characterized by more decentralized bargaining structures, and western countries like Spain, Italy, Portugal, and Slovenia – which also saw a dramatic increase in the level of unemployment but are all characterized by centralized bargaining systems – was the capacity of the first group to go back to pre-crisis level of unemployment after 2010. The second group instead, which includes most of the so-called stressed countries, still exhibited high unemployment rates after 2013. As our results from the previous two tables and of

figure 3 show, this heterogeneity in employment experiences also emerges in the analysis of wage dynamics and wage rigidities, which, in line with theoretical predictions, might in turn explain the different dynamics in employment across firms engaging in different bargaining regimes. Table 5 supports this hypothesis reporting the results of the same specification used for wages, but for changes in employment. [15]

While in table 5 – where we control only for country, industry, firm-size and year dummies – we find no significant difference in the share of shrinking firms across firms, which are subject to different bargaining regimes, in table 6, where we add the usual battery of fixed effects and trends, our results are in line with theoretical predictions. More specifically, we find that – in the aftermath of the global financial crisis – the share of firms cutting employment was higher in those cells with a higher share of firms subject to centralized bargaining. In particular, our results imply that a standard deviation increase in the share of firms which were subject to multi-level bargaining within a cell leads to an increase in the share of firms reducing the labor force of approximately 25%. The coefficient for multi-employer bargaining is less precisely estimated but of the expected sign. On the contrary, and as expected, the coefficient of firm-level bargaining is not significant. This is in line with the theory, as at the firm-level both wages and employment are bargained. Therefore, as showed in table 3 and 4, the bargained cost of labor can fall as a response to the fall in aggregate demand caused by the crisis. In this way, the reduction of the labor force is mitigated (Card, 1990; Nickell and Andrews, 1983).

[15] Despite the fact that **Germany** and **Austria** provide information on firms with more than 1 employee, for these two countries the use of the full (unweighted) sample is not encouraged according to CompNet User Guide (2016). According to this document, the samples in both countries include only 1-3% of firms in the population but covers 30-40% of the total employment, thus indicating a clear bias towards large firms in both countries. The 20E sample (which is population weighted) is more comparable, and therefore recommended for cross-country analysis. For these reasons we exclude these two countries when using the full sample.

Table 5: Share of shrinking firms

| Share of srinking firms | (1) Model 2 | (2) Model 2 | (3) Model 3 |
|---|---|---|---|
| Multi-level | 0.205*** | 0.145** | 0.108 |
| | (0.0663) | (0.0666) | (0.0648) |
| Multi-employer | 0.134*** | 0.120*** | 0.110*** |
| | (0.0368) | (0.0354) | (0.0316) |
| Firm-level | 0.100 | 0.0916 | 0.0861 |
| | (0.0993) | (0.0798) | (0.0626) |
| ML*Crisis | -0.134** | | |
| | (0.0519) | | |
| ME*Crisis | -0.0183 | | |
| | (0.0318) | | |
| FL*Crisis | -0.0549 | | |
| | (0.112) | | |
| ML*Crisis(+1) | | -0.0462 | |
| | | (0.0633) | |
| ME*Crisis(+1) | | 7.60e-06 | |
| | | (0.0313) | |
| FL*Crisis(+1) | | -0.0435 | |
| | | (0.100) | |
| ML*Crisis(+2) | | | 0.0457 |
| | | | (0.0791) |
| ME*Crisis(+2) | | | 0.0196 |
| | | | (0.0327) |
| FL*Crisis(+2) | | | -0.0761 |
| | | | (0.0889) |
| Constant | 0.261*** | 0.276*** | 0.285*** |
| | (0.0186) | (0.0164) | (0.0140) |
| Observations | 579 | 579 | 579 |
| R-squared | 0.634 | 0.617 | 0.620 |
| Country dummy | YES | YES | YES |
| Sector dummy | YES | YES | YES |
| Size dummy | YES | YES | YES |
| Year dummy | YES | YES | YES |

Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6: Share of shrinking firms – Robustness

| Share of srinking firms | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| Multi-level | 0.0578 | 0.0814 | 0.0917 | 0.101 | 0.0399 |
| | (0.0879) | (0.0864) | (0.0909) | (0.0971) | (0.0903) |
| Multi-employer | 0.0800 | 0.124 | 0.113 | 0.121 | 0.132 |
| | (0.0739) | (0.0747) | (0.0723) | (0.0763) | (0.0780) |
| Firm-level | 0.0626 | 0.0407 | 0.0510 | 0.0605 | 0.0385 |
| | (0.0682) | (0.0754) | (0.0726) | (0.0754) | (0.0757) |
| ML*Crisis(+2) | 0.0319 | 0.0745 | 0.0526** | 0.0479* | 0.240*** |
| | (0.0663) | (0.0684) | (0.0251) | (0.0268) | (0.0638) |
| ME*Crisis(+2) | 0.0186 | 0.0245 | 0.0588** | 0.0602** | 0.0538 |
| | (0.0327) | (0.0310) | (0.0237) | (0.0256) | (0.0358) |
| FL*Crisis(+2) | -0.0819 | 0.0181 | 0.0154 | 0.0117 | 0.0708 |
| | (0.0905) | (0.101) | (0.0551) | (0.0606) | (0.101) |
| Constant | 0.271*** | 0.251*** | 0.277*** | 0.275*** | 0.253*** |
| | (0.0171) | (0.0170) | (0.0166) | (0.0195) | (0.0116) |
| Observations | 567 | 567 | 567 | 567 | 567 |
| R-squared | 0.653 | 0.668 | 0.728 | 0.731 | 0.786 |
| Country dummies | YES | YES | YES | YES | YES |
| Sector dummies | YES | YES | YES | YES | YES |
| Size dummies | YES | YES | YES | YES | YES |
| Year dummies | YES | YES | YES | YES | YES |
| Country-Sector | YES | YES | YES | YES | YES |
| Sector-Size | YES | YES | YES | YES | YES |
| Size-year | | YES | YES | YES | YES |
| Sector-year | | | YES | YES | YES |
| Sec-Size-year | | | | YES | YES |
| Country-year | | | | | YES |
| Country-Sec_tear | | | | | YES |

Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Lastly, we look at profits to check whether they have represented an alternative adjustment mechanism.[16] More specifically firms can decide to adjust to a negative shock through prices, which in turn define their profits, instead of acting solely through adjustments in labor costs. We expect this to be true especially for those firms that cannot react through a reduction in wages. Table 7 seems to confirm our hypothesis that once hit by a negative shock, firms that are more constrained in their adjustment by higher downward wage rigidity are more likely to see their profit decrease; as our coefficients indicating centralized regimes start to be negative with some lag but not very significant.

[16] The variable profit margin has not been computed by Austria, Hungary, and Malta which are therefore excluded from this analysis.

Table 7: Profit Margin

| Profit Margin | (1) | (2) | (3) |
|---|---|---|---|
| Multi-level | 0.0123 | 0.0155 | 0.0130 |
| | (0.0211) | (0.0210) | (0.0206) |
| Multi-employer | -0.0126 | -0.00562 | -0.00375 |
| | (0.0129) | (0.0123) | (0.0127) |
| Firm-level | 0.0345* | 0.0433** | 0.0426** |
| | (0.0176) | (0.0176) | (0.0175) |
| ML*Crisis | -0.00280 | | |
| | (0.00795) | | |
| ME*Crisis | 0.0111 | | |
| | (0.00663) | | |
| FL*Crisis | 0.00504 | | |
| | (0.0145) | | |
| ML*Crisis(+1) | | -0.0123 | |
| | | (0.0106) | |
| ME*Crisis(+1) | | -0.00209 | |
| | | (0.00532) | |
| FL*Crisis(+1) | | -0.0145 | |
| | | (0.0124) | |
| ML*Crisis(+2) | | | -0.00945 |
| | | | (0.00781) |
| ME*Crisis(+2) | | | -0.00973* |
| | | | (0.00543) |
| FL*Crisis(+2) | | | -0.0198 |
| | | | (0.0142) |
| Constant | 0.00381 | 0.000497 | 5.28e-05 |
| | (0.0140) | (0.0137) | (0.0137) |
| Observations | 798 | 798 | 798 |
| R-squared | 0.501 | 0.500 | 0.502 |
| Country dummy | YES | YES | YES |
| Sector dummy | YES | YES | YES |
| Size dummy | YES | YES | YES |
| Year dummy | YES | YES | YES |

Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

If we turn our attention to f Table 8, where we have added all our additional fixed effects and trends, we can see that being subject to multi-level bargaining set-ups is associated with a significant decrease in profit margin in the aftermath of the GCF. In particular, a standard deviation increase in the share of firms in multi-level set-ups is predicted to reduce profit margin by 20%. The coefficient of multi-employer bargaining instead is less precisely estimated but of the expected sign. This could be explained by the fact that firms in multi-employer bargaining tend to be more heterogeneous both in terms of country of origin and of size. Also, the fact that we expect that only most profitable firms will be willing and able to cut profits to react to a negative shock can be an explanation for the lack of a statistically significant reduction in profit margin for this group of firms.

Table 8: Profit Margin – Robustness

| Profit Margin | (1) C-S S-Z | (2) Z-Y | (3) S-Y | (4) S-Z-Y | (5) C-S-Y |
|---|---|---|---|---|---|
| Multi-level | 0.0106 | 0.0129 | 0.0140 | 0.0141 | 0.0167 |
| | (0.0236) | (0.0236) | (0.0233) | (0.0230) | (0.0245) |
| Multi-employer | -0.00486 | -0.00475 | -0.00475 | -0.00488 | 0.00183 |
| | (0.0153) | (0.0153) | (0.0149) | (0.0148) | (0.0158) |
| Firm-level | 0.0264 | 0.0305 | 0.0291 | 0.0286 | 0.0257 |
| | (0.0193) | (0.0189) | (0.0198) | (0.0196) | (0.0192) |
| ML*Crisis(+1) | -0.0125 | -0.0178 | -0.0209*** | -0.0209*** | -0.0285* |
| | (0.0107) | (0.0110) | (0.00711) | (0.00694) | (0.0157) |
| ME*Crisis(+1) | -0.00212 | -0.00142 | -0.00169 | -0.00139 | -0.0180** |
| | (0.00545) | (0.00556) | (0.00573) | (0.00568) | (0.00835) |
| FL*Crisis(+1) | -0.0154 | -0.0255* | -0.0223* | -0.0203 | -0.0135 |
| | (0.0128) | (0.0136) | (0.0124) | (0.0123) | (0.0109) |
| Constant | 0.0158 | 0.0180 | 0.0136 | 0.0161 | 5.685*** |
| | (0.0154) | (0.0155) | (0.0156) | (0.0155) | (0.443) |
| Observations | 798 | 798 | 798 | 798 | 798 |
| R-squared | 0.615 | 0.620 | 0.639 | 0.641 | 0.694 |
| Country dummies | YES | YES | YES | YES | YES |
| Sector dummies | YES | YES | YES | YES | YES |
| Size dummies | YES | YES | YES | YES | YES |
| Year dummies | YES | YES | YES | YES | YES |
| Country-Sector | YES | YES | YES | YES | YES |
| Sector-Size | YES | YES | YES | YES | YES |
| Size-trends | | YES | YES | YES | YES |
| Sector-trends | | | YES | YES | YES |
| Sec-Size-trends | | | | YES | YES |
| Country-trends | | | | | YES |
| Country-Sec-trends | | | | | YES |

Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In conclusion, the results just presented do confirm that the incidence of wage bargaining constraints on firm wages is heterogeneous across cells and that the extent of wage flexibility at the firm-level plays a key role in shaping the relative importance of wages, employment and profit adjustment to the crisis. They also show that better data, i.e. micro-distributed data comparable across country, help in achieving theoretically sensible and economically meaningful results. Moreover, these results are robust to a full battery of fixed effects and trends at the micro-level. In this way, the type of variation we exploit to answer our questions should be more convincing.

# 6. Conclusions

This paper investigates whether the different degree of downward wage rigidity characterizing centralized and decentralized bargaining systems across EU countries influenced the speed and nature of the adjustments to the Great Recession of firms operating under the two different systems. To do this we merge two existing datasets: one (WDN) – survey based – collects information on existing wage bargaining set-ups, and another (CompNet) provides hard data out of firms' balance sheets. In so doing we create a novel micro-distributed database at the country/sector/firm-size level for 13 EU countries. This novel micro-founded data set contains information which is comparable across countries and is one of the main original contributions of this paper.

Using this dataset, we find empirical evidence that the degree of wage flexibility – implicit in centralized and decentralized wage bargaining systems – plays a key role in shaping firms response to the crisis. In particular we find that firms subject to centralized systems of wage negotiation – like multi-level and multi-employer bargaining, and therefore subject to a greater degree of downward wage rigidity – experienced decrease in their size and lower profits more often that the firms subject to decentralized regimes, which instead were able to cut labor costs more flexibly. These findings are in line with what theory would predict, i.e. that wage bargaining set-ups can amplify the impact of adverse shocks. The results are also empirically more solid than the ones obtained by previous literature, as we use more granular data while keeping a cross-country approach. Moreover, our results are robust to a full battery of fixed effects and time-trends. In a period in which several countries – such as Portugal, Greece or Spain – are undertaking substantial structural reforms, underlying the role that institutional set-ups can have in facilitating the shock absorption has important policy implications. This is particularly important in the case of a monetary union, where cross-country differences in the ability to adjust wages in response to an adverse shock may counter the needed economic convergence of member states.

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# A. Wage Bargaining classification

The WDN is a research network of the European System of Central Banks (ESCB) which carried out a unique cross-country, firm level survey. The survey was carried out in two waves: while both waves are structured in the same way and contain some identical questions, the first wave (2006-2009) is aimed at identifying the sources and features of wage and labor cost dynamics in 17 ESCB countries, as opposed to the second wave whose goal was to assess labor market adjustments in the aftermath of the Great Recession (2010-2013) in 25 ESCB countries.[17]

In the context of our analysis, the survey data are specifically used to measure wage bargaining institutions at the firm level across countries. More specifically, all firms in the sample were asked whether they were applying a collective pay agreement bargained and signed at the firm level and whether they were applying a collective pay agreement bargained and signed outside the firm. We aggregated the answer to these questions at the country-sector-size level ("a cell") and we calculated for each cell the share of firms engaging in bargaining at the plant level, at the multi-employer level, or at no bargaining at all. As previously stressed, among the various characterizing features of wage bargaining regimes the level at which bargaining takes place, or, in other worlds, the degree of centralization of the negotiations, is likely to be the major responsible for the inhibition of wage adjustment mechanisms.

For our analysis, as a rule we have used the last WDN wave. However, given that during the period covered by the last wave some countries carried out structural reforms also with respect to the wage bargaining regulations, we had to use the first wave of the survey in order to be able to claim that our measures are indeed time invariant over the period analyzed, i.e. 2006-2012. The tables below document when this was the case and categorizes the countries in two-tier and non-two-tier and explain how we treated the raw data based on this classification. Once again, note that that two-tier countries are characterized by the fact that stand-alone plant-level bargaining is permitted only if it supplements sector-level bargaining by negotiating higher wages, while in non-two-tier countries company bargaining, which dominates, is purely at the firm-level and is not dependent on centralized bargaining agreements.

[17] The countries surveyed in the first wave are: Austria, Belgium, Cyprus, Czech Republic, Estonia, France, Greece, Hungary, Ireland, Italy, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Slovenia, and Spain. Bulgaria, Croatia, Germany, Latvia, Malta, Romania, Slovakia, and the United Kingdom joined the Network later and are included in the third survey wave only.

Table A1: Wage bargaining classification (1)

| Country | Classification | Rationale | Adjustments and WDN wave used |
|---|---|---|---|
| AT Austria | Centralized Two-tier | - The most important level of collective wage bargaining is the multi-employer sectoral level.<br>- It is not possible to derogate from collective wage agreements in order to pay wages below the collectively agreed level (the favorability principle applies). | - No adjustments required to WDN3 data. |
| DE Germany | Decentralized Non-two-tier | - The dominant feature was sectoral collective bargaining. However, an unprecedented decentralization of the wage-setting process to the firm level took place.<br>- Even within union wage contracts negotiated at the industry level, there is scope for wage flexibility at the firm level through so-called "opening". These allow the works council to negotiate arrangements which are less favorable than those set out in the industry-level agreement, to take account of the particular circumstances of their | - Being a non-two-tier country, firms stating to bargain both at sector and company level were considered as firms bargaining at company level only<br>- WDN3 data has been used |
| EE Estonia | Decentralized Non-two-tier | - The labor market is characterized by a high degree of wage flexibility and almost fully decentralized wage setting, with wages being determined mostly within firms.<br>- A comprehensive reform to EPL entered into force in 2009, aimed at easing employment protection by reducing the costs of terminating employment relationships. However, no reforms targeting wage bargaining regimes specifically have been implemented in the period under analysis. | - Being a non-two-tier Country, firms stating to bargain both at sector and company level were considered as firms bargaining at company level only<br>- WDN3 data has been used |
| ES Spain | Centralized Two-tier | - Spain has had one of the highest rates of collective bargaining coverage. The main level of collective bargaining has traditionally been the sectoral level.<br>- New legislation in 2012 gives preference to company agreements and allows companies to derogate from collective agreements. | - Due to the 2012 reform heavily affecting collective wage bargaining procedures, the previous wave of WDN data (WDN1) was used<br>- No further adjustments required |
| FR France | Centralized Two-tier | - Wage bargaining in France is predominantly conducted at sectoral level.<br>- The principle of favor forbids company agreements from providing less favorable provisions than higher-level agreements. This principle has been diluted through a recent reforms in 2013 aimed at reducing labor costs. | - Due to the recent reform heavily affecting collective wage bargaining procedures, the previous wave of WDN data (WDN1) was used.<br>-No further adjustments were required. |
| HU Hungary | Decentralized Non-two-tier | - The most important level of collective wage bargaining is the company level.<br>- The new 2012 Labor Code aimes at allowing parties to enjoy greater contractual freedom in both employment contracts and collective agreements. | - Due to the 2012 reform heavily affecting collective wage bargaining procedures, the previous wave of WDN data (WDN1) was used.<br>-No further adjustments were required. |
| IT Italy | Centralized Two-tier | - The collective bargaining structure consists of two levels: national agreements, setting the minimum wage levels, and firm-level contracts, aimed at negotiating additional wage components. The dominant bargaining level remains the sectoral one.<br>- Since 2011, actions have been undertaken by social partners to favor decentralization. | - Due to the recent reforms heavily affecting collective wage bargaining procedures, the previous wave of WDN data (WDN1) was used.<br>-No further adjustments were required. |

Table A2: Wage bargaining classification (2)

| Country | Classification | Rationale | Adjustments |
|---|---|---|---|
| LT Lithuania | Decentralized Non-two-tier | - Collective bargaining takes place virtually only at the company level. | - Being a non-two-tier Country, firms stating to bargain both at sector and company level were considered as firms bargaining at company level only<br>- WDN3 data has been used |
| MT Malta | Decentralized Non-two-tier | - The wage setting practice is mainly based on collective bargaining at firm level. | - Being a non-two-tier Country, firms stating to bargain both at sector and company level were considered as firms bargaining at company level only<br>- WDN3 data has been used |
| PL Poland | Decentralized Non-two-tier | - Collective agreements are mostly concluded at the company level.<br>- It is possible to derogate from a collective agreement (in full or in part) because of the financial situation of the employer. | - Being a non-two-tier Country, firms stating to bargain both at sector and company level were considered as firms bargaining at company level only<br>- WDN3 data has been used |
| PT Portugal | Centralized Two-tier | - Portugal has traditionally had a high level of collective bargaining coverage. The dominant level is the sector or branch and derogation is not possible.<br>- An important reform of the collective bargaining system came into effect in 2012. | - Due to the 2012 reforms heavily affecting collective wage setting procedures, the previous wave of WDN data (WDN1) was used<br>- No further adjustments were required. |
| SL Slovenia | Centralized Two-two-tier | - The sectoral level is the dominant level of bargaining and pay setting for most sectors in Slovenia. . Sectoral bargaining can be supplemented at company level, where agreements at a lower level can only improve on the arrangements reached at the higher level.<br>- The largest labor market reform was in 2013, to increase labor market flaxibility and decrease labour market duality. It targeted EPL regulation. | - Due to the nature of labour market reforms over the period of interest, which did not affect directly the wage setting regulation, the most recent wave of WDN data (WDN3) was used<br>-No further adjustments were required. |
| SK Slovakia | Decentralized Two-tier | - Collective bargaining takes place at both industry and company level.<br>- Company agreements can only improve on what has been negotiated at industry level. | - No adjustments required to WDN3 data. |

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ISSN 2513-1303

Member of Leibniz Association