Collective Bargaining in Europe: A Systematic Data-Driven Description*

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Abstract

This paper presents the first systematic, data-driven cross-country analysis of collective bargaining (CB) institutions in Europe, focusing on wage floors and contracted wage increases in Finland, France, Germany, Italy, Norway, and Portugal. We compile roughly twenty years of CB agreements and link them to detailed micro-data (linked employer–employee and balance sheet data, except for survey-based Germany). A core contribution is the harmonization of heterogeneous data infrastructures into three categories: Linked, Imputed, and Survey data. The analysis documents marked institutional heterogeneity: contracted wage increases are binding at the individual level in Finland, Germany, and Italy (or at the firm-average level in Norway), but largely absent in France and Portugal. In PPP-adjusted terms, wage floors are lower in Italy and Portugal. Adjustments in wage floors and contracted increases are highly concentrated and synchronized across industries. Using a centralization measure capturing the direct CB coverage of workers, we document substantial cross-country variation and a strong negative association between centralization and industry-level wages.

Keywords: collective bargaining, wage setting, wage floor, contracted wage increases **JEL Codes:** J01, J08, J38, J52, J58

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1 Introduction

Collective bargaining (CB) is a central feature of labor market institutions in European countries, as well as in many other developed countries (Bhuller et al., 2022). Despite numerous single-country studies, the literature lacks systematic, data-driven cross-country analyses of CB institutions.[1] A deeper understanding of the institutional features of wage setting has a profound impact for the design of public policies. For instance, the recent EU Directive 2022/2041 "Adequate minimum wages in the European Union" has sparked intense debate among Member States. To date, the literature lacks a micro-founded systematic description of CB agreements across countries. This type of analysis is essential for understanding wage setting mechanisms across different labor markets, because a meta-analysis of the existing evidence would be hard to interpret due to project-specific variable definitions and sampling constraints that limit the external validity of the findings.

This project addresses the gap in cross-country CB system descriptions by providing a systematic data description of how the institutional features of CB systems can be understood within a common context. We analyze institutional aspects of wage-related CB features, such as wage floors and contracted wage increases, using information from six European countries: Finland, France, Germany, Italy, Norway, and Portugal. For each country, we compiled approximately twenty years of CB agreements and combined this information to detailed linked employer-employee and balance sheet micro-data (except for Germany, where the analysis is survey-based). We describe how to create as harmonized data as possible in six different countries, when such data do not exist. By harmonizing variable definitions and sampling schemes, we can describe to what extent results are comparable across countries. We also discuss important institutional differences across countries. To our knowledge, this study is the first of this kind to describe the linking of employer-employee micro data to collectively bargained wage floors and contracted wage increases in several countries.

The harmonized data enables us to make the following contributions to the literature divided on two main themes, one is data harmonization and the second is describing the institutional differences across countries. First, we describe how we link CB details to microdata in different countries to create as harmonized data as possible. This is a challenging task, because such linked data is lacking previously in most of our countries, and each of the components, the CB data and microdata differ in infrastructure across countries. We discuss the challenges that arise from this harmonization undertaking.

[1] For single-country studies, see for instance, Gautier et al. (2019) for France, Card and Cardoso (2022) for Portugal, Adamopoulou and Villanueva (2022) for Spain, and Fanfani (2023) for Italy, among others. See also OECD (2019b) for a review of previous research on unions and collective bargaining. For a general institutional description of CB systems, see e.g., OECD (2019a).

Second, in effort to describe how the CB institutions vary across countries, we describe several key institutional features of CB in our data. We also discuss how the description is affected by the issues arising in the first step.

Earlier research have mainly provided macro-level, cross-country descriptive accounts of CB institutions (see e.g., OECD, 2017).[2] Cross-country comparisons of minimum wages relative to median wages (i.e., Kaitz index) are generally limited to institutional contexts with a statutory minimum wage (see e.g., OECD, 2022).[3] Under collective bargaining, agreements set schedules of wage floors that vary by agreement and by worker or job characteristics, leading to hundreds distinct wage floors within a country. The literature does not provide harmonized cross-country descriptions or comparisons of these collectively agreed wage floors. An analysis of collectively bargained wage floors requires micro data and information on the occupation-specific collective agreement under which each worker is employed. Related empirical work examines the determinants of collective bargaining coverage using macro-level data (see e.g., Traxler, 1996). The literature lacks quantitative analyses of wage floors that apply standardized procedures to harmonized micro data. Notably, using micro data allows us to analyze the full wage distribution rather than only mean outcomes. An exception is Garnero et al. (2015), who link institutional features of minimum wage systems to the minimum wage bite using data on more than 1,100 collective bargaining agreements across 17 European countries: sectoral, bargained minima raise the Kaitz index relative to statutory floors but are also associated with a higher incidence of workers paid below prevailing minima; greater collective bargaining coverage mitigates this trade-off.

We start by describing country-country variation in coverage of CB. This metric is relevant for the potential of the CB to affect the workforce, as it can only affect directly those that are covered by it. Coverage turns out to vary a lot across our six countries. One reason for this is that in some countries the CBAs are extended to cover also firms that are not organized by law. In other countries the use of extensions and how much coverage increases through them varies.

One key institutional feature is the schedule of wage floors. Under CB the CBA contain a schedule of wage floors that vary within the contract along characteristics of the employees, such as, the occupation, educational attainment, tenure in the job, the region where the job is. We describe the level at which average wage floors across industries are set in different countries in common terms, such as in PPP terms, or relative to the median wages within a country. We also describe in this setting how wage floors vary from one year to another, which describe the schedule of wage floors and how dispersed that is across industries.

Moreover, we describe a central feature of CB that differ across European countries:

[2] Jäger et al. (2025) provide a comprehensive, up-to-date overview of the literature.

[3] EU minimum wages are typically about half of average full-time wages, with most countries clustered at 45–55% and a few near 60% (OECD, 2022).

whether or not negotiating takes place over contracted wage increases: it is a central feature of CB in four out of our six European countries. Contracted wage increases apply at least at some level to all workers, while wage floors apply directly only to those whose wage is at the wage floor.

Another interesting feature is to what extent CB agreements are coordinated consistently within each country or vary substantially across sectors. Finally, to give the above descriptions a number to illustrate their meaningfulness, we investigate the degree of CB centralization in each country. Variation in centralization essentially describes to what extent CB has the potential to directly affect wage distributions of countries. We define it as the proportion of the workforce whose wages are directly influenced by CB through either wage floors or contracted wage increases.

Our findings firstly show the possibilities and challenges in trying to construct harmonized data in six very different countries in terms of data infrastructure. We create three different groups based on how well the data is linked. In the first group that we label "Linked data" are Finland, Norway and Portugal from our countries. There the collective bargaining features such as wage floors can be linked with microdata fairly precisely such that all the personalized wage floors that depend on industry, exact profession, tenure in the job, education etc. are linked to individuals based on these characteristics. In the second group that we label "Imputed data" are France and Italy. There the CBA and the wage floors they contain need to be imputed, for example, based on most common occupations and the full schedule of wage floors cannot be then used. This produces a coarser description of CB than in the first group but one that is still informative about differences in CB across countries. In the third group that we label "Survey data" we have Germany, where the wage floors are interpreted from a survey to plants. The survey does not contain any exact wage floors, rather the cushions of wages above wage floors, and thus the wage floors are imputed indirectly from these. Also in this case other caveats about survey data apply, such as imprecision in the measurement.

We then describe how CB differ across our countries institutionally and discuss how the differences in data infrastructure affect these results. We find differences across countries when examining the location of levels of wage floors in common PPP terms to the extent that these differences are not driven by differences in data infrastructure. In Finland and France the 1 digit industry-level average wage floors are relatively concentrated, while in Norway they are not as concentrated and in France and Portugal there is much wider variation across average wage floors. Moreover, in the common PPP terms the lowest average wage floors are at much lower levels in Italy and Portugal than in our three other countries.

When examining the variation across all wage floors the picture changes somewhat. Here the differences in data infrastructure complicate the comparison. We can describe

the wage floors within our three groups more straightforwardly, but not across groups. In group 1) "Linked data", Portugal has the most concentrated and typically again lower wage floors within this group, Finland has the second highest wage floors and Norway the highest. The dispersion of wage floors are relatively similar in Finland and Norway with Finnish wage floors being slightly more dense, but both are much more dispersed than Portugal. In group 2) "Imputed data" Italy has lower wage floors than France, but they have relatively similarly dense distributions except for few outliers. The density is created by the imputation method, because not all wage floors can be linked to microdata, rather only a selection of wage floors are imputed. This produces a denser distribution than in group 1). In group 3) "Survey data" the German wage floors are very wide, and this is likely the product of imputing the wage floors to survey data that does not have the exact wage floors but they need to be backed out from other variables, and the measurement error in survey data.

Institutionally it is interesting to note the contractual wage increases that only occur in Finland, Germany and Italy in the fashion that they apply to all workers such that they are at least partially binding. This means that all the workers covered by a specific agreement that specifies, for example, certain percentage increase in wage for all workers, should receive at least that percentage. Sometimes the contracted wage increases are specified as euro amount increases. In Norway the contracted wage increases are not mandated at individual level, but are rather agreements that firm-level average wages should increase by certain percentage or amount. There are no contracted wage increases in France or Portugal. In the latter two countries only the wage floors are increased, but these of course affect directly only individuals at wage floors, and potentially indirectly others with slightly higher wages. These differences create a large and interesting differences in how CB can affect wages across countries.

We then describe the changes in wage floors and changes in contractual wage increases across countries. These changes are more reliable despite the linking / imputing issues than wage floor levels, because the wage floors and contracted wage increases tend to have less variation within a contract or even across industries. The changes in wage floors and contracted wage increases are relatively concentrated to the same value in all countries. This suggests that the changes are relatively coordinated within a country, such that different sectors tend to have similar changes in their CB wages.

We next attempt to provide a description in a single measure that captures to what extent different features of collective bargaining has the potential to directly affect wage distributions across our six countries, and which features are contributing the most. This is done just for illustrative purposes to highlight the potential of the CB, because the end result is potentially more affected by differences in data quality than the actual bite of the CB systems. To build the measure we use the link between CB information and employer-employee data to examine what fraction of individuals are at or very

close to the wage floor that applies to them, and / or how many individuals receive wage increases that match the contracted wage increases. The more individuals seem to be restricted in their wages by the CB system in the manner just described, the more concentrated the system is seen. An important contribution is also what fraction of the workforce has wage setting affected by the CB.

This illustrative concentration measure reveals significant variation in CB centralization among our countries. In group 1) Finland has the highest concentration measure. This result stems from the very high fraction of individuals receiving as wage increases exactly the contracted wage increases. In Portugal the concentration measure stemming from wage floors is three-fold relative to other countries. That is, in Portugal much higher fraction of the workforce receives wages at wage floors than in our other countries. Norway has the lowest concentration measure in group 1). In group 2) the concentration measures tend to be lower than in group 1) and this likely reflects the imputation nature of data in France and Italy. We could not match all individuals to their correct wage floors or contracts, thus we derived a low concentration measure. In group 3) the German concentration measure is a bit higher, but this again could reflect the fact that wage floors are imputed indirectly using survey data, thus some imputed wage floors are not the true wage floors but at a higher level, leaving to a higher concentration measure.

We also illustrate to what extent potential variation in CB over time and across countries reflects macroeconomic conditions. To this aim, we correlate wage floors variation with macroeconomic variables. At this stage we correlate the concentration measure with employment share (reflecting the relative size of the industry) and average wages within 1-digit industry, country and year. Interestingly, we find that concentration measure is not that correlated with employment share, but is strongly negatively correlated with average wages.

This article continues by providing a brief conceptual framework for our setting in Section 2, describing collective bargaining institutions in all our six countries in Section 3 and data in Section 4. Section 5 presents our main results and Section 6 concludes. Tables and Figures are presented after the main text.

2 Conceptual framework

We seek to clarify some definitions and relationships involving wage components that are negotiated in sectoral collective bargaining in European countries. To facilitate comparisons, we distinguish between three different regimes, depending on which wage components are negotiated at the sectoral level. For ease, we only consider a setup with a single CB unit, assume full compliance, and focus on the passthroughs of CB wage rates on the distribution of final wages for different workers.

Regime 1: Collective bargaining determines wage floors

Consider the case where the sectoral collective bargaining in period t determines a wage floor f_t, which is applied to all workers in the CB unit. Accordingly, we denote the previous period wage floor as f_{t-1} and the change in wage floor as $\triangle f_t$. We denote the final wage in period t as w_t and define the (local) wage cushion in period t as $c_t := w_t - f_t$. It is further useful to define the concept of (local) wage drift as $\triangle c_t := \triangle w_t - \triangle f_t$.

Beyond the wage floor f_t, let's now imagine that the sectoral bargain puts no additional constraints on wages for workers that are paid above the wage floor or on the local wage components. In this case, the sectoral CB implies the following changes in the distribution of final wages $\triangle w_t$:

$$\triangle w_t = \begin{cases} \triangle f_t & \text{if } w_{t-1} = f_{t-1} \\ \triangle f_t - c_{t-1} & \text{if } f_{t-1} < w_{t-1} < f_t \\ 0 & \text{if } w_{t-1} \geq f_t \end{cases} \tag{1}$$

Thus, the wages for "fully constrained" workers increase in accordance with the floor adjustment, i.e., the passthrough is 1, while the wages for "partially constrained" workers increase less than the floor adjustment, i.e., the passthrough is below 1, and there is no change in wages for "unconstrained" workers. Put differently, unless the local wage components are retained, the adjustments in wage floors will imply changes in wage cushions as follows:

$$\triangle c_t = \begin{cases} 0 & \text{if } w_{t-1} = f_{t-1} \\ -c_{t-1} & \text{if } f_{t-1} < w_{t-1} < f_t \\ -\triangle f_t & \text{if } w_{t-1} \geq f_t \end{cases} \tag{2}$$

In practice, even in a "pure" wage floor bargaining regime, local wage components may change over time, either in response to the CB wage floor adjustments or due to other unrelated factors. Nevertheless, under full compliance, CB wage floor adjustments put some structure on how wage cushions can change for different workers. In particular, we must have $\triangle c_t \geq 0$ for the "fully constrained" workers (as $c_{t-1} = 0$ and f_t is binding), while $\triangle c_t \leqslant 0$ for other worker groups. This will have implications for the measurement of passthroughs of CB wage floors on wages for different workers.

Regime 2: Collective bargaining determines base wages

Let's now consider the case where the sectoral collective bargaining in period t determines a base wage b_t, which is applied to all workers in the CB unit. Accordingly, we denote the previous period base wage as b_{t-1} and the change in base wage as $\triangle b_t$. As earlier, we denote the final wage in period t as w_t, which now includes (local) wage

supplements $s_t := w_t - b_t$. We imagine the contract to be such that supplements are "added" to the salary of workers as a top-up on their base wage. Accordingly, we define the change in (local) wage supplements as $\triangle s_t := \triangle w_t - \triangle b_t$.

Unlike in the previous regime, when the sectoral CB adjusts the base wages b_t, this adjustment should be reflected in the wages of all workers covered in the CB unit. Effectively, this means that the sectoral bargain puts constraints on the wage *growth* even for workers that are paid above the base wage. In the special case where local wage supplements are fully retained, i.e., $\triangle s_t = 0$, the sectoral CB implies the following changes in the distribution of final wages $\triangle w_t$:

$$\triangle w_t = \begin{cases} \triangle b_t & \text{if } w_{t-1} = b_{t-1} \\ \triangle b_t & \text{if } b_{t-1} < w_{t-1} < b_t \\ \triangle b_t & \text{if } w_{t-1} \geq b_t \end{cases} \tag{3}$$

Thus, wages for all workers, independent of their initial wage level, increase in accordance with the base adjustment, i.e., the passthrough is 1. In practice, local wage components may change over time. Nevertheless, under full compliance, base wage adjustments put some structure on how supplements can change for different workers. In particular, we must have $\triangle s_t \geq 0$ for the "fully constrained" workers (as $s_{t-1} = 0$ and b_t is binding), while $\triangle s_t \lesseqgtr 0$ for other worker groups. This will have implications for the measurement of passthroughs for different workers.

Regime 3: Collective bargaining has general increases and floors

Let's now consider a regime where the sectoral collective bargaining in period t determines a general wage increase $\triangle g_t > 0$, which is applied to all workers in the CB unit. However, a "general wage increase" regime without a nominal benchmark is incomplete, as there is no "base" salary for new hires or inexperienced workers that can be assigned the general increase. This feature distinguishes this regime from the previous two. Thus, we rather consider a more realistic regime that has a general wage increase as well as a wage floor. In practice, the wage floor may be binding for newly hired or inexperienced workers who are yet to receive a general wage increase. As earlier, we denote the change in base wage as $\triangle f_t$ and the change in final wage as $\triangle w_t$. We also maintain the notions of wage cushions $c_t := w_t - f_t$ and wage drift $\triangle c_t := \triangle w_t - \triangle f_t$, where part of the wage drift may reflect a general wage increase.

In this regime, the sectoral bargain puts constraints on the wage *growth* for all workers as well as a wage floor constraint for some workers. For now, we disregard changes in local wage components. The two relevant cases to consider are $\triangle f_t > \triangle g_t$ and $\triangle f_t = \triangle g_t$. If $\triangle f_t < \triangle g_t$, we expect a wage increase of $\triangle g_t$ for incumbents. The sectoral CB thus implies the following changes in the distribution of final wages $\triangle w_t$:

$$\triangle w_t = \begin{cases} \triangle f_t & \text{if } \triangle f_t > \triangle g_t \text{ and } w_{t-1} = f_{t-1} \\ \triangle f_t - c_{t-1} & \text{if } \triangle f_t > \triangle g_t \text{ and } f_{t-1} < w_{t-1} < f_t - \triangle g_t \\ \triangle g_t & \text{if } \triangle f_t > \triangle g_t \text{ and } w_{t-1} \geq f_{t-1} + \triangle g_t \\ \triangle g_t & \text{if } \triangle f_t = \triangle g_t \text{ and } w_{t-1} = f_{t-1} \\ \triangle g_t & \text{if } \triangle f_t = \triangle g_t \text{ and } f_{t-1} < w_{t-1} < f_t - \triangle g_t \\ \triangle g_t & \text{if } \triangle f_t = \triangle g_t \text{ and } w_{t-1} \geq f_{t-1} + \triangle g_t \end{cases} \tag{4}$$

Notably, all workers are "constrained" in this regime. When $\triangle f_t > \triangle g_t$, the wages for "fully floor constrained" workers increase in accordance with the floor adjustment, i.e., the passthrough of wage floors is 1, while the wages for "partially floor constrained" workers increase less than the floor adjustment, i.e., the passthrough of wage floors is below 1 and this "eats" into their wage cushion. By comparison, the wages for "growth constrained" workers increase in accordance with the general increase, i.e., the passthrough of general wage increase is 1. When $\triangle f_t = \triangle g_t$, a general wage increase–similar to regime 2 with base wage adjustments–implies a wage growth of $\triangle g_t$ for all workers, i.e., the passthrough of general increase is 1.

In the above notation, we have disregarded changes in local wage components. Further allowing for adjustments in local wage components will have implications for the measurement of passthroughs of CB wage floors and general wage increases on final wages of different workers.

3 Institutional background

Here we describe how CB institutionally affects wages. We include a subchapter for each of our six countries.

The central elements of the CBA data are the wage floors informing the lowest possible wage for a worker that depend on industry and specific occupation of the worker, and possibly also on individual level characteristics, such as tenure in occupation or industry.

Another central element in the CBA data are contracted wage increases for Finland, Germany, Italy and Norway. The contracted wage increases are binding at worker level in the first three countries mentioned and on average workplace level in Norway. Contracted wage increases inform to what extent wages increase at minimum from one year to another.

3.1 Finland

In Finland, wages of the vast majority of the workforce is affected through sectoral collective bargaining (CB). Negotiations between the social partners focus primarily on contracted wage increases but also cover wage floors that depend on job and employee characteristics for each sector. Contracted wage increases are typically in percentages, but sometimes also euro amounts are used. This means that the base wage (not including overtime pay etc.) needs to increase by at least with the stated percentage or euro amount going to the next year. The important feature is that the contracted wage increases apply in a binding way to each worker covered by a particular contract. There are a few industries, where a part of the contracted wage increase is left to be locally (firm level) determined. Finland does not have a statutory minimum wage, the sectoral wage floors are thought to cover the workforce well enough. In addition, Collective Bargaining Agreements (CBAs) often include terms on working time, compensation for overtime, employer provided family benefits and other employment conditions, but wages remain the central item of bargaining. Typically CBAs are done for two years, in recent years also three-year agreements have been common (Vartiainen, 1998).

CB has long been and remains the cornerstone of the labor market despite a shift away from centralized wage agreements in the 2010s. Wage coordination has traditionally mostly followed an informal export-led idea, where the export sector, deemed most exposed to global competition, sets the benchmark for wage increases also for other sectors. Since 2018 the wage coordination is formalized to follow the export-led model, such that the contracted wage increases negotiated by the export sectors act as a ceiling for other sectors. This practice became institutionalized during the 2016 "Competitiveness Pact" (Kiky) negotiations that were led by the Government of Finland. The system aligns aggregate wage growth with the competitive pressures of the export industry with the idea of supporting employment in the export sectors.

The extension mechanism plays a key role in wage-setting: sectoral collective agreements are generally extended to be universally applicable by an independent committee under the Ministry of Social Affairs and Health if they meet representativeness criteria. As a result, almost 90% of the employees in Finland are covered by collective agreements either directly or through extensions (Ahtiainen, 2024). While union density has declined to around 55% (Ahtiainen, 2023), the system still delivers wide coverage through the extensions.

3.2 France

All workers must be paid at least the national minimum wage (SMIC). Beyond the legal national minimum wage, wages are primarily determined through collective bargaining, which occurs at both the industry level and the firm level.

At the industry level, nearly all firms are assigned to a specific "contractual industry", where wage agreements are negotiated. Once these agreements are signed by trade unions and employer organizations and then extended by the Ministry of Labour (usually within a few months), they automatically apply to all firms and workers in that industry, regardless of whether they participated in the negotiation. Firms and workers cannot opt out of these agreements. Regarding the relationship between industry-level and firm-level agreements: industry-level agreements set the minimum standards. Firms are allowed to offer higher wages, but not lower than what is set at the industry level.

Collective bargaining agreements (CBAs) mainly set legal minimum wages for each job category, rather than guaranteeing overall wage increases. Each CBA includes a classification grid that defines job levels based on factors such as skills, responsibilities, and experience. These grids establish minimum wages specific to each position, and it is illegal to pay workers below these levels. Annual wage negotiations are mandatory, but there is no obligation to reach an agreement each year. As a result, CBAs do not have a fixed duration, they remain in effect until a new agreement replaces them.

While most wage floors are set at the national industry level, some sectors also have regional or local agreements. On average, a typical CBA includes around 20 distinct wage levels (Fougère et al., 2018). Wage floors are usually specified as monthly amounts, and they may include bonuses. Unlike the national minimum wage (SMIC), they are not automatically adjusted for inflation.

3.3 Germany

The role of unions in wage setting in Germany has decreased markedly over the last decades, with the wage coverage of union contracts declining from around 80 percent in the early 1990s to around 40 percent now (Kügler et al., 2018). CBAs in Germany are concluded between unions and employer associations. They are not reached through a formal political process, nor are not legally binding. Unions, employer associations and the resulting CBAs are primarily organized at the level of sectors and regions. Firms are voluntary members of an employer association and as such adhere to the CBA negotiated between unions and the employer associations. The coverage of wages by a CBA thus depends on the firm's membership in an employer association and is independent of union membership. Firms can leave their employer association and can also decide not to enter a association in the first place. After opting out of a collective agreement, firms have to honor the prevailing sectoral CBA for incumbent employees or until a new agreement has been reached at the firm level in cooperation with the work council and are free to set wages for new hires. The fact that firms are voluntary members of employer associations has meant that, over time, many firms have left associations

and thereby also CBA agreements. In addition, wages in CBA-covered firms are increasingly dependent on economic conditions, due to so-called 'opening' or 'hardship' clauses. Firms that adhere to a sectoral CBA may opt out of the agreement in times of economic difficulties. CBAs generally include information on wage increases in percent, wage floors in levels for 3 to 13 pay groups and job amenities. CBA wage increases usually last for approximately one year. CBAs can be extended at the sectoral level, but extensions are less common than in other European countries.

3.4 Italy

In Italy, the wage level of all private sector employees must comply with the minimum set by the most representative collective bargaining agreement (CBA) of each industry and occupation. This rule is directly derived from the national Constitution. There is some uncertainty about the concept of "most representative" collective contract, and this ambiguity has provided some margin for a minority of firms to engage in elusion behavior, such as strategic selection of CBA (e.g. Garnero and Lucifora, 2022). However, the collective bargaining coverage is virtually full among private sector employees, and the salaries set by the CBAs tend to have a strong influence on the actual pay dynamics (e.g. Devicienti et al., 2019; Boeri et al., 2021).

Negotiations regarding pay levels usually occur once every two years, whereas other rules within CBAs are usually bargained every four years. The dates of such negotiations are not coordinated across collective contracts, and there can be delays in contract renewals. Moreover, wage negotiations usually set a schedule of future minimum wage increases that will occur at regular time intervals, thus pay floor changes usually occur more often than once every two years. Pay floors represent both a statutory minimum and a fixed component of the wage. Thus, the growth in a pay floor usually implies that all wages of workers within the affected CBA and occupation must grow by the same fixed amount. Although several rules set within collective contracts can be changed into less favorable conditions by individual firms, this principle does not apply for what concerns minimum wage levels.

Collective bargaining negotiations are quite centralized, as they generally occur at the national sector-wide level. Wage negotiations are also quite coordinated, since pay rises tend to follow target inflation levels that depend on past price dynamics and are regularly published by the government. However, the frequency and speed of wage adjustments can vary between CBAs and across occupations within the same CBA, leaving some room for flexibility in wage dynamics at the industry and occupation level.

3.5 Norway

In Norway, around half of private sector workers are employed in establishments that are formally covered by sectoral collective bargaining agreements (CBAs) (Nergaard, 2022). Furthermore, in recent years, another 10 percent of workers are covered by extensions of sectoral CBAs.[4] The remaining private sector workers may be covered only through a firm-level agreement or have an individual contract with their employer. By comparison, with rare exceptions, nearly all public sector workers have their wages set through public sector negotiations. The contractual period for most sectoral CBAs is two years. However, social partners typically negotiate wages every year, leading to minor CBA revisions, while non-wage aspects (e.g., workplace amenities and benefits) can be negotiated every second year, when CBAs are renewed for another term.

The Norwegian wage bargaining system is an example of a two-tier bargaining system, where central negotiations are supplemented by local bargaining at the firm-level (Bhuller et al., 2022; Barth et al., 2014). Despite this type of flexibility embedded in the two-tier system, there is strong coordination across sectors. Importantly, the Norwegian system features pattern bargaining, where the export-oriented manufacturing sector negotiates first and sets norms for the overall wage growth for covered workers and the centrally negotiated components of wage growth.

As a result, the wage growth of workers covered by sectoral CBAs reflects both centrally and locally negotiated components. The centrally negotiated wage increases are typically implemented through a combination of (i) general wage increases that apply to broad worker groups (e.g., at industry level) and (ii) adjustments of wage floors that vary across fine-grained job titles and worker groups with different seniority and/or skill levels. In some cases, central negotiations also provide "guaranteed" wage increases for specific worker groups (e.g., those covered by certain low-wage CBAs). Nevertheless, the local components of wage growth are relatively important, with some calculations indicating that only about one-fourth of the wage growth for private sector workers can be directly attributed to centrally negotiated wage increases in recent years (AID, 2025). Notably, however, the general provisions of local bargaining are also decided in agreements between social partners, who not only negotiate central wage increases, but also provide guidelines for overall wage growth for covered workers.

[4]While the legal provisions for extensions of sectoral CBAs in Norway have existed since 1992, the first CBA extensions came in 2004. Since then, several major sectoral CBAs covering different private sector industries have been extended. As a result, the share of private sector workers covered by extensions has gradually increased. The institutional backdrop of this policy change was the eastward enlargement of the EU around mid-2000s that led to an influx of labor migrants and raised concerns about low wage pressures in certain parts of the Norwegian economy (Bratsberg and Holden, 2015).

3.6 Portugal

The overwhelming majority of the workforce in the private sector of the economy in Portugal is covered by collective bargaining (approximately 90%). Extension mechanisms are common. Firms tend to apply the terms of the contract to all of their workforce, irrespective of union membership. Workers' and employers' representatives can subscribe to an agreement that they had initially not signed. Compulsory extensions are determined by the Government when the bargaining partners fail to reach an agreement or workers are not covered by a trade union. Therefore, the impact of collective bargaining goes far beyond union membership.

Industry-wide agreements predominate in the economy, while firm-level collective bargaining covers a low proportion, less than 10 percent, of the workforce. The negotiation of different collective agreements is usually synchronized, taking effect in January each year.

Collective bargaining agreements set minimum working conditions, in particular the minimum base monthly wage for each category of workers, net of employer payroll taxes, overtime pay, and the normal duration of work. Other pay components negotiated in most agreements are tenure-indexed subsidies and a daily meal allowance, which is tax-free up to a given level set by the government. All regular monthly components of pay, with the exception of the meal allowance, must be paid 14 months a year (national law). Collectively bargained pay clauses almost always have a nominal duration of one year, even though delays in renegotiation are common. Wage floors must comply with the national minimum wage, which leads to the automatic update of the lowest floors whenever the minimum wage is raised. Other clauses prescribing work rules and practices are updated less frequently.

4 Data sources

We employ data from Finland, France, Germany, Italy, Norway and Portugal. Here we discuss the data on a general level. The more detailed data description is provided in Appendix A separately for each country.

From each of the countries the two main types of data we use are 1) data on details of collective bargaining agreements (CBAs) and 2) microlevel data of the labor force. In Germany the analysis is based on survey data for plant managers. Although in principle it sounds simple to link the two types of data, in practice this is a challenging task to perform the first time across six different countries. The available data quality and infrastructure are different across countries. We attempted to create as similar data as possible across countries, although certain differences are ultimately unavoidable. Because generally CB contract id is not directly collected as part of the administrative

registers, the central issue in the overall linking procedure is always to assign the correct CB contract (and floor within that contract) to the given worker.

To structure the discussion, we created three groups that within group have relatively similar data structure. Group 1), “Linked data", comprises countries that are able to link individuals in microdata to CBAs using industrial classifications, occupational codes, tenure in jobs, education. The countries in this group are Finland, Norway and Portugal. Group 2) is “Imputed data" where the connection between CBAs and individuals is based on imputation of most common occupations in specific industries and then using the lowest or median wage floor for them. Thus, the imputation uses only partially the variation in the full CBA data that have larger schedule of wage floors and potentially more contracts than what are imputed in our data. Countries in this group are France and Italy. Group 3) is “Survey data" where we use survey for plant managers for Germany. The survey asks what is the average cushion over wage floor for workers in a particular group, and the wage floor itself needs to be imputed based on this information.

The resulting data in all groups have population shares of people under CBAs. Thus, we can depict the share of workforce affected by wage floors or contracted wage increases or calculate population weighted averages of wage floor levels. Since the results are potentially sensitive to which method was used to link the CBAs and individuals, we adopt a conservative approach and consider results as comparable within the three groups, but not across them.

5 Results

In the results section we group all the results according to the groups we have presented above: 1) "Linked data" comprising of Finland, Norway and Portugal, 2) "Imputed data" comprising of France and Italy and 3) "Survey data" comprising of Germany.

We first discuss the great efforts we did to combine for the first time the CBA data with microdata in six different countries in terms of data infrastructure. Table 1 attempts to describe the raw data on wage floors in different countries in Panel A and then in Panel B the estimation sample we are working with. The table shows for both the number of different contracts, that is, collective bargaining agreements, number of wage floors per contract and number of different wage floors in total (multiplying the previous two numbers together). The last row per panel is the interquantile range of wage floors to give some idea of the variation in the data we managed to keep after merging the two types of data in each country.

The results for the data merging analysis show (still partly missing) that in the "Linked data" countries we could not link all the contracts we know of, but still managed to link good number of contracts keeping also sensible variation within the data.

In the "Imputed data" countries, due to the imputation, some variation in the wage floors is lost. In the "Survey data", Germany has more range in the wage floors, the issue there is more the uncertainty whether those wage floors imputed from survey data are accurate.

We then show the differences in CB across our countries by describing industry-level average wage floor variation. The results are organized always such that they are comparable within group, where groups are: 1) "Linked data" (Finland, Norway and Portugal), 2) "Imputed data" (France and Italy), and 3) "Survey data" (Germany) as discussed in the previous section.

Figure 1 presents the levels of 2-digit industry-level average wage floors in PPP terms over time in the three groups. They are combined in the same figure, but notice that the y-scale is the same only within the group. Also, the results are comparable within group, but not directly across groups. Nevertheless, the figure shows that in group 1) wage floors are concentrated on a lower level in Portugal than other countries, and that the floors are slightly lower level in Finland than in Norway. The levels of wage floors are comparable because the figure presents them in nominal PPP terms. Another feature is concentration of wage floors, the figure shows that average wage floors are relatively concentrated in Finland, slightly more dispersed in Norway and in Portugal most industries are concentrated on a low level, but few smaller industries create a large dispersion in average wage floors there.

In the imputed data countries it is clear that the wage floors are on a higher level in France than in Italy. Also, there seems to be more dispersion in the average wage floors in Italy. The German survey data produces a really wide range even in average wage floors and that is a feature probably attributable to the survey imputation methodology.

Figure 2 repeats the same exercise but including only the largest five industries in each country. This figure is perhaps easier to read than the previous one and highlights the same features as previously. The main difference is that the Norwegian dispersion in average wage floors vanished indicating that the dispersion is coming from smaller industries.

We next describe our data in a richer way. We use all the wage floors we have managed to link or impute to individuals and present their distributions. Figure 4 presents the variation across all the wage floors by industry pooling different years together. The graph is naturally weighting by number of those employees to which the link/imputation was able to be done. Now the description takes into account the fact that the wage floors vary within industry based on finer industry code, specific occupation and also person-specific factors, such as, tenure and education. Figure 4 shows that there is fair amount of variation across wage floor levels in all countries considered.

In group 1) the Portuguese wage floors seem quite concentrated to low values and Financial services stand out as having higher wage floors and more dispersion. Also

the differences between Finland and Norway are highlighted in that the wage floors in Finland tend to be concentrated to a lower levels than in Norway. In Norway the education sector stands out in having more dispersion than in Finland. In group 2) the French and Italian wage floors tend to be quite concentrated except for a few outliers in Italy. This concentration may not be a real description of the collective bargaining institutions, but rather a result of the imputation method. It may lead to being able to impute only a limited number of wage floors to individuals leading to less dispersion than there is in reality. Similarly in group 3) the wide dispersion likely caused by the survey imputation is really visible in this graph, note the differing y-scale from others.

Figure 5 presents similarly wage floor level variation but separately for different years pooling all industries. The previously noted differences become very apparent in this figure, in terms of levels and dispersion. In group 1), Finland and Norway have certain level differences between them but are very apparently at a higher level than Portugal. Also the relative density in Portugal is apparent in this graph. In group 2) it becomes very clear that France has higher wage floors than Italy, as almost all the variation is on a higher level. Also, in Italy there is more dispersion across wage floors. And the German variation in group 3) is wide as shown before.

Figure 3 presents the changes in industry-level average wage floors from one year to another for all industries (excluding some outliers) in panel a) and for top 5 industries in panel b). The changes in average wage floors are more consistent number to look at than average wage floor levels, because the wage floors tend to be changing in certain fashion within a country, and even if individual would not have been linked or imputed to the correct wage floor, the change over time could represent the true changes more accurately. Secondly, the average wage floor change variation describes whether different industries seem to coordinate their collective bargaining outcomes such that average wage floors in different industries would change by a similar amount within country and year.

The result is that most wage floors are changing in relatively coordinated manner within country, but there does seem to be some dispersion in all countries. In Finland and Norway the average changes in wage floors are below five percent, and in Portugal, France and Italy the typical change in average wage floors seem to be rather close to zero, especially towards the end of the examination horizon, 2019. In panel b) it is noticeable that even within top 5 industries there are important differences in how much average wage floors change within country and year.

Turning to the densities of floor changes, Figure 6 shows the densities for floor changes by year pooling all industries. Here it is again apparent that the floors change in similar fashion across industries especially towards the end of the examination horizon. The density plot reveals some variation for example in Italy, although noting the scale of the y-axis, this variation is relatively small within a year.

We next discuss contracted wage increases. As written in the institutional description, the contracted wage increases are the main negotiating pieces at least in Finland and Norway and Germany. They are implemented such that in Finland, Italy and Germany each worker who is covered by a certain contract needs to get at least the contracted wage increase starting from their salary in the previous year (typically as a percentage in Finland and Germany) that is collectively negotiated for the collective agreement covering them. In Norway the mandatory increase in wages needs to happen at firm level on average, so the system is not as binding at individual level. Because contracted wage increases are a central and often forgotten feature (in academic papers) about the system, it is important to describe them here. ′

Figure 7 shows contracted wage increase distributions over time pooling industries. One observation from these figures is that the variation in contracted wage increases is relatively narrow. For example, for Finland the variation in contracted wage increases is narrower than variation in wage floors. As this is the main negotiating piece, the result highlights how coordinated the Finnish collective bargaining system is. For Norway there is slightly more variation in contracted wage increases and, as noted above, they are not as binding at worker level as in Finland. Interestingly, there is even more variation in Italian contracted wages.

Figure9 combines the wage floor changes and contracted wage increase in a single measure of how wages change in CBAs. The result shows relatively concentrated changes within year in all countries.

We next turn to building a centralization measure. The centralization measure attempts to capture in one number how centralized the collective bargaining system is in a country by considering to what extent the workforce is directly impacted by CB in their wage setting. Specifically, we examine what fraction of individuals are at or very close to the wage floor that applies to them, and / or how many individuals receive wage increases that match the contracted wage increases. The more individuals seem to be restricted in their wages by the CB system in the manner just described, the more concentrated the system is seen. However, at this point the exercise is merely illustrative for how these data could be used to capture differences in centralization. In the current form the differences across countries are in large part driven by differences in linking / imputing the CB data to microdata. Differences within our three groups can be interpreted as differences in institutions more reliably, but still suggestive.

What already creates extensive variation in the concentration measure across countries is the fact that in Finland, Italy and Germany the contracted wage increases are used extensively and in a binding fashion, in Norway they are binding only as firm level averages, and they do not exist in France or Portugal. Moreover, the share of the workforce covered by CB varies to a great extent between countries. Moreover, wage floors are binding to a very different degree across countries. The combination of these

stylized facts leads to very different concentration levels of how wages are set in different countries.

Our suggestive findings show significant variation in CB centralization among our countries. Table 2 shows the concentration measure results pooling all years and industries into one measure by country. The table shows the contribution of share of workforce covered by CB, wage floors and contracted wage increases (when applicable) separately and the combined concentration measure for each country. The table shows that illustratively the wage floors seem to lead to a relatively low concentration measures of between 0.045 and 0.09 for other countries, except Portugal, where the concentration measure stemming from wage floors is 0.21. These differences are again likely driven by differences in data infrastructure, but do highlight how binding the wage floors are in Portugal. Finland nevertheless has the highest concentration measure in this illustration out of the six countries considered. This result stems from the very high fraction of individuals receiving wage increases that exactly match the contracted wage increases in Finland.

We also provide a macro regression that illustrates how the centralization measure could be used to consider association between centralization of collective bargaining and macroeconomic differences across countries and industries. To this aim, we correlate the centralization measure with macroeconomic variables: employment share and average wages within 1-digit industry, country and year. We estimate Equation 5:

$$y_{ctj} = \alpha + \beta x_{ctj} + \lambda_c + \lambda_t + \lambda_j + \epsilon_{ctj} \tag{5}$$

Where y_{ctj} is the dependent variable for country c in year t and 1-digit industry j (either employment share or average wage). x_{ctj} is the main independent variable (concentration measure, "share binding"). λ_c, λ_t, and λ_j are the fixed effects for country c, year t, and industry j, respectively.

The analysis sample does not include Germany for the data is too different from other countries. Standard errors are not adjusted to any clustering (but data is aggregated already). We also include regressions (3) in the tables below that are weighted by cell (country, industry, year) size.

Table 3 shows results of this regression using as the outcome the employment share of an industry (indicating the relative size of the industry) and Table 4 presents similar regressions using as the outcome average hourly wages in the industry. Interestingly, we find that concentration measure is not that correlated with employment share, but is strongly negatively correlated with average wages. This indicates that the more concentrated the CB the lower average wages it is associated with. As the specification includes country, industry and year fixed effects, it is not capturing variation across these factors.

6 Conclusions

This article describes novel efforts to combine data on collective bargaining with microdata, and the institutional variation of CB the data reveal in six European countries: Finland, France, Italy, Norway, Portugal and Germany. We showed how average and individual level wage floors vary across countries in common PPP terms, and how differences in datainfrastructure could influence this. Moreover, we discussed important differences in collective bargaining systems, namely that Finland, Germany and Italy have contracted wage increases that are binding at individual level and that Norway has contracted wage increases binding at firm level on average, while France and Portugal do not have contracted wage increases at all. These differences greatly affect the potential of the collective bargaining system to affect the wages in the workforce.

The descriptive analysis shows that in common PPP terms the wage floors are at lower levels in Italy and Portugal followed by France than in other countries. Portuguese wage floors are typically quite concentrated relative to other countries at lower levels, but there are a few smaller industries that have significantly higher wage floors providing variation in average wage floors. We also showed the distribution of all wage floors population weighted showing differences in the dispersion of wage floors. The change in wage floors and especially contracted wage floors produced quite dense distributions. This suggests that across industries the changes are quite well coordinated within country and year, such that most industries change their collective bargaining outcomes by similar amounts. The last part is especially true in Finland.

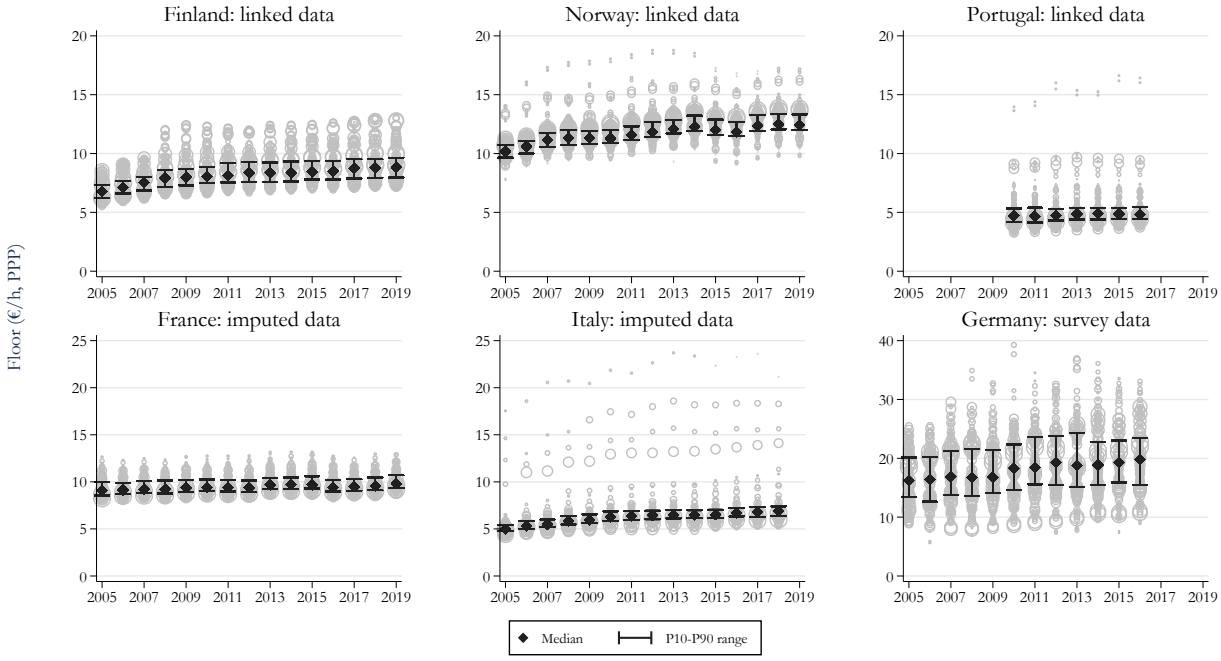
The changes in wage floors and contracted wage increases revealed that they often move together. This reveals that in the CB there is much coordination within a country such that different industries reach in the same year similar negotiating outcomes.

We also provided an illustrative centralization measure that shows how the kind of data we have can be used to capture how centralized the collective bargaining system is. We showed that there are great differences across countries in to what extent individuals receive exactly wages at the wage floors or contracted wage increases as the wage increases they experience. The exact results need to be interpreted with caution, because differences in data could be driving these results that are provided more for illustrative purposes.

We also regressed the centralization measure against industry level employment shares and average wages in data aggregated at country, industry and year level. The regression analysis showed that the concentration measure is not very correlated with employment shares, but is quite strongly and negatively correlated with average wages.

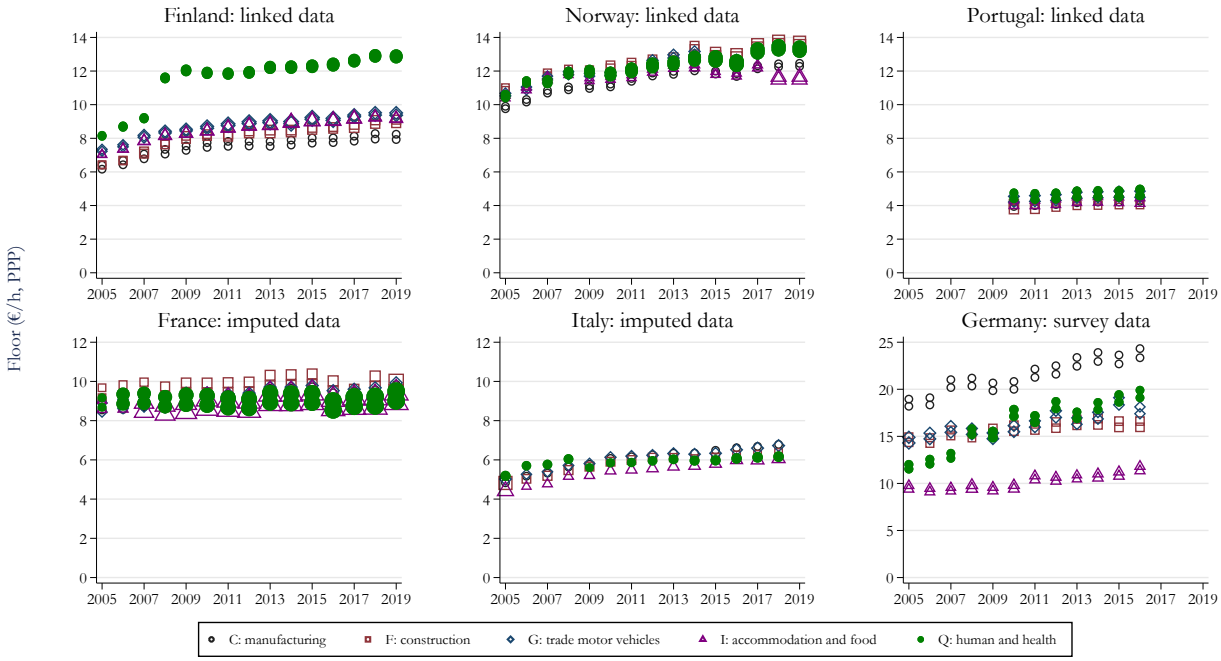
Figures and Tables

Figure 1: Average floor levels for all industries



Notes: Mean floor levels by year for all industries, weighted by industry size.

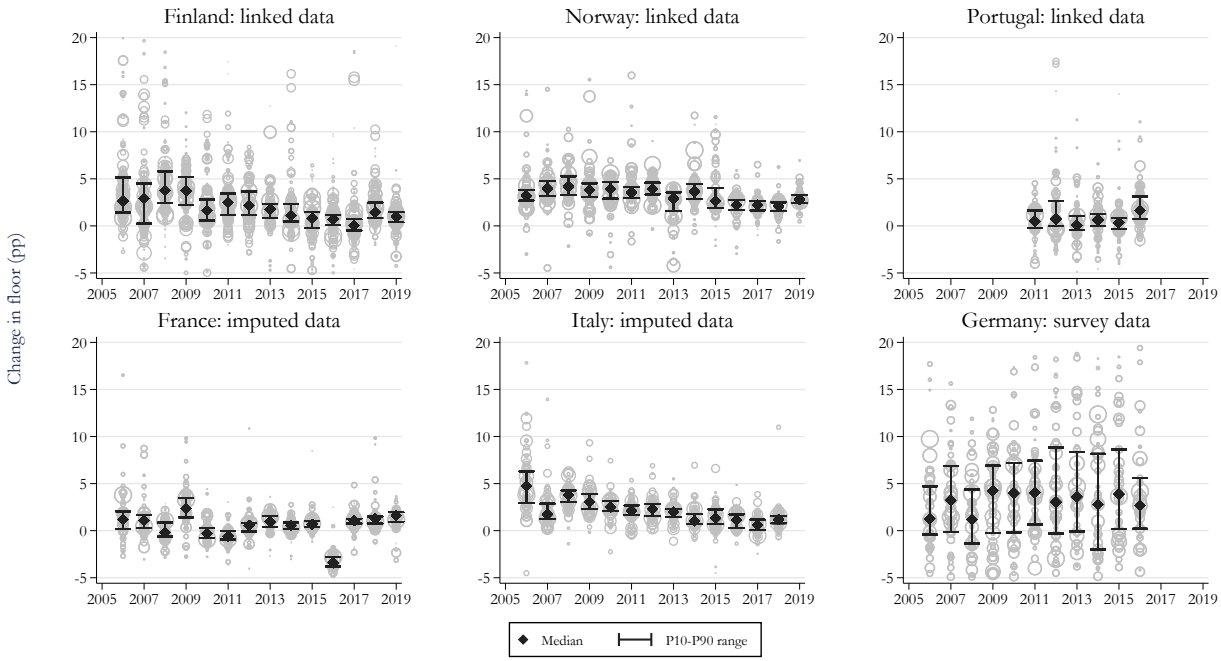
Figure 2: Average floor levels for five largest industries



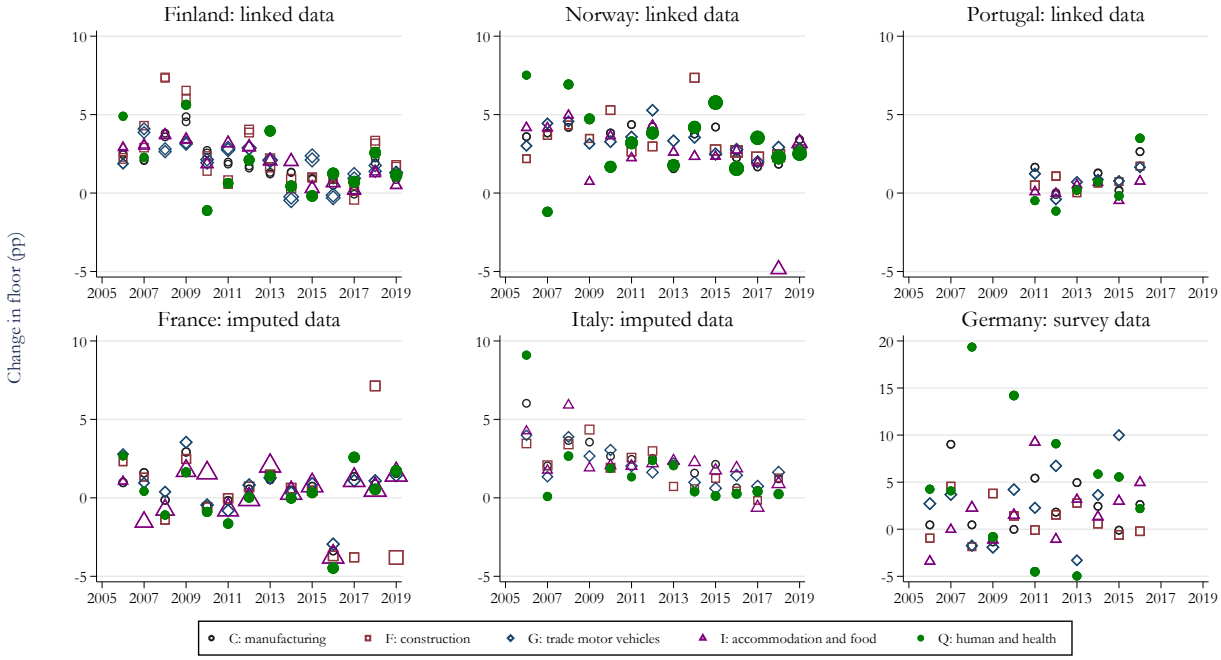
Notes: Mean floor levels by year for five largest industries, weighted by industry size.

Figure 3: Average floor changes for all and five largest industries

(a) All two-digit industries

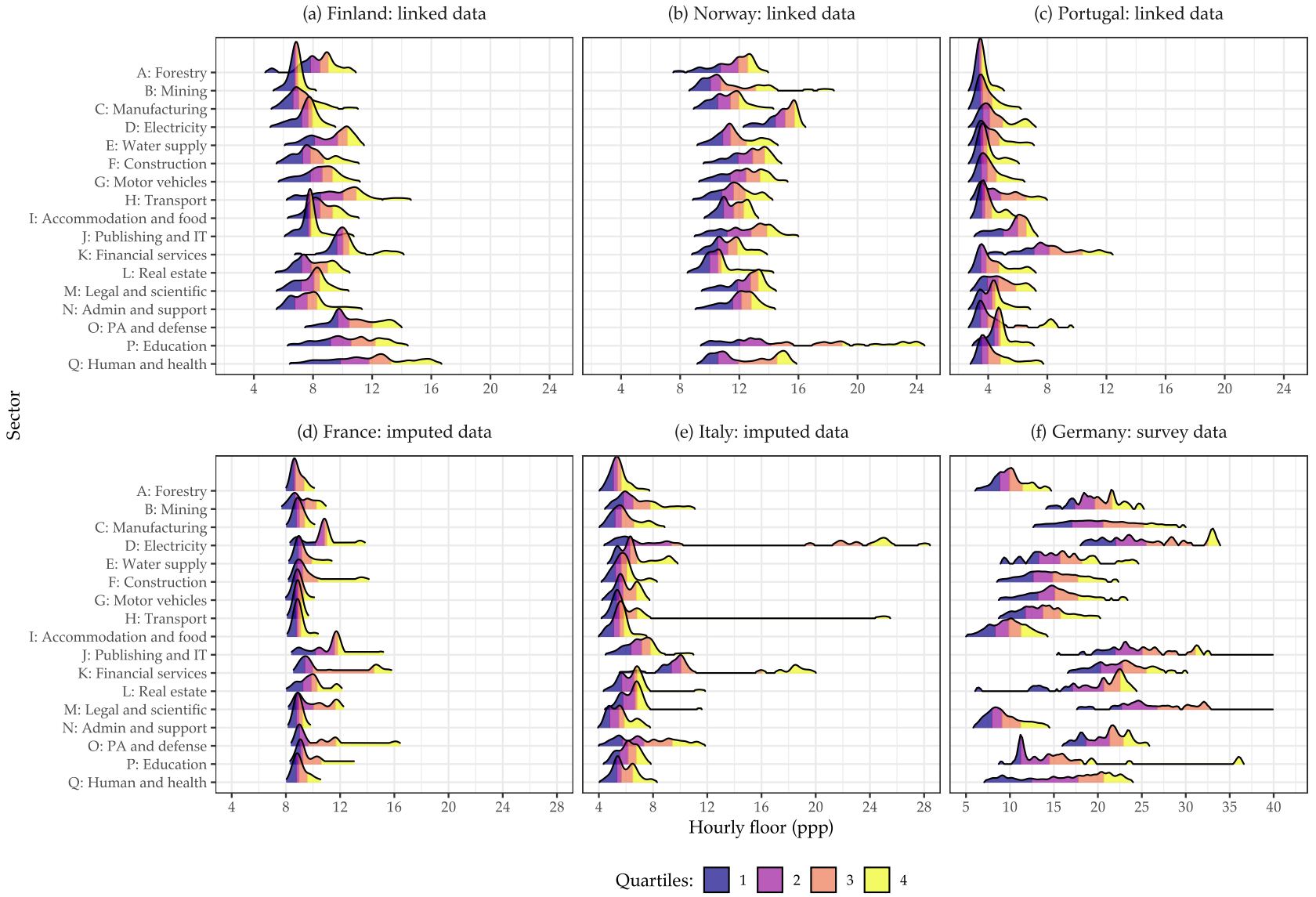


(b) Top five one-digit industries



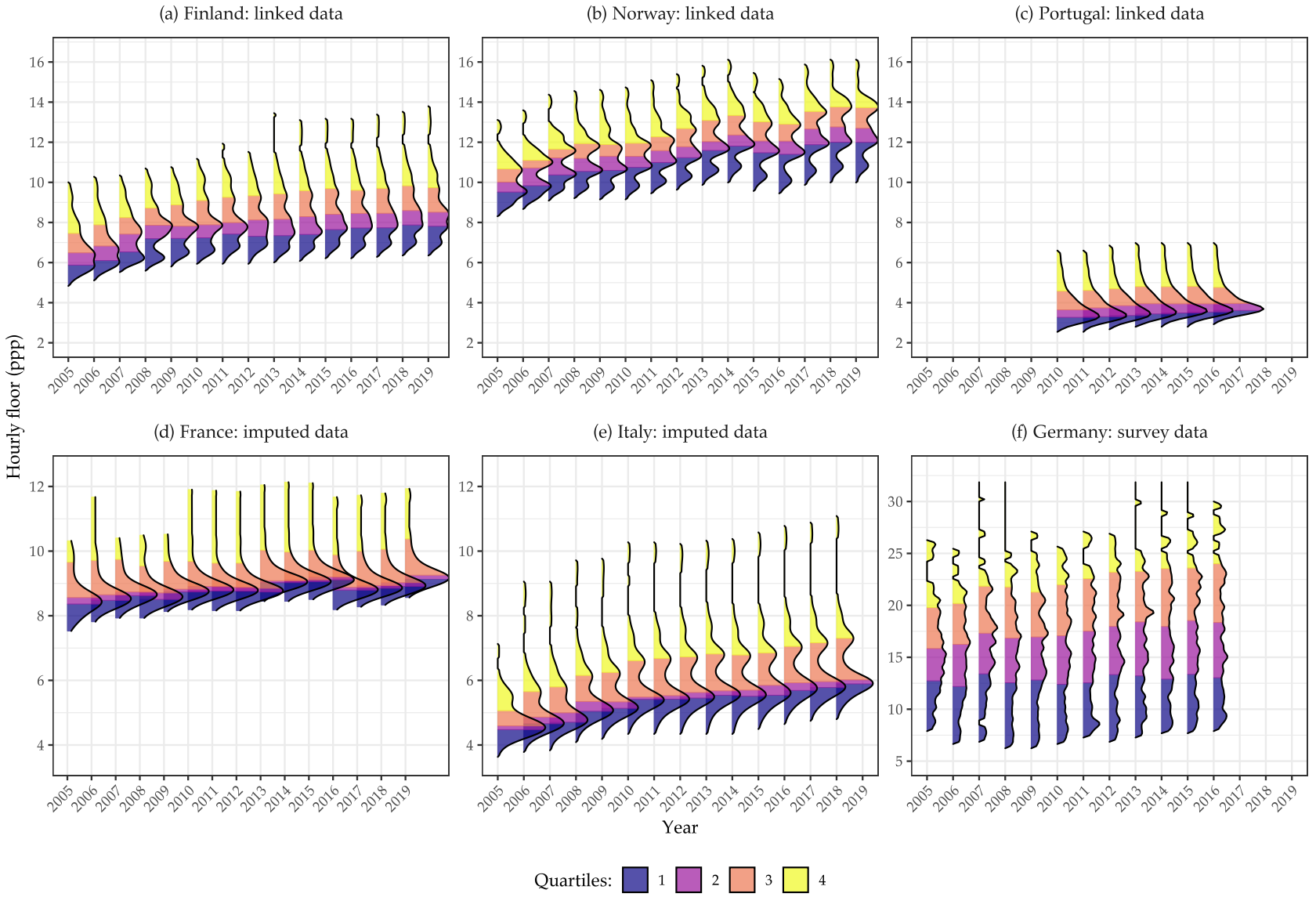
Notes: Variation in the average floors by year for all 2-digit and five largest 1-digit industries, weighted by industry size.

Figure 4: Floor distributions, by industry



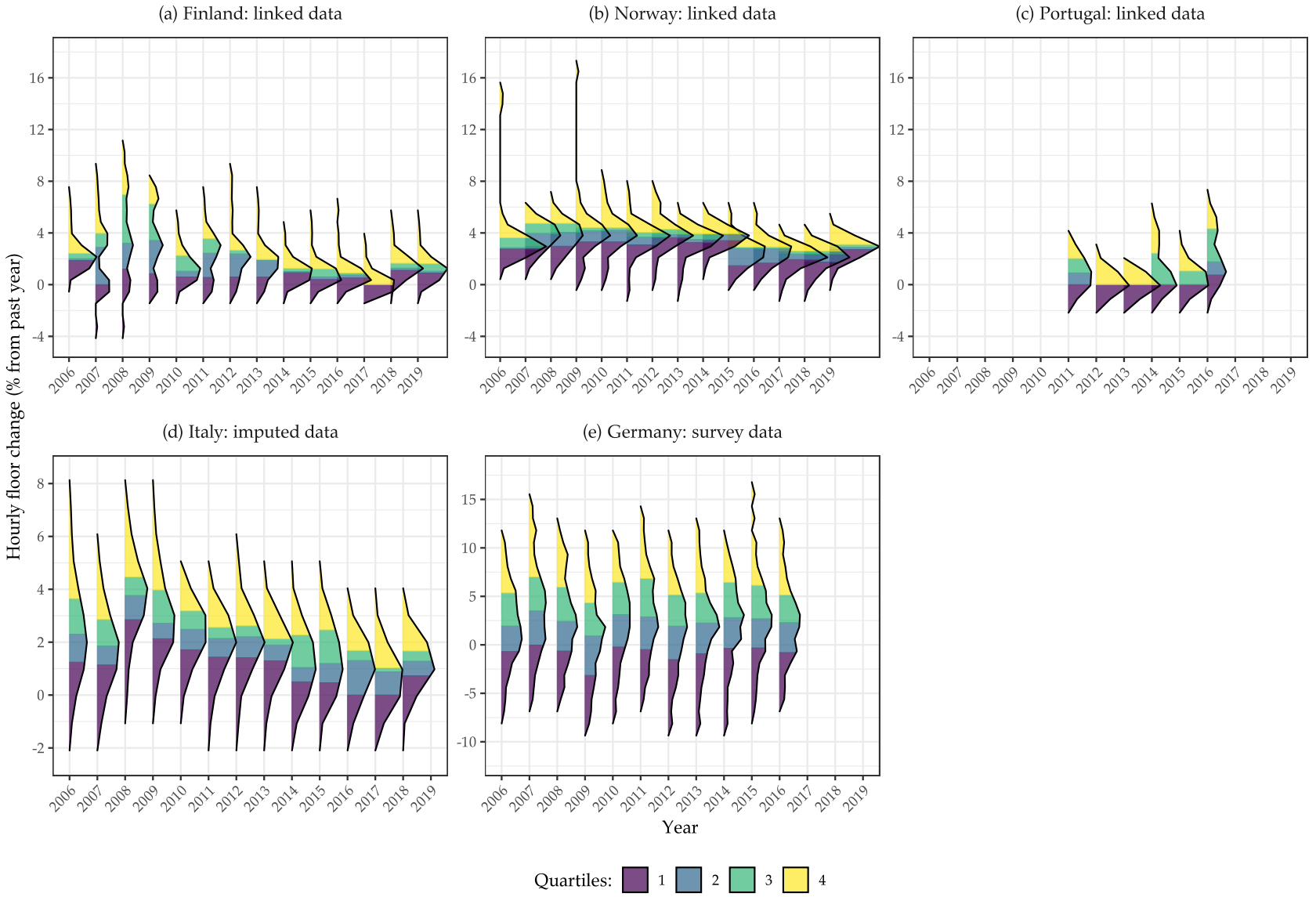
Notes: Floor distributions in the 2006-2019 period, separately by industry, in purchase power parity units.

Figure 5: Floor distributions, by year



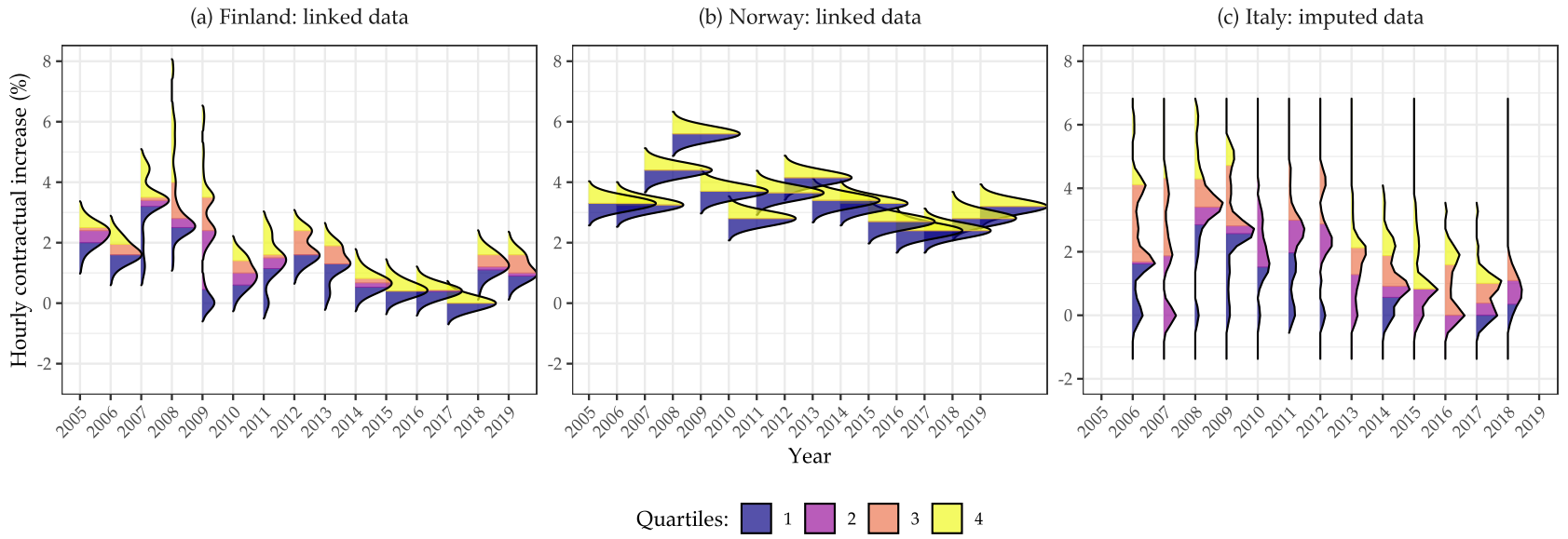
Notes: Floor distributions pooling all industries, separately by year, in purchase power parity units.

Figure 6: Floor change distributions, by year



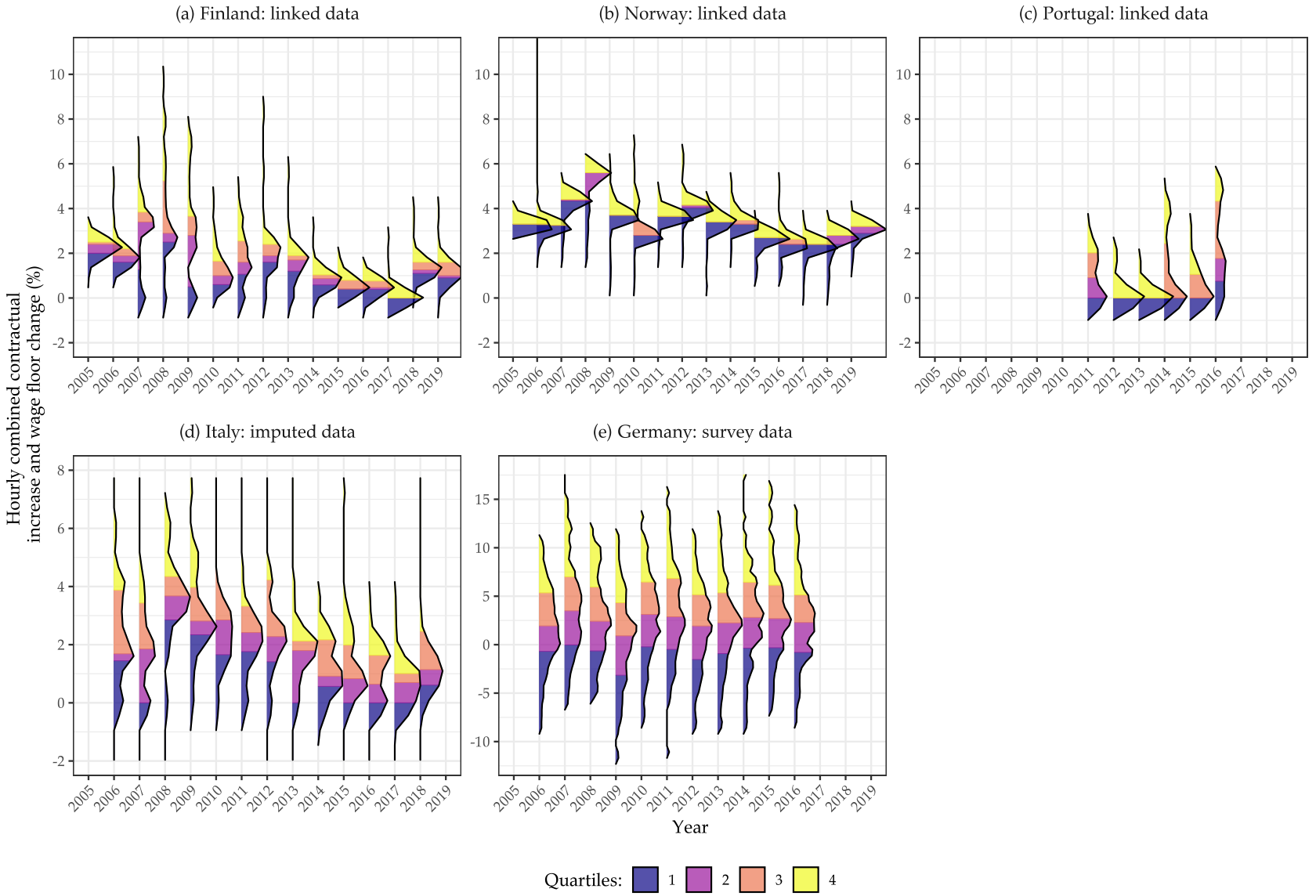
Notes: Floor change distributions pooling all industries, separately by year, in purchase power parity units.

Figure 7: Contractual wage increases, by year



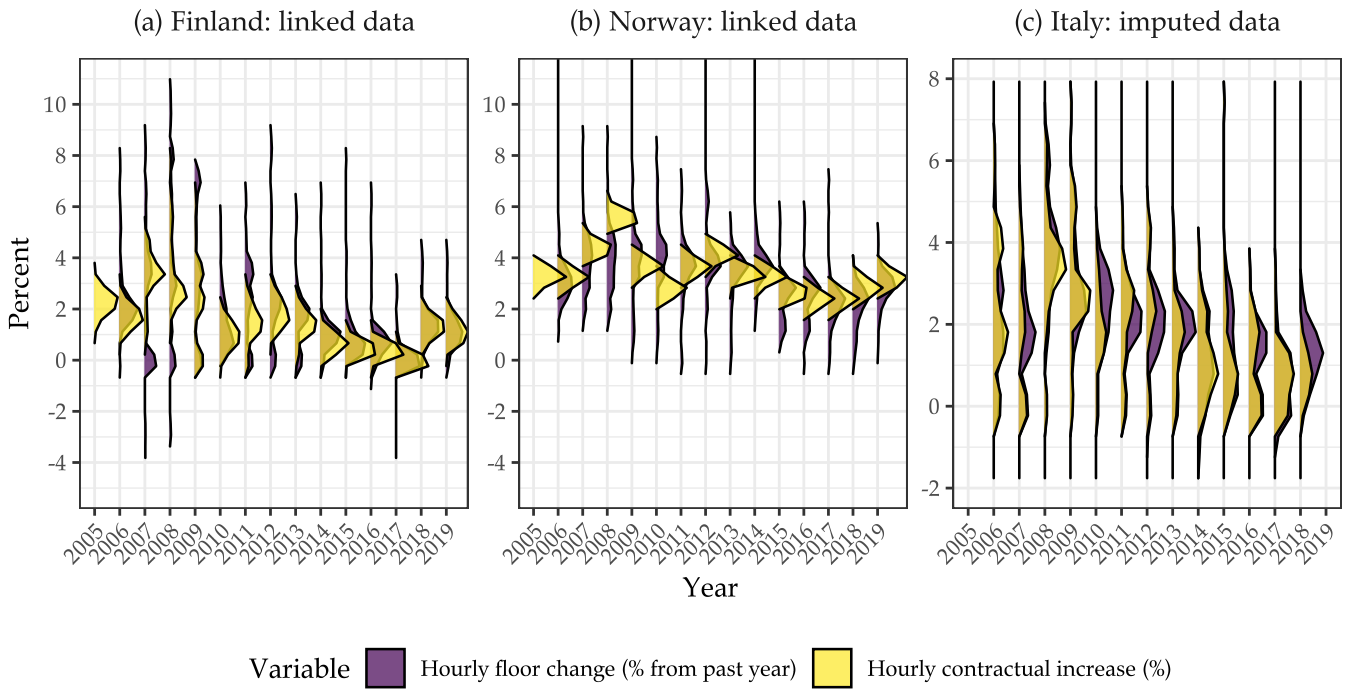
Notes: Yearly wage increases pooling all industries, separately by year.

Figure 8: Wage floor changes and contractual wage increases pooled, by year



Notes: Pooled yearly wage increases and floor changes across all industries, separately by year. Countries with no contractual increases (Portugal and Germany) show only the floor changes.

Figure 9: Wage floor changes and contractual wage increases pooled, by year



Notes: Yearly wage increases and floor changes across all industries, separately by year.

Table 1: Contracts data

	Linked			Imputed		Survey
	Finland	Norway	Portugal	France	Italy	Germany
Panel A: Raw floor data						
No. of contracts	151	154	–	253	167	–
No. floors per contract	23.05	11.66	–	7.01	8.73	–
No. floors across contracts	3481	1797	–	1776	1458	–
Q3-Q1 hourly floor (EUR)	5.09	8.22	–	4.63	2.88	–
Panel B: Analysis sample						
No. of contracts	125	146	189	252	68	174
No. floors per contract	14.65	2.54	13.95	3.51	2.51	168.78
No. floors across contracts	1831	371	2636	885	171	29368
Q3-Q1 hourly floor (EUR)	3.05	3.62	2.74	1.91	1.54	12.14
Panel C: Additional information						
Link/imputation level	Education, tenure, 5-digit occupation, municipality	Establishment's CB contract and worker's age, tenure and 7-digit occupation	Worker's CB contract and job		2-digit sector, 3 firm size classes, 4 geographic groups, 2 occupation groups	Imputation of 8 wage floors at the establishment level, using average establishment pay above the wage floor
Additional notes	The raw data only include private sector CB contracts.	The raw data only include private sector CB contracts.	The raw monthly floors were converted using modal hours of work in the job category.	Covers large and private-sector contracts; records up to 8 floors (lowest and highest across 4 occupation groups)	Information measured in 2018. Monetary values in 2020 PPP.	Representa-tive, weighted survey, with (assumed) 8 pay groups and floors by establishment defined by k-means.

Notes: entries are at the contract-floor level (not employee-weighted.) Panels A and B report numbers for 2019, in 2020 money. All floors shown in hourly full-time equivalent units.

Table 2: Centralization measure

	Share covered	Collective bargaining bite			Centralization measure		
		Floors	Increases	Total	Floors	Increases	Total
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Linked data							
Finland	0.80	0.101	0.264	0.365	0.080	0.211	0.292
Norway	0.56	0.124	0.145	0.268	0.069	0.081	0.150
Portugal	0.89	0.235	–	0.235	0.210	–	0.210
Panel B: Imputed data							
France	1.00	0.089	–	0.089	0.089	–	0.089
Italy	1.00	0.045	0.033	0.078	0.045	0.033	0.078
Panel C: Survey data							
Germany	0.62	0.104	–	0.104	0.065	–	0.065

Notes: Column (2) shows the share of workers with wage floors close to their hourly wage, defined as being between -5 and 10 pp from the wage. Contractual increases at column (2) are classified as biting when floors are not already biting and the wage change is between -0.25 and 0.5 percent from the collective contract wage increase. Column (3) shows the total share of workers with either wage floors or contractual wage increase biting. Columns (5)-(7) show the corresponding centralization measure that adjusts floors and increases by the share of covered workers in the given country (reported at column 1).

Table 3: Correlation between employment share and centralization measure

	(1)	(2)	(3)
Centralization measure	0.009	0.010	0.033***
	(0.011)	(0.008)	(0.000)
Constant	0.057***	-0.001	-0.026***
	(0.003)	(0.008)	(0.000)
Controls		X	X
Weights			X
Observations	1,011	1,011	51,180,909
Adj. R2			

Controls include country, 1-digit industry, and year fixed effects. Column (3) show results from a regression weighted by country-industry-year cell size. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 4: Correlation between average wage and centralization measure

	(1)	(2)	(3)
Centralization measure	-0.120	-3.333***	-4.601***
	(0.932)	(0.525)	(0.002)
Constant	14.911***	12.139***	12.694***
	(0.244)	(0.533)	(0.005)
Controls		X	X
Weights			X
Observations	1,011	1,011	51,180,909
Adj. R2			

Controls include country, 1-digit industry, and year fixed effects. Column (3) show results from a regression weighted by country-industry-year cell size. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

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A Country-specific details

A.1 Finland

Linkage of collective bargaining agreement contracts

To match the collective agreements to individuals we use information from the memorandums of the governmental Board for the Ratification of Validity of Collective Agreements (*Työehtosopimuksen yleissitovuuden vahvistamislautakunta*). The memorandums outline the field of application of each agreement in great detail, which the board uses to decide whether the agreement is extended to cover the whole sector.

A new memorandum is created every time a nationwide private-sector collective agreement is renewed. This ensures that we track the universe of nationwide private sector collective agreements, and that we always have up-to-date information on their fields of application. For matching, we only consider agreements that have been extended to cover the whole sector. Firm-specific or non-extended agreements are difficult to accurately match with individual data and only account for 5-10% (Ahtiainen, 2024) of collective bargaining coverage in Finland.

In most cases, the board's memorandums directly include industry codes for the field of application inquired from the employer organizations and employee unions. In these cases, we have directly used the provided codes for matching with the intuition that the board and the signatory parties likely have the best information of the field of application. If no industry codes were provided, we chose suitable codes based on the wording of the agreement and the industry codes of a sample of large firms known to abide by the agreement. We utilize the full granularity of the 5-digit industry codes to separate agreements from each other.

In addition to industry, the field of application of collective agreements often varies by occupation. In particular, separate collective agreements commonly exist for managers and specialists (ylempi toimihenkilö), white-collar employees (alempi toimihenkilö) and blue-collar employees (työntekijä). To separate these agreements from each other we have created a key matching each of these employee groups to a subset of 5-digit occupation codes. For the few agreements that specify even finer occupational demarcation we specify suitable occupation codes separately.

Each agreement typically contains multiple wage floors, and rarely also multiple contracted wage increases, for different employee groups. We match each individual with the correct floor and increase using their occupation, education, municipality and tenure. As agreements typically only include verbal descriptions for occupation, education and municipality, we have matched these descriptions with the corresponding Statistics Finland occupation, education and municipality codes by hand. Since the occupational and educational demarcations of the collective agreements do not exactly necessarily match those of the classifications, we sometimes match multiple wage floors

with one individual. In these cases, we keep only the lowest matched wage floor in the final matched dataset.

Country-level description of the data

Our dataset consists of individual-level register and survey data from Statistics Finland matched with hand-collected collective agreement data on contracted wage floors and wage increases from all Finnish nationwide private sector collective agreements from 2005 to 2020. The main part of our individual-level data comes from the Finnish Structure of Earnings Survey (SES), a repeated cross-section of payroll data from 1995 to 2023 collected as a survey on employers. The SES data covers approximately 55-75% of all private-sector employees depending on year and industry. Those omitted consist of most employees working for employers not part of employer organizations, small businesses (under five employees), and employers in agriculture, forestry, fishing or extraterritorial organizations. In addition, the owners and top management of firms are excluded.

SES data contains detailed information on the industry, occupation, education, hours worked, and hourly and monthly wages separated to different pay components. In addition, it includes pseudonymized identifiers which allow tracking employees, enterprises and establishments across time and linking the dataset to other Statistics Finland data modules. The data is collected from the September or October of each year for monthly-paid employees, and as the average of the fourth quarter for hourly-paid employees. As SES may include several concurrent employment spells, for example for part-time workers, we only retain the spell with the highest hours worked for each individual per year to obtain panel-form data.

We augment the SES data with information from the Statistics Finland FOLK and FIRM register data modules. The FOLK and FIRM modules cover the entire Finnish population of individuals and firms, respectively, but lack the granularity of the wage data in the SES modules. Thus, we only use the FOLK and FIRM datasets to calculate the tenure and to harmonize the industry and occupation codes of each individual. We conduct the harmonization by carrying the most recent industry and occupation codes (TOL 2008 and AML 2010, respectively) backward in time when possible, and otherwise through a flow analysis of the most common target code for each source code. We calculate tenure as the sum of the lengths of all employment spells of each individual in each harmonized 2-digit industry using day-level employment spell data, converted to years by dividing by 365.

The data on contracted wage increases collected by Kotilainen (2018) for 2005-2013 forms the base of our collective agreement data. We have corrected and extended the wage increase data up to 2020 and complemented it with nearly 70,000 observations for wage floors spanning the entire period. The resulting data contains the universe of

wage floors and increases for nationwide private sector collective agreements in force some time between 2005 to 2020.

We collected the data directly from agreement texts by hand. Most agreements were kindly provided by the Board for the Ratification of Validity of Collective Agreements, which we supplemented with agreements from the National Library of Finland and the webpages of employer organizations and employee unions. We would like to thank Helmi Korhonen, Stefano Lai, Jacqueline Lindholm, Väinö Siimes and Shubhdeep Singh for excellent research assistance in data collection.

A.2 France

Datasets with Information on Wage Floors We have access to two datasets that contain information on wage floors. This draft only use the BMB dataset.

1. The FGR data are constructed by Fougère, Gautier, and Roux (2018).[5] The FGR only contains a sample of the largest CBA. The data are recorded at the CBA identifier–salary grid level and at quarterly frequency. They cover the period from 2005 to 2016 and track a sample of the main CBAs in France. The strength of this dataset is that it contains the universe of wage floors for each CBA. A limitation of the dataset for this paper is that salary grid-level information is not available in the administrative data.

2. The BMB data (Branch Minimum Base, henceforth BMB) are constructed by the Ministry of Labour.[6] Like the FGR dataset, the BMB is based on CBAs (including conventions collectives, accords interprofessionnels, and accords professionnels) with 5,000 or more employees. It is recorded at the CBA identifier–occupation group–salary grid level and at quarterly frequency. However, unlike the FGR dataset, which records all salary grid levels ("grille de classification"), the BMB dataset only includes the lowest and highest wage floors for the four socio-professional categories (worker, employee, intermediate profession, and executive). Therefore, up to 8 wage floors are recorded. Negotiated minimum wages are classified into three types based on their base: hierarchical salary ("salaire hiérarchique") and guaranteed salary—monthly or annual ("salaire garanti—mensuel ou annuel"). The 2022 version of the BMB includes agreements for nearly 400 branches from 2003 to 2022.

Datasets with Information on Wages We have access to two datasets that contain wage information at the micro-level. The first one, the DADS, is the well-known matched employer-employee dataset for France. The second one, is an employer survey that

[5] We thank Erwan Gautier for sharing the dataset with us.

[6] See Andre and Muller, 2014 for a detailed introduction to the BMB dataset.

records for several jobs (stratified by qualification) the base monthly earnings. A key advantage of the latter dataset is that it contains the CBA *and* the salary grid identifier. This allows a finer link between monthly earnings and wage floors. However, an important drawback is that this dataset does not track workers but a given job position. This version of the draft only use the DADS panel.

1. The dataset "DADS panel tous salariés 2021," which includes a sample of salaried workers from 1976 to 2021. The dataset is provided by the CASD and is constructed by the French national statistical office (INSEE) from social security records. 1) for the private sector, based on records that establishments must fill out once a year for each employee (*DADS, Déclarations Administratives de Données Sociales; DSN, Déclarations Sociales Nominatives*), and 2) for central government public employees (*FPE, fichiers de paye des agents de l'État*).

   The sample corresponds, until 2001, to a 1/25 sample obtained by keeping individuals born in October of even years. Starting in 2002, the sample was doubled to include all workers born in October (the labor market history of workers entering in 2002 is not retrospectively added before 2002).

   The dataset contains establishment and firm identifiers and includes public sector jobs. The panel does not follow workers outside salaried employment (e.g., self-employed workers). Since 2008, unemployment spells have been recorded.

   This dataset contains gross salary, occupation categories, and hours worked. It does not distinguish between "base" and "total" earnings for each employer. Since 2005, the dataset has recorded the CBA identifier for each firm. We use the CBA identifier and the occupation category classification to link the DADS to the BMB dataset.

2. The dataset "ACEMO Panel 1999-2016".[7] All private sector firms (but agricultural employers) and included. The survey aims to provide short-term indicators on the evolution of the basic monthly salary and the basic hourly wage. The responding establishments select representative job positions for twelve qualification levels (three levels for each of the four major socio-professional categories: workers, employees, intermediate professions, and executives) and provide the base monthly and hourly wages. A reference sheet mapping the twelve job-level grid to the classification grid of the establishment's main CBA is provider to the surveyed establishment.[8] Using this sheet and for each of the twelve defined qualification levels, surveyed establishments are asked to select a job that they consider the

[7] See Andre and Muller, 2014 for a detailed description of this dataset.

[8] Prepared by Dares for each applicable collective agreement, these sheets classify the different levels in the classification grid (coefficient, category, level, etc.) into the twelve job levels tracked by the quarterly survey.

most representative (typically the one with the largest number of employees in the relevant level). This should be a currently filled job that can be tracked quarter to quarter. Responding establishments then provide the job title and the corresponding coefficient or hierarchical level. These responses are entered into the Acemo survey's management database. Once updated, this database allows the quarterly survey questionnaires to be pre-filled (see Figure 1).

Note that, in contrast to the DADS panel, the ACEMO survey tracks job positions and qualification levels, not individuals. When an employee in a tracked position changes their salary grid level or leaves the establishment, the responding establishment selects another employee with the same salary grid level to replace them. Reference employee changes affect roughly one in ten positions each quarter.

Construction of a Linked Dataset: Wage Floors with Wages

Sample restriction on the BMB dataset. We exclude legal texts labeled as "accord professionnel" and "avevant infranational", keeping only those labeled as "convention collective". Most legal texts are convention collective. See the text above. We retain texts at different geographical levels (national and subnational). We construct monthly wage floors using the "salaire hiérarchique" and the "salaire garanti". If monthly information is unavailable, we use annual minimum earnings divided by 12.

We use the same method to construct agreed wage increases.

Sample restriction on the DADS dataset. For each worker, we keep one person-year observation, selecting the primary employer as the one with the highest earnings. We consider full-time workers employed in the private sector. Person-year observations are excluded if the CBA, firm, or establishment identifier is missing. We deflate earnings based on 2020 EUR. The hourly wage is calculated as the ratio of earnings to hours worked at the main employer. Monthly earnings are calculated as the ratio of earnings to months worked. Since the number of months worked is not directly observed in the dataset, it is estimated by dividing the number of days worked at the primary employer by 30. We convert French classification codes (PCS) to ISCO-08.

A.3 Germany

Linkage of collective bargaining agreement contracts

Our analysis makes use of data provided by the German Institute of Employment Research (IAB) called the LIAB dataset (the Linked Employer-Employee data of the IAB, LIAB; Ruf et al., 2021). The LIAB data links administrative employer-employee information from the German Social Security Records with survey information from the Ger-

man Establishment Panel. The LIAB data includes information on both workers and the establishments at which they work, on sectors and regions, as well as on the CBA coverage type (sectoral CBA, firm CBA or no CBA) of establishments and whether they pay their employees above the CBA wage floor. The employee data comprise roughly 80 percent of the German workforce, and self-employed workers, civil servants, and military personnel are not included in the dataset. The Establishment Panel contains survey information on firms such as on value added per worker, investment, firm size, firm entry and exit dates. Data on wage increases in percent has been newly digitized from publications on CBAs of the German Institute of Economic and Social Research and the German Statistical Office. This CBA information is available for sectoral CBAs and is merged to the LIAB data by three-digit sector, federal state and year. While CBAs in Germany include information on wage increases and the specific wage floors for pay groups, the data on wage floors is not readily available. Information on actual wage floors by CBA pay groups is therefore imputed from survey responses of the German Establishment Panel at the establishment level. Pay groups vary in number by sector, region and employment group (broadly for workers, employees and trainees), are defined by CBA for observables such as education, skill and job tenure, and range from approximately 3 to 13 groups per CBA. We use an Establishment Panel question that asks CBA-covered establishments by how much on average they pay their employees above the CBA wage floor, to impute wage floors for eight pay groups in each establishment. Specifically, we restrict our data to establishments with at least eight employees and use a k-means algorithm to assign wages into eight groups for each establishment, and use the average establishment pay above the wage floor to assign average wage floors to each of the eight groups. We thus implicitly assume that the average pay above the wage floor is a good approximation for wage floors of eight pay groups at the establishment level.

Country-level description of the data

We use the cross-sectional model of the LIAB data, which includes an individual employment history on the reference data of June 30 every year. Sample weights provided for the Establishment Panel are used to approximate results that are representative for Germany. For the wage floor analysis, union coverage for Germany is defined as having either a sectoral or a firm CBA in place. In the LIAB data, wage information is daily and no information on precise hours is available. We keep full-time daily wages for individuals aged 18 to 65, and impute hourly and monthly wages by assuming 8 hours worked by day, and 20.8 days of work per month. In the data, wages are censored at the top at the social security threshold. These top-coded wages are imputed following Card et al., 2013. To account for outliers, we drop the few observations with imputed wages that are higher than the 99.9th percentile of the wage distribution. As the LIAB

variable for approximating wage floors (extent of pay above the wage floors), is not available for years 2005, 2007 and 2017 onward, we impute this information for years 2005 and 2007. If this information is available for an establishment in years 2004 and 2006, and 2006 and 2008 respectively, we replace the missing information with the mean value for the adjacent years. We further generate ISCO occupational codes in this data using a crosswalk between the five-digits KldB 2010 occupational variable contained in the LIAB data and four-digit ISCO codes. The ISCED 2011 education classification is not available for Germany, so that we define four closely aligned education categories: unskilled, apprentices and secondary school certificate, university of applied sciences graduates, and university graduates.

A.4 Italy

Linkage of collective bargaining agreement contracts

The source of information on actual wages, workers' and firms characteristics is LOSAI, which is an approximately 10% random sample of the universe of Italian private sector employees' social security records. This dataset is distributed by the Italian Ministry of Labor. Unlike other administrative sources, LOSAI does not contain an explicit key variable allowing us to link collective contracts to each worker. For this reason, we implemented probabilistic matching of workers to collective contracts.

Based on information derived from Fanfani, 2023, which uses the full population of private sector employees and explicit information on collective contracts applied to each worker, we calculated the most common collective contract applied within granular labor market cells. A cell was defined as the interaction between two-digit sectors, four geographic groups, three firm size groups, and two occupation groups. We then assigned to all workers within the same cell in LOSAI data the main collective contract applied according to the full population data. This procedure leads to a sample with around 70 imputed collective contracts in LOSAI.

Country-level description of the data

ISCO occupation code imputation ISCO is not reported in LOSAI data. ISCO can be derived from another Italian administrative archive (*Comunicazioni Obbligatorie*), but it is available only for workers that were hired or had a separation with the employer since 2010. Using this source of information, we have run an imputation procedure to assign 2-digit ISCO occupation codes. The procedure is similar to the imputation of collective contracts, but here the labor market cell was defined as the interaction between two-digit sector, five occupations, sex, two age groups and two wage groups (below-above the national median wage).

Selection of the relevant MW within each collective contract In Italy a collective contract sets several minimum wages, but using admin data we can only match a worker to a collective contract. Thus, we do not know which among the (usually 5-6) job-title minimum wages within a collective contract applies to the worker. For this reason, we applied the following imputation procedure, which uses a broad occupational classification available in LOSAI. Workers identified as "apprentices" or "blue collars" were assigned to the lowest occupation-specific minimum wage of the collective contract. Workers identified as "white collars" were assigned to the median occupation-specific minimum wage of the collective contract. Finally, workers identified as "managers" or "mid-managers" were assigned to the highest occupation-specific minimum wage of the collective contract.

The share of workers paid less than the minimum could be over-estimated when using the above assignment rule, due to the fact that some managers or white collars could be assigned to higher minimum wage levels than their actual one. Similarly, minimum wage differences between blue collars and white collars could be over-estimated due to the fact that not all blue collars are paid the lowest minimum wage. Despite these data limitations, this imputation procedure allows to assign workers to minimum wages that are more likely to be the relevant one for them.

Definition of hourly wages Hours worked are not provided in Italian administrative data. For this reason, we have computed full-time equivalent (FTE) daily wages, which is feasible, and it requires adjusting the wage of part-time workers using a coefficient that can be used to impute full-time equivalent days worked. Then, we have divided FTE daily wages by 8, which is the standard duration of work schedules, to derive an estimate of hourly wages. However, if the worker has overtime hours, this information is not reported in the data. Thus, actual hourly wages could be over-estimated if the worker has a schedule that is longer than 8 hours.

A.5 Norway

Linkage of collective bargaining agreement contracts

As detailed below, our data sources provide information on which CBAs each establishment is covered for each year in our sample period. This information is crucial for us to assign CBA wage floors and wage increases to individual workers employed in these establishments. To assign wage floors, we take a few additional steps, following the approach broadly described in Bhuller et al. (2022), Online Appendix. First, our approach relies on a detailed cross-walk between the textual information in CBAs on specific job titles and worker groups categorized by seniority and/or skill levels and the information that is available in our administrative data, such as the 4- or 7-digit occupational

codes corresponding to each job title and other measurable worker characteristics, such as age, education, apprenticeship status, tenure and work experience. Second, we use a dataset that provides information on manually transcribed wage floors by job title and worker category for around 150 major CBAs for each year in our sample period, covering the large majority of private sector workers covered by sectoral bargaining in Norway (Bhuller, 2025).[9] Third, we supplement information on all extensions of CBA wage floors, relying on cross-walks between the textual information on targeted labor market segments and worker categories within each segment and corresponding indicators for CBA extension exposure based on detailed information on industry, occupation and geographic areas. Finally, for workers that based on our establishment-level records or different cross-walks could be covered by multiple CBAs, either because the establishment has adopted multiple CBAs or if there is an extension in place, we assign the highest wage floor to each worker among the alternative floors. In addition, we also assign information on centrally negotiated wage increases, for which we use public information on such increases across broad CBA areas in annual reports published by the Norwegian Technical Reporting Committee for Income Settlements (AID, 2025).

Country-level description of the data

Data from Statistics Norway Our analysis uses matched employer-employee records available from Statistics Norway. From 2005 to 2014, these records are based on the annual *ATMLTO* datasets, which cover close to the universe of employment spells in each year, with the exception of spells lasting less than a week and spells with average weekly contractual hours less than four. From 2015 to 2019, we rely on the monthly *A-ordningen* datasets, which cover all employment spells, including very short spells. Information from these two sources is harmonized and aggregated to the annual level to construct a population-level matched employer-employee dataset from 2005 to 2019, where we retain only the main employment spell for each individual per year.

While our dataset contains information on base salaries, variable supplements, bonuses, overtime pay and both contractual and overtime hours for all employment spells from 2015 and onwards, it only provides information on the total cash salaries and contractual hours before 2015. For the analysis that focuses on measures of hourly wages that include supplements, bonuses and overtime pay, we thus rely on harmonized measures of total cash salaries and contractual hours for each year in our sample period. For the analysis that uses measures of hourly wages based on base salaries and contractual hours, we use supplementary data from Statistics Norway's Wage Survey Statistics (*Lønnsstatistikk* between 2005 and 2014. The survey data allow us to construct comparable measures of base salaries for around 40 % of private sector workers in each year between 2005 and 2014.

[9] By comparison, the case studies in Bhuller et al. (2022) focused on only 18 major CBAs in Norway.

Besides the matched employer-employee records and wage surveys, we also use register-based information from Statistics Norway's population, education and employment statistics to construct additional variables that are necessary for our analysis.

Additional Data on Collective Bargaining We use several sources of information to construct reliable measures of collective bargaining coverage. In particular, we use information from the *AFP* and *SLV* schemes that are administered by major employer associations and labor confederations and are part of nearly all sectoral CBAs in Norway. These datasets provide information on the dates when each establishment adopted (and exited) either scheme. Additionally, we use information from membership records for the two major employment associations in Norway (*NHO* and *Virke*), which provide details about the CBAs covering each employer (i.e, establishment or firm) that is a member in either association. Their members employ almost 80 % of all private sector workers covered by sectoral CBAs in Norway. We use these data sources of construct an establishment-level panel dataset with information on whether each establishment had CBA coverage and details about which CBAs it was covered by in each year.

Finally, we also collected information on all CBA extensions enacted by the Norwegian Collective Bargaining Board since 2004, with information on which CBAs were extended and when, and which labor market segments (e.g., broad industry and/or geographic area) and worker groups in each segment were targeted in each extension.

A.6 Portugal

Linkage of collective bargaining agreement contracts

The Labor Bulletin (*Boletim do Trabalho e Emprego, BTE*) reports all newly negotiated collective bargaining agreements in Portugal, in pdf format.[10] We extracted the following information for agreements signed 2008-2016: denomination of the agreement, which usually includes the signatory union(s) and employer association(s); type of agreement (sectoral, company, multi-company, or government directive); starting date; planned expiration date; and reference information on the preceding agreement. We coded as well the information on the worker categories and respective wage floors within each agreement, i.e. the monthly salary for full-time work, which by law must be paid 14 months a year.

The construction of a panel of wage floors had to address several challenges (see Card and Cardoso, 2022, JEEA, for further details). The first observation for any CBA floor category occurs when the first contract renegotiation takes place after January 1, 2008. So our database will build up after that date, into a stable set of contracts from 2010 onwards. Secondly, increases in the national minimum wage will override wage

[10] Available at http://bte.gep.msess.gov.pt.

floors below the new national minimum. Hence we updated all wage floors to meet the minimum wage as of the reference date of the QP. Thirdly, some agreements set different wage floors depending on firm attributes (e.g., its revenues) or workers' (e.g., their tenure or performance evaluation). Fourthly, an employer or employer association will often sign separate but identical agreements with different unions. We consolidate such duplicate or "parallel" agreements, reducing the total number of agreements from 1,467 to 1,061. Agreements covering firms in agriculture or fisheries, or those in Madeira or the Azores are not considered. Therefore, we analyze 988 new consolidated agreements as part of our basic CBA data set.

Nearly all collective bargaining agreements nominal wage clauses have a one-year duration, but an existing CBA remains in force until a new one is negotiated.

Country-level description of the data

Quadros de Pessoal (QP): linked employer-employee data The Ministry of Employment collects an annual census of all firms with at least one wage-earner in the private sector of the economy. Firms report their full roster of workers. The worker data includes gender, age, highest level of education achieved, occupation, date of hire, nationality, monthly earnings (split into several components), hours of work (normal and overtime), as well as the name of the CBA that she is covered by (if any) and the job category within the agreement.[11] The firm data includes its region, industry, yearly sales, etc. The information refers to a reference week in October each year or to the full month of October, depending on the variable. Firm sales refer either to the previous or current year, whichever is stated.

Unfortunately, the QP does ***not*** report the actual wage floor for the worker or the name of the floor category as used in the BTE that same year. Instead, it reports a *job title* or *professional category* of the worker, which in many cases can be matched to the list of job titles or occupations reported for the floor categories in BTE.

We exclude workers under the age of 18 or over 64, those in Madeira and the Azores, and those employed in agriculture and fisheries. We also exclude apprentices (3.5% of the relevant sample), workers who are not employed full time (15.1%), and those with missing information on wages (8.9%, including unpaid family members and firm owners) or education/date of hire (0.1%). On average we have about 1.85 million workers per year.

[11] To infer a worker's yearly labor income, we multiplied by 14 the monthly total pay reported for October by the data source, including the base pay, other components paid regularly on a monthly basis, irregular components paid less frequently, and overtime pay. The data refer to October because it was considered a representative month in the year. However, the 13th and 14th months of pay usually include only the regular monthly pay components.

Reliability of the procedure to link CB agreements to the worker-level information

We first matched agreements in QP to those in our BTE database. We then matched the wage floor groups within an agreement in BTE to the job category codes reported in QP. We assign the correct floor to a worker whenever the relevant variable is available in QP, though that is not always possible. We were able to match about half of all workers in QP covered by a CBA to their wage floor. The main challenges we could not overcome were (1) lack of information on the variable(s) needed to assign workers to a wage floor within a CBA; (2) existence of several sub-floors for each job category; (3) lack of obvious matches between the job types specified in BTE and the job titles used in QP.

The procedure used was an exact matching of the agreements and their wage floors in BTE to agreements and worker categories in QP, by direct inspection of the designation of the agreement and each job category across both data sources. Card and Cardoso (2022) report details on the subset of workers in QP that were successfully assigned a floor. They also compare covered workers with a matched floor to those for whom no floor could be assigned. The fraction of matched workers remained stable from 2010 onwards. Covered workers who can be assigned a wage floor are broadly similar to those who cannot. In particular, their gender, education, experience, job tenure, and mean log wages are quite similar. This similarity is also true year-by-year.