The Employer Size Wage Effect: Within and Across Firms

André Diegmann
IWH, IAB, CESifo, ZEW

Steffen Müller
IWH, OvGU

Benjamin Schoefer
UC Berkeley, IWH

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Abstract

We revisit the employer size wage effect (ESWE)—the perhaps most influential departure from the law of one price for labor. Our main result is that this canonical fact *disappears completely* across establishments within the same firm. Our simplest vehicle for this result is to augment the standard ESWE regression of wages on establishment size with a *firm fixed effect*. The reason for why no prior such within-firm study exists is likely the need for population-wide triple-merged firm-establishment-worker data, which our research design draws on in the context of Germany (where about 25% of employment is in multi-establishment firms). That is, while firms pay different wages across their establishments, establishments are large or small without any relationship to wages whatsoever. This wage-size decoupling poses a challenge to the monopsony view. According to monopsony, employer size and wages go hand in hand, with the inverse finitely elastic firm-specific labor supply curve corresponding to the ESWE (with caveats we discuss and attempt to address). Instead, our findings point towards rationed labor supply, rent sharing, and firm-level personnel policies as theories of wage setting and labor demand. More broadly, our additional finding that multi-establishment firms tend to pay wage premia raises the possibility that high-wage employers appear to operate *off* their labor-supply curves and *pay premia above and beyond what monopsony would demand*. Our paper also includes the first systematic meta-analysis of the ESWE.

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1 Introduction

The perhaps most robust, universal and influential departure from the law of one price for human capital is the employer-size wage effect (ESWE): larger employers tend to pay higher wages, and this relationship holds across time periods, countries, and types of employers, and is robust to composition adjustment.[1] As the first meta-analysis of the ESWE in this paper shows, the estimated elasticities of wages to employment range between 0.019 at the 25th percentile and 0.050 at the 75th percentile, thereby implying large wage differentials given the wide dispersion in firm size. Besides interpretations such as rent sharing or compensating differentials, the perhaps most prominent contemporary explanation is monopsony (see, e.g. Green, Machin, and Manning, 1996; Bachmann et al., 2022, for an application of monopsony to the ESWE). According to monopsony, firms select the employment level along a finitely elastic firm-specific labor supply curve, dictating that size and wages go hand in hand.

In this paper, we show that this canonical regularity *disappears completely* across establishments within the same firm. To do so, we draw on *new triple-matched firm-establishment-employee data* covering the (near-)universe of German social security records (Diegmann et al., 2024). In our main specification, we simply rerun the conventional cross-sectional ESWE specification but include a *firm fixed effect* while including establishment size as the employer size proxy. This design permits us to separate the employer size that would matter for monopsony from other factors such as firm-level rent sharing or personnel policies that may be active at the firm level. Naturally, once we include firm fixed effects, we rely on variation of establishment size in multi-establishment firms, which make up about 25% of German private sector employment. We ensure that these establishments are spread across different local labor markets. While this within-firm between-establishment analysis was not possible before in the German context, our meta-analysis also confirms that it has so far not yet been conducted in any other context.[2] Our main specification is at the establishment level, with average log wages as well as composition-adjusted firm wage premia as given by firm fixed effects identified by movers (Abowd, Kramarz, and Margolis, 1999; Card, Heining, and Kline, 2013), and we also consider worker-level and firm-weighted specifications.

The irrelevance of establishment size for wages within firms holds for both raw wages and firm wage premia adjusting for worker quality. Our regression estimates of the coefficients on log employment are precise zeros, with point estimates of just -0.0038 to 0.0027 and tight standard errors of around 0.001. That is, while firms pay different wages across their establishments, establishments are large or small without any relationship to wages whatsoever. The disappearance of the ESWE is robust to controlling for industry-location fixed effects (as a proxy for the local labor

[1] See, e.g., Moore (1911); Brown and Medoff (1989); Abowd, Kramarz, and Margolis (1999); Oi and Idson (1999); Bloom et al. (2018).

[2] Existing studies may include firm or establishment employment concepts. A handful of studies, e.g. (Brown and Medoff, 1989; Bayard and Troske, 1999; Troske, 1999), also include both firm and establishment employment information as continuous controls but do not include a firm-fixed effect, thereby not permitting our analysis.

market), to splitting the sample into firms subject or not subject to a collective bargaining agreement, to weighting firms equally (irrespective of establishment count), to restricting the sample to firms with many or few establishments, to aggregating establishments by location, and to different weighting as well as in worker-level specifications. For comparison, we recover the conventional ESWE in standard specifications: (i) among single-establishment firms (0.073, SE 0.000), (ii) among establishments of multi-establishment firms omitting the firm FE (0.035, SE 0.001), and (iii) when considering firm-level total employment (0.048, SE 0.001), with numbers for AKM establishment effects about two thirds or half the magnitude.

An important implication of our findings is the tension with the monopsony view of the ESWE and perhaps of the labor market more generally. After all, the ESEW can be considered the other (more precisely: inverse) side of the firm-specific labor supply curve that is at the heart of monospony:[3] to grow and be large, firms must pay higher wages.[4] But firms operating along the labor supply curve with wages only is hard to square with our results among MEF establishments (absent a perfectly offsetting comovement in labor supply curves).

To understand this fact further, we conduct a series of additional analyses that broaden the definition of monopsony beyond the basic setting. As a first pass, we recognize the dynamic monopsony and search model setup (Manning, 2006, 2013; Burdett and Mortensen, 1998; Bloesch, Larsen, and Yding, 2024), whereby firms can also exert non-wage expenses to recruit workers, such as investing in recruitment or by offering non-wage amenities. While our sample shrinks for these analyses that merge on survey-level data, we find that, if anything, in our sample of multi-establishment firms compared to single-establishment firms, smaller (and often opposite-signed) effects of establishment size on outcomes such as vacancy duration, hours spent recruiting, euro cost of recruitment, or the number of applicants. So if anything, it seems that MEF establishments have an easier time being large than SEFs even though they do not increase the wage. Second, turning to separations and hiring as outcomes, also find no evidence of an additional effect of size on turnover rates among MEF establishments compared to SEFs. Third, we also do not see stronger evidence for a trade-off in terms of worker quality as an outcome although we find some imprecisely effect on labor productivity (for which we need to switch gears to an establishment sample with low coverage and hence wide confidence intervals that include the SEF effect).

To reconcile the tension, we put to use the insight that MEF establishments tend to be high-wage firms. Specifically, we show that they typically pay premia above what would be predicted from a SEF "wage function" (which we estimate using a Lasso model among SEFs). With that wage function in hand, we find that MEF establishments pay premia irrespective of size, with

[3] We discuss that this relationship need not hold in any case and discuss the assumptions or departures in the paper. See Manning (2006) and the discussion on page 18 in Bassier and Manning (2025).

[4] Microfoundations of the finitely elastic firm-specific labor supply curves that generate monopsony (Robinson, 1969; Manning, 2013; Azar and Marinescu, 2024; Kline, 2025) include reduced form "tastes" for employers (Card, Cardoso, Heining, and Kline, 2018; Berger, Herkenhoff, and Mongey, 2022), commuting costs, or wage posting search and matching models Burdett and Mortensen (1998).

only about about 25%-40% of them paying below the SEF benchmark. Hence, MEF labor demand appears to occur in the context of wage premia, which may detach employment in those firms from labor supply and generate *rationed firm-specific labor supply*—room for MEF establishments to grow large without premia exactly because they might already pay an excess premium for their size. This result squares with the aforementioned findings on MEF establishments hiring easily even when large and absent the size premium. This view would resolve the monopsony puzzle in those firms—because they do not appear to act as simple monopsonists but overpay, and enough qualified workers line up no matter the size. A broader implication is intriguing: perhaps high-wage employers more broadly often operate *off* their labor-supply curves and *pay premia above and beyond what monopsony would demand*—as appears to be the case for our multi-establishment firms.

While pointing away from standard monopsony views, our findings instead point towards other forces at play in the determination of wages and employment, at least within MEFs. Our discussion of those forces evokes themes of the literature on efficiency wages (Katz, 1986), featuring rationed labor supply, rent sharing, and wages subject to richer forces than basic supply and demand considerations. For instance, by zooming into within-firm variation across establishments, we connect to an emerging literature on the role of firm-level wage setting. Our paper is the first to document that the wage-size gradient breaks down within firms, and moreover brings this new finding into conversation with labor market models such as monopsony. Most related to our work is Hjort, Li, and Sarsons (2024), who study multi-national corporations and find that firms extend headquarter wage premia across countries, and that wages comove across countries in the same firm, consistent with firm-level rent sharing. Hazell, Patterson, Sarsons, and Taska (2022) zoom into a sample of vacancies that disclose wages in the United States and focusing on national employers hiring across US local labor markets, find that a significant minority post nationally identical wages, and that geographic wage variation is attenuated within national employers more broadly. Similarly, there is a literature on pay equity constraints across worker groups within firms (Bewley, 1999; Saez, Schoefer, and Seim, 2019; Amior and San, 2025), although there is evidence that the ESWE really emerges in a skill-group-specific way within firms (Barth and Dale-Olsen, 2011).

The paper is organized as follows. In Section 2, we provide our meta analysis of the ESWE. In Section 3, we present the data, our research design, and our sample. In Section 4, we present our empirical results. Section 5 interprets these results and presents additional analyses of mechanisms, and situates our findings in the literature on the ESWE and monopsony specifically. Section 6 concludes.

2 Meta-analysis of existing empirical estimates

We provide an overview of the ESWE in the form of a comprehensive meta-analysis of existing empirical estimates, presented in Figure 1 and Table 1 (with additional information in Appendix Table A1). To our knowledge, this is the first such meta-analysis.[5] *An important result is that none of the existing studies has conducted a within-firm analysis, which is the innovation of our paper.* Crucially, none of the studies conduct our within-firm between-establishment analysis such as through a firm fixed effects—our main contribution.

Broadly, we report the regression coefficient of interest γ in specifications of the following kind:

$$\ln w_{it} = \alpha + \beta X_{it} + \gamma \ln n_{j(it),t} + \varepsilon_{it}. \tag{1}$$

where X_{it} may include Mincer controls or worker fixed effects, and the employment measure is, depending on the study, the establishment or firm. The specifications may be purely cross sectional or include panel dimensions. Moreover, some regressions are at the establishment level rather than the worker level. Hence, we exclude studies that report ESWE by binning employer size (e.g., Bloom et al., 2018).

We identify 57 preferred estimates from 23 studies, spanning a variety of specifications, countries, data sources, and time periods. We group estimates into four categories based on the degree to which worker heterogeneity is controlled for.[6] Studies with preferred estimates belonging to multiple categories appear in multiple categories. Within categories, we average preferred estimates across time periods and/or countries within studies, if applicable, and report one preferred estimate per study and category.[7] This yields 33 estimates from 23 studies. We list those estimates in Figure 1 and Table 1, which we complement with additional information in Appendix Table A1.

Overall, we find consistently positive ESWE estimates. Based on the 33 preferred estimates reported in Table 1, the mean elasticity of wages with respect to employer size is 0.038, indicating that a doubling of employer size is associated with a 3.8 percent increase in wages. The median estimate (0.037) is very close to the mean, the 25th percentile is 0.019, and the 75th percentile is 0.050, resulting in an interquartile range of 0.031.[8]

[5] To be included, studies must (1) be published in a refereed journal at the time of the meta-analysis (i.e., August 25, 2025); (2) report the ESWE as a continuous elasticity (as opposed to wage–size regressions based on size classes); (3) use data from developed or highly developed countries; and (4) have a clear focus on estimating the ESWE, rather than merely reporting a size coefficient in an otherwise unrelated wage analysis.

[6] We recognize that studies cannot all be forced into a single template, but our selection of preferred estimates within studies generally followed these guidelines: we prioritized plant over firm size (as most studies and our main analysis focus on plants), worker-level over employer-level regressions, pooled samples over subgroups (or the largest subgroup if only subgroup results were available), and estimates based on the largest dataset when multiple sources were used.

[7] We anticipate that coefficients across separate regressions within the same study may be positively correlated (due to study design etc.) and report two bounds for the standard error of the average coefficient. The first number is for zero correlation $SE(\bar{\beta}) = K^{-1} * \sqrt{\sum_{k=1}^{K} SE_k^2}$, the second for perfect correlation, which is the mean of the standard errors.

[8] Accounting for the precision of the estimates via inverse-variance weighting is not feasible, as some studies do not

Turning to different empirical contexts, Table 1 shows that ESWE estimates are lowest in the Scandinavian countries (0.014)—a new result that is unsurprising given the relatively low wage inequality in Scandinavia. They are similar in continental Europe excluding Scandinavia (0.050) and the rest of the world (0.048; Brazil, Canada, the United Kingdom, and the United States). We observe substantial differences across the four categories defined by the extent to which worker heterogeneity is controlled for. The average ESWE is relatively high (0.057) among studies that do not control for worker heterogeneity. Among studies that control for observable worker characteristics, the average drops to 0.035, and it declines further to 0.016 in studies that control for unobserved worker heterogeneity using worker fixed effects, consistent with high-wage workers tend to sort into large firms.

AKM-based studies of the ESWE place the estimated employer fixed effect on the left-hand side of the regression, thereby explicitly accounting for worker heterogeneity. Perhaps somewhat surprisingly, the two studies employing AKM-style employer effects report relatively high ESWEs (lower panel of Table 1). Alvarez, Benguria, Engbom, and Moser (2018) report an elasticity of 0.072 for Brazilian firms, declining from 0.106 in the late 1990s to 0.047 around 2010. In contrast, the estimates in Lochner, Seth, and Wolter (2020) for establishment size in Germany are close to the continental European mean (0.05) and show less variation over time.

We summarize those patterns in a regression analysis based on the 33 preferred estimates, reported in Appendix Table A2: (i) ESWE is lowest in Scandinavian countries, (ii) it is similar between continental Europe (excluding Scandinavia) and the rest of the world, and (iii) estimates are lowest when worker fixed effects are included,[9] somewhat higher when observable worker characteristics are controlled for, and highest in worker-level regressions without controls for worker heterogeneity as well as in employer-level regressions with AKM employer effects as the dependent variable. We do not find any systematic differences regarding the time period analyzed in these studies.

Using AKM employer effects derived from the same German matched employer–employee social security data as we do, Lochner, Seth, and Wolter (2020) is the study most comparable to ours. The key innovation of our research design is to draw on novel data that permits us to compare establishments belonging to the same multi-establishment firm, so that we control for a multitude of typically unobserved employer characteristics such as employer- and product brand, human-resource practices, hiring policies, or firm-level surplus or bargaining power.[10]

report standard errors. Moreover, extremely small standard errors in a few studies would result in nearly all the weight being placed on them. For instance, Pehkonen et al. (2017) report standard errors of 0.0001 whereas the seminal work by Brown and Medoff (1989) reports standard errors around 0.002 implying that Pehkonen et al. (2017) would get 400 times the weight of Brown and Medoff (1989).

[9]But we also note that the specifications that contain worker fixed effects identify the EWSE of panel variation and hence largely employment-size changes among stayers (short-run variation that may be lower).

[10]Other studies set in the German context include Gerlach and Schmidt (1990) and Gerlach and Hübler (1998) (both based on the German Socio-Economic Panel), Schmidt and Zimmermann (1991) (based on data from the Zentralarchiv für Empirische Wirtschaftsforschung in Cologne), and Gibson and Stillman (2009) (based on the International Adult

Importantly, while some studies also include firm-level employment (on its own or in a horse race with establishment employment), none of those studies includes a specification that includes a firm fixed effect—the key innovation of our study.

3 Research design, data, and sample

We present our research design and then describe our data and sample. It will be useful to define single-establishment firms (SEFs) and multi-establishment firms (MEFs).

3.1 Research design

We provide a combination of formal regression models that impose a linear relationship between log wages and log employment, and supplement this analysis with nonparametric binned scatter plots. We also provide individual case studies of large firms. Throughout, our focus is on the elasticity of wages to employer size as the statistic corresponding to the ESWE.

Regression specification. We run versions of Equation (1) in our data, which is triple-matched firm-establishment-worker data from Germany, which we detail below in Section 3.2:

$$\ln w_j = \alpha + \nu_{m(j)} + \theta_{f(j)} + \gamma \ln n_{j(i)} + \varepsilon_i. \tag{2}$$

Index j denotes establishments, as our main specification is an establishment-level variant. We also replicate our results while firm-weighting (inversely weighting establishments by their firm's establishment count) and effectively weighting by establishment size in a worker-level (universe-based) specification. Our regressions are cross-sectional, so that the fixed effect specification cleanly isolates within-firm size differences rather than confounding employment changes among, e.g., stayers.

Our outcome variables are the log mean of the establishment wage and AKM establishment fixed effects, which adjust for composition. We detail those variables below in Section 3.2. We here note that by considering AKM effects as a *dependent* variable, we circumvent the debate on precision in those variables (Bonhomme, Lamadon, and Manresa, 2019; Kline, Saggio, and Sølvsten, 2020). Our standard errors are robust (and have found very similarly small SEs when experimenting with clustering, e.g., at the labor market region-industry level).

Our coefficient of interest is γ—capturing the employer size wage effect as an elasticity of wages to employment (after controls).

Literacy Survey). These studies are conducted at the worker level and control for observable worker characteristics. They meet all inclusion criteria for this meta-analysis except for reporting the ESWE as a continuous elasticity. Roughly approximating the ESWE by assigning midpoints to the reported firm size categories yields elasticities around 0.015 in the first two studies, 0.023 in Schmidt and Zimmermann (1991), and approximately 0.05 in Gibson and Stillman (2009).

As controls, our preferred specification includes fixed effects $\nu_{m(j)}$ for the establishment's labor market m, proxied for by industry and local labor market (*Kreis*, see below), or their interaction. By studying relative size within the market, the specifications with local labor market fixed effects moreover would capture employment shares, the relevant concept for some monopsony models (as in Berger, Herkenhoff, and Mongey, 2022).

In our key specification, we then include firm fixed effects $\theta_{f(j)}$. This specification identifies γ off variation of different sized establishments all belonging to a multi-establishment firms and compares how relative size—compared to the firm's other establishments in other labor markets—correlate with that establishment's wage.[11]

We also consider versions where we additionally or solely consider firm-level employment (the sum of the firm's establishments' employment) or run a horse race between firm and establishment employment (while noting that our firm FE is qualitatively different from such a parametric control for firm level employment).

Nonparametric scatter plots. In addition to the parametric regression above, we also show the ESWE and its disappearance in binned scatter plots of the relationship of wages and employer size. We will do so in subsets of SEFs and MEFs (and other sample splits). Given the large number of observations, we report binned scatter plots. We then calculate the quantile cutoffs values separately by sample, for the plots to also illustrate dispersion in employment size. We also present case studies for particularly large individual firms.

3.2 Main data and analysis sample

Our data is triple-linked matched firm-establishment-worker data from Germany. Our cross-sectional analysis focuses on 2019. Our main specifications are in establishment-level data, but we also draw on worker-level data to replicate the results in that specification in the literature.

Data. Broadly, our data draw on three components: firm-level, establishment-level, and worker-level information.

Our baseline dataset is the *Establishment History Panel* (BHP) provided by the Institute for Employment Research (IAB). Employers in Germany are obliged to notify all employees who are subject to social security contributions. Thus, the data cover the universe establishments with at least one employee subject to social security contributions. Civil servants and the self-employed are exempt from such notifications and hence not covered. Establishment information is then observed on June 30th on a yearly basis (see Ganzer et al., 2023 for a detailed description).

Besides employment, the BHP contains mean average wages, and we supplement our data with the IAB-estimated AKM fixed effects following Lochner, Seth, and Wolter (2020). For some

[11] The versions that additionally include labor market fixed effects employ a double comparison with other firms.

specification, we draw on additional establishment surveys. We detail our key variables below.

To obtain firm identifiers in the IAB data, we make use of a recently established data merge between the BHP and comprehensive firm level data (MUP).[12] The record linkage between the two datasets is based on name and address information between MUP and BHP and is generated following an algorithm developed in Doherr (2023). Diegmann, Doherr, Hälbig, and Wolter (2024) provide a final dataset with clean links between establishments and firms and show match rate statistics. For the year 2019, which is the main focus of our analysis, 81.9% of all observed establishments have firm links, and more than 90% of employment—with even higher match rates in the sectors we focus on. From the perspective of the MUP firms, match rates are round 80%.

Finally, for our worker-level specification, we also draw on the 100% version of worker-level data from the *Integrated Employment Biographies* (IEB), containing complete information on earnings and days worked in each employment spell and worker characteristics. We restrict the sample to regular workers who are employed subject to social security contributions, thereby excluding apprentices and marginal employees. To align the data with our establishment data, we retain all employment spells that contain June, 30th of 2019. In case of parallel employment spells, we choose episodes with highest daily wages. We follow Dustmann, Ludsteck, and Schönberg (2009) and Card, Heining, and Kline (2013) and impute wages that lie above the social security contribution limit.

Firm vs. establishment definitions. We now clarify the definition of firm vs. establishment in the German IAB data. Following Ganzer et al. (2023), an *establishment* is a regionally (at the municipality (*Gemeinde*) level) and economically (5-digit industry) delimited unit in which employees work. It may consist of one or more branch offices or workplaces belonging to one enterprise. The Federal Employment Agency issues an eight-digit establishment identifier. It identifies a unit uniquely and is issued if an establishment is obliged to submit social security notifications. The assignment of an establishment identifier depends on the economic purpose of the establishment and its main economic activity within municipalities. Larger production units could hold multiple identifiers if the site hosts more than one economic purpose, e.g., research and development, production and catering. An establishment may or may not be economically independent. Hence, it reports employees to the Federal Employment Agency but, for instance, no information to the tax authorities.

For robustness of the definition of establishments, we also consider an alternative definition in which we aggregate employment at the district (*Kreis*) level, summing establishment employment across industries and municipalities (*Gemeinden*) to that level of aggregation, so there there is at

[12]The firm-level data is the *Mannheim Enterprise Panel* (MUP), the most comprehensive micro panel data of companies in Germany. Besides the official Business Register of the Federal Statistical Office, the MUP has close to full coverage of all firms starting around 2000. Bersch et al. (2014) provide detailed information on data collection, processing, and variable definitions. We largely draw on this dataset to obtain a firm identifier but do not currently use the underlying firm-level variables.

most one observation per municipality and 5-digit industry per firm. There are 400 districts and around 11,0000 municipalities in Germany.[13]

A *firm* in the MUP data is defined in terms of legal units defined as in the statistical business register, where a legal unit may be a natural person engaged in economic activity, a legal person, or an association of persons. Economic activity includes not only the operation of businesses but also the exercise of certain self-employed professions (e.g., law) and the holding of shares or participation in other legal entities. Examples of legal units include joint stock companies, limited liability companies, general partnerships, and sole proprietorships. A legal unit is the smallest entity required to prepare financial statements or comparable records for commercial and/or tax purposes. Importantly, a legal unit may comprise several establishments; however, not every legal unit corresponds to an establishment in the sense of a production unit (Diegmann et al., 2024).

Variables. Our main variables are employment, and notions of the wage. The baseline employment measure is based on all employees observed for each identifier (i.e., here without restrictions on full time status or apprenticeship status etc., which would not affect our main results). We use this measure either at the establishment level or aggregated to the firm level (in an alternative specification). Alternatively, we provide results based on employment numbers of full-time employees.

Our wage variables are either the IAB-provided mean wage at the establishment level (from the BHP establishment panel), which we log. This variable is calculated for full-time employees only.

Importantly, we also consider composition-adjusted wages, specifically the IAB-provided AKM (Abowd, Kramarz, and Margolis, 1999) fixed effects based on Card, Heining, and Kline (2013) and Lochner and Wolter (2025), using the 2014-2021 vintage for all of Germany (East and West). These fixed effects are estimated in a panel regression of worker-level wages on worker-level controls, worker fixed effects, and establishment fixed effects.[14] We reiterate as mentioned above in Section 3.1 that by considering AKM effects as a *dependent* variable, we circumvent the debate on precision in those variables (Bonhomme, Lamadon, and Manresa, 2019; Kline, Saggio, and Sølvsten, 2020).

Sample. We conduct our cross-sectional analysis in 2019. The main reason for 2019 is to avoid the Covid pandemic. Our main analysis sample covers the core private sector establishments based on the sector classification of the German Statistical Office (WZ08). Thus, we drop observations from public administration and defense, education, health care and social work activities, and arts, entertainment and recreation. Moreover, we drop observations with only one employee (and

[13] We use the most recent regional boundaries of 2021 with 400 districts and 10,994 municipalities. In the 2019 cross-section of the BHP, we observe establishments in 10,462 municipalities.

[14] In one (worker-level) specification, we also draw on the associated IAB-estimated worker fixed effects as a simple variable to control for worker quality.

include robustness checks with higher cutoffs). (This restriction is inconsequential as our non-parametric binscatter plots will reveal relatively linear log-log relationships and unreported checks confirmed robustness to larger firm size cutoffs.) We also restrict our sample to establishments with an estimated AKM fixed effect (even when considering raw wages as an outcome). Some robustness checks merge on smaller establishment surveys (described at the end of the section) and hence consider subsamples of this main analysis sample.

Defining single-establishment firms (SEFs) and multi-establishment firms (MEFs). In our research design, we separate establishments and firms into single-establishment firms (SEFs) and multi-establishment firms (MEFs). Our most basic definition does so on the basis of at exactly vs. more than one establishment in our data. We note that any unassigned establishments would misclassify some SEFs.

Summary statistics. Multi-establishment firms make up about 25% of German private sector employment, whereas about 12% of establishments are a member of MEFs. Among *establishments* with at least 10, 50 and 100 employees, these statistics are 27% and 17%, 32% and 26%, and 34% and 30%, respectively. Similarly, 3.8% of *firms* are MEFs. Among *firms* with at least 10, 50 and 100 employees, the shares of MEF employees and establishments is 27% and 7.9%, 36% and 21%, and 41% and 29%, respectively. Figure 2 reports these numbers by sector, and shows that MEFs make up a larger fraction (or, equivalently, are overrepresented in) the following industries: finance and insurance, mining, electricity, ICT, and wholesale and retail.

Table 2 reports summary statistics for our analysis sample, for the pooled sample, and MEFs and SEFs separately. Columns (1)-(3) are establishment-weighted and Columns (4)-(6) are weighting establishments by their employment. We consider the wage (based on establishment log mean wage), the establishment AKM effect, employment, industry (one sector code), an establishment-level indicator of being located in East or West Germany, establishment age in years, fraction female, fraction of helper activities, professionals, specialists and experts, and proxies for turnover (hiring rate, separation rate, and turnover rate).

3.3 Additional surveys for supplementary checks

For some additional investigations, we merge on establishment surveys, generating smaller samples for those checks.

Additional dataset: IAB Establishment Survey. We merge on the annual IAB Establishment Survey, for instance, for sample splits by collective bargaining coverage. Since the 2019 sample (our analysis period) is small, we expand coverage by filling in information missing in 2019

with information from the closet year before or after in the survey.[15] With this approach, we can merge on survey information for 31,060 establishments in our 2019 BHP analysis sample. Appendix Table A4 provides summary statistics for the merged sample distinguishing between single-establishment and multi-establishment firms. Of particular relevance are information on collective bargaining agreements (CBA), for which we construct an indicator for coverage defined as either the establishment is covered by sectoral collective agreements or inhouse/company agreements, or the establishment informally orients its wages to sectoral agreements—and for this outcome variable, we moreover extrapolate the status across all establishments within the firm (as we have found that there is little variation in coverage within the firm).

Additional dataset: IAB Vacancy Survey. To understand potential offsetting mechanisms whereby MEF establishments can grow large without drawing on the wage margin, we merge on the 2019 wave of the IAB Vacancy Survey (see Börschlein et al., 2024).[16] The survey is a representative repeated annual cross section of about 14,000 establishments. Appendix Table A5 provides summary statistics for the survey merged to our 2019 sample distinguishing between single-establishment and multi-establishment firms. Of particular relevance are information on the vacancy duration,recruitment effort (hours and expenditure) to fill the vacant position, number of suitable applicants, and the number of invited applicants for the recent hiring process.

4 Results

We now present our results dissecting the employer size wage effect. We start by showing that substantial wage variation and size variation exists among SEF and MEF establishments, and also across establishments within a given MEF. Moreoever, even though MEF establishments are larger and pay more than SEFs, the wage and size distributions of MEF and SEF establishments have considerable overlap.

We then move to the analysis of the ESWE as such. We estimate this effect separately for SEFs and MEFs. For MEF establishments, we conduct between and within firm analyses, in specifications with and without firm fixed effects.

Lastly, we show a large set of robustness checks and heterogeneity analyses.

[15] The representative annual survey started in 1993 in West Germany and 1996 in East Germany and currently covers about 16,000 establishments. Appendix Figure A.1 reports the survey years for establishments observed in the BHP in 2019.

[16] For information based on the vacancy survey, we backfill information from the years 2015 to 2018 if the establishment was not in the survey in 2019.

4.1 Univariate analysis: distributions of wages and employment by firm type

We start by plotting the distributions of log employment and wages (raw and AKM FEs) for SEF and MEF establishments in Figure 3, both in terms of raw levels (to compare overlap between the groups) and "normalized" versions that demean (to compare within-group dispersion). Specifically, for the latter normalized versions, we demean by labor market region times industry fixed effects for SEFs, and additionally by firm fixed effects for MEFs and then plot the resulting residuals.

Starting with the raw level comparison, we confirm that while MEF establishments pay more and are larger on average than SEFs, there is substantial overlap in those distributions. Turning to the residual variation, we find that wage dispersion is strikingly similar between MEFs and SEFs, with standard deviations of 0.17 and 0.35 for wages and 0.85 and 1.04 for employment, respectively. (Appendix Figures A.2 and A.3 complement this perspective by further reporting on the dispersion of size, wage and AKM effect dispersion.) This perspective already makes clear that even at the univariate perspective, MEF establishments exhibit tremendous heterogeneity in employment and wages even within firms, in a way that is not dissimilar from the large dispersion seen between SEF establishments. We will understand the joint distribution of those variables next, when we study the "effect" of employment on wages.

4.2 Replicating and deepening the Standard ESWE in our data

We now report our main results: the relationship between wages and employment across establishments. We start by replicating the ESWE facts across establishments. That is, we estimate the specification in Equation 2 *without* the inclusion of firm fixed effects and in the pooled sample that does not yet separately estimate the effect within SEF and MEF establishments.

Establishment-level specification. We start with our main specification conducted on the establishment level. We report the formal regression estimate following Equation 2 in Table 3 Columns (1)-(3), and complement this estimate with a nonparametric binned scatter plot to visualize the underlying variation in Figure 4. We always report results separately for the log wage and the establishment AKM effect as dependent variables, where the latter nets out worker quality differences. (Generally, we find that the ESWE is larger for the former, indicating sorting of high-quality workers into large and high-wage firms.) Our coefficient of interest is γ, which captures the ESWE, i.e., the elasticity of wages to employer size.

Across German establishments, the coefficients of the establishment-level wage regression on log employment are 0.073-0.074 for raw wages. Turning to the specification with the establishment AKM effect as the dependent variable, which nets out worker quality compositional effects, we find an effect about half the size at 0.037. This attenuation implies that high-wage workers systematically sort into large firms that pay higher wages, so that the raw wage effect overstates the true wage premium effect. While the main specification in Column (1) and depicted in the scatter plot do

not include controls for industry or location, we report results with industry (2-digit industry) and location (local labor market region) fixed effects in Column (2), and their interaction in Column (3). Results are similar across these specifications. Standard errors are consistently below 0.001. Hence, our pooled baseline results are consistent with the analogous specifications in Lochner, Seth, and Wolter (2020) (see also Section 2).

Worker-level specification. While our main analysis will remain at the establishment level, we also report a worker-level specification rather than one at the establishment level, for comparability with the worker-level variants in the literature (see Section 2). The results are contained in Table 4 Columns (1)-(3). We find similar ESWE coefficients of about 0.052-0.112 with standard errors around 0.001-0.002 for raw wages. The smaller estimates come from specifications in which we account for worker quality by including Mincer controls (female indicator, indicator for part-time employment, three education groups, and 12 occupation groups) as well as the continuous value of the AKM worker FE from Abowd, Kramarz, and Margolis (1999); Card, Heining, and Kline (2013) as generated in Lochner and Wolter (2025).

4.3 Main result: no ESWE across establishments within the firm

We now turn to our within-firm across-establishment variant of the specification in Equation 2—now estimated *with* firm fixed effects. This cross-sectional specification is then naturally only estimated in the sample of MEFs (as SEFs leave no variation after the inclusion of firm FEs).

Single-establishment firms. We report the results in the remaining columns of Table 3 as well as Figure 5. We separately estimate γ for the sample of single-establishment firms (SEFs) and establishments belonging to multi-establishment firms (MEFs). For the SEFs, Columns (4)-(6) report essentially identical estimates as for the pooled analogs in Columns (1)-(3), perhaps unsurprisingly in light of the sample being dominated by SEFs (see also Section 3.2 above), with estimates for γ around 0.073-0.074 for raw wages and 0.036-0.037 for establishment AKM effects.

Multi-establishment firms: no firm FE. We then turn to the sample of multi-establishment firms. In Columns (7)-(9), we start by replicating the specifications analogous to Columns (1)-(3) and (4)-(6) from the pooled and SEF samples in terms of controls—but do not yet include the firm fixed effect. We find a mild attenuation of the ESWE. For raw wages, the coefficient estimates are now in the range of 0.035-0.046. For AKM effects, we estimate ESWEs of 0.020-0.022. That is, we document up to a halving of the ESWE when moving to MEFs—but a remaining sizable effect. This mild reduction motivates a check on other employment concepts for MEFs, so that we include firm-wide employment in the same specification as an independent variable (which we construct by summing employment across establishments). We find a large "independent" effect of firm size

on wages of about 0.045-0.048, which survives the inclusion of establishment employment (which in turn then drops to 0.013 in the horse race specification). While we leave open the interpretation of these results, we overall find strong ESWE no matter the specification and interpret the strong effect of firm-level employment as a stepping stone towards our analysis with firm fixed effects.[17]

Multi-establishment firms: with firm FEs. We then move to our specification with firm fixed effects in Columns (12)-(14)—whereby we compare how wages and establishment employment comove across establishments within the same firm. Here, the main finding is a striking zero estimate for γ, the coefficient of interest that captures the ESWE. For raw wages, the estimated coefficients range between -0.0038 and 0.0023, with tight standard errors that let us rule out effects above 0.004—just a tenth the size of the point estimate for the baseline estimates before firm fixed effects. For AKM effects, the effects are similarly tightly estimated around zero, with point estimates of -0.0001 to 0.0027 and permitting us to rule out even smaller positive effects.

Hence, despite the tremendous variation in wages and employment even within firms, establishments can evidently grow and be larger or smaller without any systematic relationship with wages whatsoever. In other words, the ESWE breaks down across establishments in the same firm.

4.4 Case studies of individual firms

To complement our large-sample analysis of all MEFs, we also present case studies of individual MEFs. We focus on AKM effects to strip out compositional effects (but would find similar results for raw wages). Figure 6 reports those related results.

Figure 6 Panel (a) zooms into the largest firms and traces out their wage-employment gradients (again in a binned scatter plot). It does so for three definitions: firm-level number of establishments, firm-level total employment, and the firm's largest single establishments (conditional on having at least 10 plants). Panel (b) plots the wage-size relationship for the largest 10 firms, based on the number of establishments. Panel (c) groups firms by extreme size: the top 10 largest firms in terms of the number of establishments, and the bottom firms pooling all MEFs with exactly 2 establishments. Panel (d) zooms into the 51 MEFs with at least 100 plants and presents estimates for each of those firms.

Across these case studies, we confirm that MEFs exhibit no relationship whatsoever between size and wage. The case studies also highlight the fact there is no "mix" of plants some of which follow the SEF gradient and others that do not, a constellation that might have been masked in the average gradient we estimated so far. This becomes particularly clear in Panel (d), where we plot 52 separate firm-level estimates centered around zero.

[17] Our meta analysis in Section 2 did not yield a persistent pattern when it comes to firm-level vs. establishment employment concepts. Among the studies in our meta analysis, such horse-race specifications have only been conducted in Brown and Medoff (1989), Bayard and Troske (1999), Troske (1999), and Barth and Dale-Olsen (2011).

We also note that the analyses reiterate that MEFs pay wages above the SEF gradient, even for the smallest MEF establishments (in terms of establishment employment as well as establishment count (Panel (b)). We pick up this important insight again in Section 5.3 below when trying to understand the implications of the high wage level of MEFs.

4.5 Additional checks

Worker-level specification. Our results so far were within the establishment-level specification (unweighted). The same result emerges within the worker-level design, reported in the remaining Columns (4)-(7) in Table 4 already discussed above, once worker quality controls are included.

Weighting and size cutoffs. Supplementing the worker-level specification, in Table 5 we revisit the MEF specifications. We find overall robust results for both raw wages and AKM effects.

First, we separately consider MEF establishments with more than or at most 5 employees. Appendix Table A6 additionally considers higher establishment size cutoffs of 10, 20 as well as 10 full-time employees. Second, we adjust establishment weights inversely to the firm's establishment count, so that the weighting is firm-level. Third, we split up MEFs by their establishment count (exactly 2, 3 to 9, 10 to 99, and 100 and up), and find similar results in the form of no economically sizable positive ESWE.

Changing the establishment definition: aggregation. So far, we rely on the administrative definition of establishments in the German IAB data, whereby an establishment for social security tax purposes is defined as a 5-digit industry code in a given municipality (see Section 3). This administrative definition may not align with the economic concept of an employer's market share that would, e.g., be relevant in a monopsony model.

To gauge robustness of our finding to the establishment definition, we additionally define establishments more coarsely by aggregating employment across industries within a location as well as aggregate municipalities to the district level (see Section 3 for details on these definitions). We report those results in Table 6.

We find nearly identical results for this definition: SEFs retain their ESWE of about 0.075 and 0.036 for raw wages and AKM effects, respectively, while the within-firm effect estimated with fixed effects among MEF establishments is economically zero (with a point estimate of about -0.003 for raw wages and -0.0016 for AKM effects).

Heterogeneity: collective bargaining coverage status. A potential explanation of our findings might be that in particular large firms are more likely to be in collective bargaining agreements that may impose similar wage floors—although those are less likely to be binding in large and

productive covered firms as they pay premia over those CBA wage floors (see, e.g. Jäger, Noy, and Schoefer, 2022).

To check for this, we merge on information on collective bargaining coverage from the IAB Establishment Panel, an annual survey of establishments. As discussed in Section 3.3, we boost sample size by filling in missing observations from other years in which our 2019 establishment analysis sample may be surveyed.

Table 7 reports the results by splitting firms into covered and non-covered establishments. We find similar results across both groups, further substantiating the perspective that collective bargaining would be unlikely to explain our findings.

5 Interpretation, discussion, and implications [preliminary]

We now present a discussion and additional checks and investigations shedding light on how employers evidently grow and are larger or smaller without tantamount wage adjustment. Overall, our additional investigations point to rich patterns beyond the simple wage-size gradient we have entertained in Section 4 above, by shedding light on turnover and recruitment dynamics as well as patterns of worker quality. To understand our results, we rely on a broad perspective on what wages may do to employers and workers akin to the discussion of Katz (1986) regarding efficiency wages, whereby wages may have offsetting effects in various ways—with the monopsony and firm-specific labor supply curve as our initially leading perspective.

5.1 Additional investigations on margins of adjustment

We start by analyzing other margins explaining our results, by which firms may satisfy labor demand, or through which wage patterns in MEFs might affect firm operations. Turnover, worker quality, and effort are the primary personnel policy targets besides wages.

Dynamic monopsony: recruitment effort. A potential offsetting effect of higher wages is more effective recruitment, as in dynamic monopsony models. To check for this prediction, we draw on the IAB Vacancy Survey (see Section 3) and study as dependent variables in our specification in Equation (2) proxies for hiring costs: vacancy duration (of the last hire), hours spent recruiting the last hire, the hiring cost in Euro, and the number of applicants. We study these outcomes separately for SEFs and MEF establishments. Strikingly, if anything, we find that MEF establishments face less of a trade-off to be large despite not increasing wages: while larger SEFs consistently face higher vacancy durations and put in more recruitment hours and expenditure per hire, the effects among MEF establishments are zero or even negative. For applicant numbers, SEFs either receive (or as a result of more recruitment effort, obtain) more applicants per hire. Hence, we find little evidence for the idea that by keeping wages stable across smaller and larger establishments, MEF

establishments face an obviously steeper trade-off at the hiring margin. Our results are therefore not just hard to reconcile with standard monopsony models in which employment and wages are chosen among a menu given the the firm-specific labor supply curve, but also in richer dynamic monopsony models with turnover costs (see, e.g. Manning, 2006, 2013; Bloesch, Larsen, and Yding, 2024).

Turnover: hiring and separation rates. We now turn to a direct analysis of worker flows: hiring and separation rates as well as turnover. We rely on administrative worker flow data from the BHP (see Section 3). Concretely, we sum all new hires, separators or their sum (turnover) in 2019 and divide by 2018 employment, and relate those three outcome variables to employment.[18] We report results in Table 10, again by SEF and MEF establishments, and the latter separately with and without firm fixed effects.

Across samples and specifications, we find that the turnover rate increases in firm size. That is, larger SEFs and MEF establishments see lower turnover, with point estimates around -0.011 to -0.018. Most of this stems from the contribution of the separation margin, meaning that larger establishments see lower separation rates. This would imply either better or more stable jobs when establishments are large—from a labor supply side perhaps reflecting higher wages or non-wage benefits.

Strikingly, for the separation margin, the coefficients are actually *larger* in magnitude (i.e., more negative) for MEF establishments: the separation rate effect is about -0.008 for SEFs, but rises to -0.012 to -0.015 for MEF establishments. That is, even though MEFs do not appear to boost wages in their larger establishments, we do not see evidence for higher separations as a trade-off. This result would point to some offsetting non-wage benefit effect if interpreted through a labor supply perspective to explain why workers are more likely to stay put.

Turning to the hiring margin (and complementing the recruitment perspective explored above already), we find that across SEF and MEF establishments (before including firm fixed effects in the latter), the hiring rate falls in larger establishments, with coefficients around -0.0045 to -0.0051. However, once we include fixed effects, we actually find that the size effect on hiring turns *positive* between establishments in the same firm, with a positive estimate of 0.0041. (All turnover effects are precisely estimated with SEs below 0.001.)

Worker quality. Another trade-off, besides size and recruitment effort, that firms face when setting wages may be worker quality. By comparing the employment effects on raw wages and composition-adjusted wage premia, we have already indirectly been able to gauge effects on worker quality. That is, we can consider the difference between the coefficient for raw wages and AKM

[18] At the firm level, the difference between hiring and separation rates would imply employment growth, although we note that we do not consider growth as outcomes and that we study the average establishment's outcomes so that this simple difference need not hold on average or in steady state.

effects for SEFs and MEF establishments in Table 3. Here, we find that MEF establishments have a considerably smaller difference than SEFs, which suggests that MEF establishments—perhaps because they do not pay wage premia for size—do not benefit as much from the positive sorting that larger SEFs experience.

In a future version, we will study worker quality with additional specifications more directly (e.g., the AKM worker effect, the establishment-level gap between wages and the AKM establishment effect, or direct human capital proxies).

Productivity. As a complement to the indirect wage-based worker quality analysis and as an outcome variable in its own right, we additionally present productivity as a dependent variable. We report results in Table 8. Rather than dividing value added by employment to obtain a labor productivity measure, we use log value added as the dependent variable to avoid division bias. Intuitively, a regression coefficient larger (smaller) than one would imply that average labor productivity (value added per worker) increases (decreases) in size. Generically, we caveat that value added also contains the capital input, besides TFP and worker quality or effort (and also reflects hours worked). For our setting specifically, we additionally caveat that this analysis again relies on the smaller sample in the IAB Establishment Panel (a survey described in Section 3) and that value added at an individual establishment within a MEF might contain additional dimensions of measurement error.

We find considerably stronger value added to size relationships in the SEF sample and when considering MEF establishment without the inclusion of a firm-level fixed effect, where coefficients are 1.035-1.082, implying that value added rises a little more than one to one with size. This could reflect higher capital intensity, higher hours worked, higher worker quality, or higher effort. It could also reflect standard TFP(r) sources such as better management, or higher prices or quality goods (recall that we control for 2-digit industry).

However, once we include firm fixed effects in the MEF sample, the coefficient drops from slightly above one at 1.035 to values between 0.74 and 0.80—suggesting that *within* MEFs, larger establishments are less rather than more productive.

However, a key limitation is the dramatic drop in sample size associated with this specification and the resulting drop in statistical precision as we require two establishments within the same firm to be covered in the 2019 (or previous/future) IAB Establishment Panel waves.

Amenities and job values. As a complement, we will also directly study proxies for employer attractiveness such as the poaching index or revealed-preference rankings as in Sorkin (2018)—which would shed direct light on how workers trade off between different firms and how specifically they perceive larger establishments of MEFs absent the wage premium SEFs appear to pay as a function of size. The implied job value would capture a summary statistic of non-wage amenities and

provide suggestive evidence on whether MEFs boost those more in establishment size than SEFs do.

5.2 Interpretation through the monopsony perspective

We attempt to squeeze the ESWE and our research design into a simple conceptual framework that we leave deliberately intuitive and verbal, and then discuss a structural interpretation of our findings as potentially speaking to the long-run firm-specific labor supply curve.

The simple economics of monopsony. Broadly, the empirical relationship can be viewed through the economic lens of the relationship between the demand and supply of labor at a given business unit j, at its wage w_j, in labor market $m(j)$ in which it operates (we suppress product market and time aspects, and take a spot perspective without attention to dynamics):[19]

$$\ln n_j \leq \min\{\ln n^S_{m(j)}(w_j, x^S(m(j), ...)), \ln n^D(w_j, x^D(m(j), ...))\}. \tag{3}$$

Prevailing employment n_j lies weakly below the supply level and demand level at the given wage. Besides the wage, these curves are functions of other factors x, some of which the firm can take as exogenous (market size, competition,...) or some that are endogenous (e.g., nonwage amenities). This equation takes the wage as given, with its determination discussed below (also incorporating conduct and market structure factors).

Our design analyzes employer-level employment and wages in cross-sectional observational data. Expression (3) makes clear that these data points are "micro-equilibria" of employer-level supply and demand and hence driven by heterogeneity in various shifters besides wages. For instance, we can start by assuming an equality sign in Expression 3—so that at the observed

[19] We can sketch a simple model by specifying the following functions for labor supply and demand: $\ln n^D_j(w) = a^D_j + b^D_j \left(\ln w + x^D_j\right)$ and $\ln n^S_j(w) = a^S_j + b^S_j \left(\ln w + x^S_j\right)$, where a capture shifters of the curve, b capture the slopes, and x capture "wedges" acting on the wage. For effect, all those parameters are permitted to be j-specific. We can make point predictions by assuming an employer-level equilibrium (i.e., an equality in Expression (3)): $\ln w^* = \frac{a^S_j - a^D_j + b^S_j x^S_j - b^D_j x^D_j}{b^S_j - b^D_j}$, with $n^D_j(w^*) = n^S_j(w^*)$ and this point. Clearly, if we had at our disposal a clean shifter in either the labor supply or labor demand curve, one could identify the respective counterparty's curve's elasticity (by measuring wage and employment responses, and then taking the ratio in the original instrumental-variables logic). The cross-sectional nature of the ESWE design amounts to an identification assumption whereby the on-net positive relationship must hence denote that between-employer employment variation is dominated by labor demand factors, such as in a^D_j, in a matter that is sufficiently orthogonal to the other sources of potential variation, and then traces out an average elasticity. But of course, it is possible to divise a perfectly offsetting variation in other parameters that would leave the cross-sectional relationship flat for some set of firms such as multi-plant ones. For instance, if larger employment solely reflects shifts in the labor supply curve, and if labor demand is very elastic, this pattern could rationalize our findings—as long as this heterogeneity differs systematically within multi- compared to single-establishment firms. The model becomes even less predictive if one permits departures from the in this footnote assumed equality specification of the weak inequality in Expression 3, as may emerge with rationing.

wage, the three employment concepts—prevailing, demanded, supplied—coincide. The "normal" picture painted by the ESWE is that (at least on average), wages and prevailing employment trace out an upward-sloping relationship. This picture is consistent with labor demand shifters driving variation in employment across employers, and those employers going up and down their labor supply curves—at least as the dominant net result of variation in the labor supply and demand curves.

Implied labor supply elasticities. Read through the lens of the standard monopsony framework, our results would speak to tremendously high labor supply elasticities facing MEF establishments, which evidently manage to grow or be large without tantamount adjustment in wages. However, see the discussion in Bassier and Manning (2025) for the pitfalls of interpreting the ESWE as an inverse labor supply elasticity, and we also note that our cross-sectional perspective might relate to the long-run elasticity rather than the short-run one, which might be considerably higher (Bloesch, Larsen, and Yding, 2024; Mertens and Schoefer, 2024; Bassier and Manning, 2025).

A knife-edge case. There are also economic reasons to expect the absence of a wage-size gradient within MEFs. For instance, if all establishments contribute into a common production function of a tradable good, firms should harmonize marginal revenue products across all production units and indeed inputs—so that no relationship with firm size should emerge. To check for the relevance of this consideration, we will split firms into tradable and non-tradable industries.

Rationing. Expression (3) is a weak inequality, and standard perspectives impose a strict equality as in monopsony models. Below, we discuss evidence for rationing, so that MEFs' wages may be such that $n_j^S(w) > n_j^D(w) = n_j$, with employment being demand-determined and employment off workers' labor supply curve—generating ample room for employment to be chosen without adjustment in wages. Similar logic may also underlie monopsony dynamics in collective bargaining contexts with binding wage floors (see, e.g. Dustmann, Giannetto, Incoronato, Lacava, Pezone, Saggio, and Schoefer, 2025).

5.3 Beyond monopsony: labor demand in the shadow of wage premia [preliminary]

By zooming into the significant shares of establishments and employment that are in MEFs, our research design is set in a sample of high-wage firms. For instance, our descriptive analysis of the distributions of wages across MEFs and SEFs (Figure 3) already foreshadowed that MEF establishments are not only larger but also pay higher wages. Our case studies of individual firms in Figure 6 also highlighted the high level of wages (AKM wage premia) among MEFs compared to SEFs.

Constructing the wage premia of MEF pay compared to SEF pay. To pinpoint the degree to which MEFs pay wage premia *conditional* on size *in a given labor market* beyond its SEF peers, we *predict* the wage by fitting a wage function that we fit on the SEF observations and then carry over this function to the MEF establishment sample. As a result, we have actual wages and SEF-predicted wages for each individual establishment. In practice, we do so using a Lasso model of wages on a rich covariate set.[20] We present results in Figure 7, for AKM establishment fixed effects, and find similar results for raw wages (Appendix Figure A.4).

Figure 7 Panel (a) illustrates the fit of the hold-out sample (25%) between the AKM effect and establishment size. The fit is almost perfect (so that the reader may not be able to distinguish the bins for predicted and actual wage levels).

Panel (b) shows the analog for the MEF establishments—again comparing actual AKM effects for the MEF sample for the predicted one (based on SEF model specification). Hence, in terms of the mean prediction, we find that MEFs pay higher wages *no matter the establishment size*. However, we find that this gap is the largest, the smaller the establishment—consistent with the idea that MEFs harmonize wages across establishments, so that the premium is the highest for the small establishments in MEFs. Complementing Panel (b), Panel (c) plots the mean of the establishment-level difference between actual and predicted wages, separately for MEF and SEF establishments.

Panels (b) and (c) show mean gaps in firms' wages but leave distributional questions open: which fraction of MEF firms pay above or below the predicted wage? To answer this question, Panel (d) plots, separately for MEF and SEF establishments, the share of establishments in a given size bin with actual AKM effects being below their idiosyncratic wage prediction. The figure makes clear that there is substantial dispersion and overlap: about 25% of MEF establishments pay *below* the wage that a SEF would be predicted to pay for that establishment type and labor market, which rises to about 40% towards the top tier of MEF establishments in terms of size. (As expected, the gradient for SEFs is stable at about 50%.) Hence, MEF establishments are generally premium-payers even conditional on size and local labor market characteristics. We caveat that prediction errors and bias might lead to misleading conclusions, such biasing upward the share of firms paying below the wage prediction.

Implications of wage premia in MEFs. If MEFs tend to pay wage premia above what is required to satisfy labor demand, then MEF employment would be detached from—lie above—labor supply—generating rationed labor supply and queuing, as discussed at the end of Section 5.2. In such a setting, the ability of MEF establishments to grow and be large without the tantamount wage increases that SEFs tend to exhibit would not be a puzzle from labor supply anymore—and the

[20]The covariates including 2-digit sector FE, local labor market (LMR) FE, log firm size, log firm size squared, interaction of log firm size with broad sector FE, and interaction of log firm size squared with broad sector FE. The penalty parameter λ is selected by 10-fold cross-validation. The lasso model takes a 75% random sample among SEF units. Selected coefficients are then used to predict the outcome variable for SEF and MEF units.

ESWE patterns could be considered empirical evidence of rationing (for other evidence, see Breza, Kaur, and Shamdasani, 2021). Instead, in the shadow of the general wage premia that MEFs appear to pay and that create room for a variety of firm sizes from the perspective of labor, the departure from monopsony would then reflect labor demand and wage setting choices MEF make. We discuss—indeed speculate about—this in the next section.

5.4 Beyond monopsony: firm-level wage setting and rationing [incomplete]

We conclude with a discussion of perspectives beyond the monospony one at least at the establishment/local labor market level. Instead, our evidence points towards firm-level forces or other wage determinants, such as firm-level wage policies and theories of rent sharing and wage bargaining.

Firm-level wage setting. Our findings are consistent with the idea that firms may set wages as policies that are not fine-tuned to worker groups or local labor market conditions. While our analysis therefore primarily speaks to the ESWE literature (Section 2), we also contribute new data points to the active literature on wage compression within firms between worker groups (Saez, Schoefer, and Seim, 2019; Amior and San, 2025) and between establishments and business units (Hjort, Li, and Sarsons, 2024; Hazell et al., 2022).[21] Those studies do not relate wages to employer size or relate findings to a monopsony framework, but focus on wage compression itself. Finally, we note that Barth and Dale-Olsen (2011) document that the ESWE is exactly born out separately by a firm's skill groups rather than by overall firm size—suggesting much more room for wage differentiation rather than compression.

Rent sharing and bargaining. Alternatively, our theories can be viewed through the lens of wage bargaining and rent sharing, where wages at a given establishment may be determined not by the firm-specific labor supply curve but by a combination of workers' outside options (which may be local labor market specific) and the marginal revenue product at the employer. If those factors are typically firm- rather than establishment-specific and/or unrelated to firm size within a firm (see the knife-edge case in Section 5.2 for homogeneous marginal products within the firm with implications here), then the patterns we document among MEF establishments can naturally

[21] For instance, Hazell et al. (2022) find that a significant minority of vacancies with wage information in the United States refer to strikingly similar wages and wage bands across local labor markets that would have merited differentiated wage setting, and that national employers do differentiate pay across those markets but in an attenuated way. In unreported results, we have found similar patterns in our German context, with MEFs differentiating wages geographically by about only half or two thirds as much as would be expected in a fine-tuned wage setting benchmark. Such "national wage setting" plausibly applies in our case too: indeed, establishments are defined as geographical units, and our intention was to saturate the regression model with labor market effects (labor market region times industry). We note that besides focusing on geographic differentiation, Hazell et al. (2022) do not study the employer size/wage effect but focus on wages as outcome variables, which are our focus on top of our monopsony lens. We also note that our findings denote a *complete decoupling* of wages from employer size, even though wages do vary tremendously across the establishments within MEFs.

emerge. (By contrast, the ESWE among SEFs would require productivity to rise with size.) Similar patterns would emerge from other wage setting models such as the class of efficiency wages (Katz, 1986).

6 Conclusion

Our paper has revisited the employer size wage effect (ESWE)—the perhaps most influential departure from the law of one price for labor. We started by presenting the first systematic meta-analysis of the ESWE. The main result of the paper is empirical: ours is the first to document that the ESWE turns to zero across establishments within the same firm. Within multi-establishment firms (MEFs), establishments are large or small without any relationship to wages whatsoever. This wage-size decoupling poses a challenge to the firm-specific labor supply curve view of monopsony. Instead, our findings point towards rationed labor supply, rent sharing, and firm-level personnel policies as theories of wage setting and labor demand. That is, the fact that MEFs may pay premia above what is needed in terms of labor supply, rationed labor supply with demand-determined employment is a parsimonious explanation for our ESWE findings. But it is a proximate one, as it leaves open the ultimate economics behind why MEF wages are so high.

We close our paper with a discussion of limitations of our study and questions we leave open. First, we do not have direct evidence on firms' personnel policies and decision making, and it would be interesting to supplement our econometric analysis on the basis of cross-sectional correlations with surveys of firms (as in Hazell et al., 2022). Second, we study correlational relationships and it may be interesting to obtain exogenous variation in labor demand or supply to probe how MEFs response to those shocks, establishment-specific or common (as in Hjort, Li, and Sarsons, 2024, for multinational companies). Third, we have only scratched the surface of potential departures from labor demand optimality conditions among establishments due to, e.g., missing reliable productivity data at the establishment level. Fourth, while we have taken the natural perspective of monopsony as our economic lens, which we found provides limited explanatory power for our findings, we have only presented suggestive investigations of alternative models that can account better for our findings, where we see bargaining and rent sharing views of wage determination as promising alternatives in MEFs.

Lastly, we advertise that our research design can be replicated in any triple-matched firm-establishment-worker data, which this paper leaves for future work. While we have attempted to rule out that institutional factors related to the German industrial relations system drive our results (e.g., by zooming into the significant share of the sample not covered by collective bargaining), it will be interesting to replicate our findings in other contexts.

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Tables

Table 1: Meta Analysis of Estimated Size-Wage Elasticities from the Literature
(Preferred Estimates, for Details on the Studies see Appendix Table A1)

Study	Country	Elasticity	SE
A: Without any controls for worker heterogeneity (mean elasticity: 0.057)			
Bernard, Jensen, and Lawrence (1995)	US	0.037	0.0004
Troske (1999)	US	0.064	0.0060
Arai (2003)	Sweden	0.016	0.0060
Manning (2013)†	UK, US	0.097	0.0022-0.0030
Barth and Dale-Olsen (2011)	Norway	0.019	0.0007
Scoppa (2014)	Italy	0.074	0.0004
Lochner, Seth, and Wolter (2020)*	Germany	0.092	n.a.
B: With controls for observable worker heterogeneity (mean elasticity: 0.035)			
Brown and Medoff (1989)	US	0.027	0.0020
Reilly (1995)	Canada	0.039	0.0092
Green, Machin, and Manning (1996)*	UK	0.041	0.0077-0.0110
Doms, Dunne, and Troske (1997)	US	0.036	0.0100
Albaek et al. (1998)†*	Scandinavia	0.023	0.0018-0.0033
Troske (1999)	US	0.047	0.0050
Lane et al. (1999)	US	0.050	0.0020
Bayard and Troske (1999)‡	US	0.048	0.0017-0.0026
Arai (2003)	Sweden	0.010	0.0050
Manning (2013)†	UK, US	0.056	0.0018-0.0025
Belfield and Wei (2004)	UK	0.060	0.0044
Lallemand, Plasman, and Rycx (2007)†	South & Central Europe	0.037	0.0026-0.0045
Winter-Ebmer (2001)	Austria	0.028	0.0010
Heyman (2007)*	Sweden	0.012	0.0016-0.0027
Barth and Dale-Olsen (2011)	Norway	0.017	0.0007
Scoppa (2014)	Italy	0.043	0.0004
Pehkonen et al. (2017)	Finland	0.007	0.0001
Green, Heywood, and Theodoropoulos (2021)	UK	0.031	0.0011
Arellano-Bover (2024)	Spain	0.059	0.0005
C: Worker Fixed Effects (mean elasticity: 0.015)			
Arai (2003)	Sweden	0.020	0.0080
Barth and Dale-Olsen (2011)	Norway	0.015	0.0010
Scoppa (2014)	Italy	0.021	0.0005
Pehkonen et al. (2017)	Finland	0.003	0.0004
Green, Heywood, and Theodoropoulos (2021)	UK	0.019	0.0007
D: Estimates based on AKM Employer Effects (mean elasticity: 0.061)			
Alvarez et al. (2018)*	Brazil	0.072	n.a.
Lochner, Seth, and Wolter (2020)*	Germany	0.050	n.a.

Standard errors are bounded for averaged estimates as described in the text. Appendix Table A1 provides additional details.

† Average over estimates for different countries. Only non-Scandinavian estimates in (Lallemand, Plasman, and Rycx, 2007) reported.

* Average over estimates for different time periods.

‡ Bayard and Troske (1999) provide sector specific ESWE estimates based on joint inclusion of plant- and firm size regressors, only. We report the sector-averaged est. size coefficients. Firm size coefficients are small and sometimes insignificant (with sector-averaged mean of 0.007).

Table 2: Summary Statistics

	Establishment-weighted			Employment-weighted		
	Full	SEF	MEF	Full	SEF	MEF
	(1)	(2)	(3)	(4)	(5)	(6)
Employment	26.504	22.704	51.809			
	(165.651)	(156.955)	(213.026)			
Log real daily wages	4.506	4.482	4.669	4.727	4.677	4.873
	(0.408)	(0.400)	(0.424)	(0.431)	(0.420)	(0.431)
AKM FE	-0.065	-0.078	0.020	0.033	0.011	0.100
	(0.225)	(0.225)	(0.204)	(0.199)	(0.201)	(0.175)
Establishment age	18.275	18.495	16.814	24.440	24.513	24.227
	(13.453)	(13.476)	(13.207)	(14.737)	(14.702)	(14.837)
Fraction female	0.404	0.391	0.490	0.375	0.368	0.395
	(0.295)	(0.289)	(0.323)	(0.251)	(0.250)	(0.254)
Fraction helper activities	0.199	0.207	0.148	0.201	0.211	0.174
	(0.253)	(0.254)	(0.240)	(0.263)	(0.263)	(0.261)
Fraction professionals	0.610	0.610	0.613	0.562	0.568	0.541
	(0.301)	(0.299)	(0.314)	(0.281)	(0.278)	(0.289)
Fraction specialists	0.103	0.100	0.124	0.128	0.120	0.151
	(0.177)	(0.172)	(0.208)	(0.158)	(0.150)	(0.175)
Fraction experts	0.088	0.083	0.115	0.109	0.100	0.133
	(0.177)	(0.175)	(0.192)	(0.164)	(0.159)	(0.175)
Hiring rate	0.248	0.247	0.258	0.221	0.223	0.216
	(0.239)	(0.241)	(0.224)	(0.175)	(0.178)	(0.163)
Separation rate	0.218	0.214	0.248	0.198	0.196	0.203
	(0.201)	(0.199)	(0.207)	(0.153)	(0.151)	(0.157)
Turnover	0.461	0.455	0.501	0.415	0.415	0.415
	(0.351)	(0.350)	(0.354)	(0.281)	(0.282)	(0.280)
East Germany	0.194	0.192	0.207	0.164	0.164	0.164
Agriculture	0.024	0.026	0.013	0.009	0.011	0.004
Mining	0.002	0.001	0.002	0.002	0.002	0.003
Manufacturing	0.132	0.140	0.081	0.279	0.287	0.256
Energy, electricity	0.004	0.003	0.009	0.009	0.008	0.013
Water	0.007	0.007	0.008	0.010	0.011	0.007
Construction	0.166	0.185	0.035	0.076	0.094	0.023
Wholesale & Retail trade	0.229	0.204	0.399	0.176	0.162	0.219
Transportation, storage	0.058	0.056	0.072	0.079	0.074	0.093
Accomodation	0.071	0.074	0.051	0.052	0.060	0.029
ICT	0.040	0.039	0.047	0.046	0.041	0.059
Banking, insurance	0.023	0.020	0.046	0.033	0.027	0.051
Real estate	0.020	0.021	0.018	0.010	0.011	0.006
Technical service	0.111	0.112	0.100	0.088	0.085	0.097
Business service	0.075	0.073	0.090	0.104	0.098	0.122
Other service	0.038	0.039	0.029	0.027	0.030	0.018

Note: The table provides summary statistics for the year 2019 for the full sample, single-establishment firms (SEF) and multi-establishment firms (MEF). The first three columns are establishment-weighted average statistics. The last three columns are employment-weighted average statistics. Average daily wages are measured in 2015 euros. Standard errors in parentheses for continues variables.

Table 3: Main Results: The Employer-Size-Wage-Effect Across and Within Firms (Establishment Level)

	Pooled			Single-Establishment Firms (SEF)			Multi-Establishment Firms (MEF) (*Unique firms: 30,507*)							
							No firm FE					With firm FE		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
A: Log real wages														
Est. size	.0785***	.0743***	.0729***	.0772***	.0740***	.0730***	.0460***	.0362***	.0347***	.0128***		.0023**	-.0031***	-.0038***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)
Firm size										.0451***	.0477***			
										(0.001)	(0.001)			
Obs.	890,728	890,728	890,728	778,068	778,068	778,068	112,660	112,660	112,660	112,660	112,660	112,660	112,660	112,660
R^2	.047	.360	.388	.043	.358	.388	.020	.406	.465	.498	.496	.808	.828	.848
Mean	4.506	4.506	4.506	4.482	4.482	4.482	4.668	4.668	4.668	4.668	4.668	4.668	4.668	4.668
B: AKM FE														
Est. size	.0383***	.0370***	.0365***	.0373***	.0364***	.0360***	.0223***	.0200***	.0197***	.0070***		.0027***	.0003	-.0001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)
Firm size										.0261***	.0276***			
										(0.000)	(0.000)			
Obs.	890,728	890,728	890,728	778,068	778,068	778,068	112,660	112,660	112,660	112,660	112,660	112,660	112,660	112,660
R^2	.037	.223	.250	.032	.223	.251	.020	.257	.319	.366	.365	.723	.735	.757
Mean	-.066	-.066	-.066	-.078	-.078	-.078	.02	.02	.02	.02	.02	.02	.02	.02
SIC		Y			Y			Y					Y	
LMR		Y			Y			Y					Y	
SIC × LMR			Y			Y			Y	Y	Y			Y
Firm												Y	Y	Y

Notes: The table shows regression results of log establishment wages on establishment size (Est. size) and firm size (Firm size).Columns (1) to (3) provide the results for all establishments (pooling SEFs and MEFs). Columns (4) to (6) provide the results for single-establishment firms (SEF). Columns (7) to (14) provide the results for multi-establishment firms (MEF). Control variables refer to 2-digit sector (SIC) FE and labor market region (LMR) FE. Firm size in columns (10) and (11) refers to the sum of all plants within the firm identifier. Columns (12) and (13) include firm FE to identify the effect of size variation on the outcome variable within the firm. Panel A shows the result for log establishment wages. Panel B shows the results for AKM establishment effects. Robust standard errors in parentheses. Significance levels: *: p<0.1, **: p<0.05, ***: p<0.01.

Table 4: Robustness Check: Worker-level Specifications

	No firm FE			With firm FE			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Est. size	0.1124***	0.0602***	0.0521***	0.0240***	0.0057***	0.0196***	-0.0004
	(0.002)	(0.001)	(0.001)	(0.004)	(0.002)	(0.004)	(0.003)
Observations	5,461,985	5,461,985	5,461,985	5,461,985	5,461,985	5,461,985	5,461,985
R^2	0.114	0.615	0.440	0.530	0.717	0.590	0.595
Worker-level controls							
Mincer controls		Y			Y		
Person FE value			Y			Y	Y
Establishment-level controls							
SIC × LMR		Y	Y				Y
Firm FE				Y	Y	Y	Y

Note: The table shows regression results of log worker-level wages on establishment size for workers in multi-establishment firms (MEF). Columns (1) to (3) provide the results without firm fixed effects. Columns (4) to (7) include firm fixed effects to identify the effect of size variation on the outcome variable with firm. Mincer controls refer to female indicator, part-time indicator, 4 education dummies, 12 occupation dummies. Person FE value refers to the separately estimated AKM person effect as a continuous variable. SIC indicates 2-digit sector FE. LMR indicates labor market region FE. Robust standard errors clustered at the firm level in parentheses. Significance levels: *: p<0.1, **: p<0.05, ***: p<0.01.

Table 5: Robustness to Weighting and Size

	Establishment size		Weighting	Within firm # of establishment			
	≤ 5	> 5	1/N(plants)	2	3 to 9	10 to 99	≥ 100
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A: Log real wages							
Est. size	0.0069	0.0016	-0.0099***	-0.0117***	-0.0075***	0.0038*	0.0148***
	(0.010)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	12,406	80,403	112,660	40,464	27,963	23,637	13,621
R^2	0.854	0.874	0.871	0.885	0.869	0.826	0.765
Outcome	4.59	4.678	4.666	4.634	4.73	4.65	4.66
B: AKM FE							
Est. Size	-0.0073	0.0002	0.0004	0.0012	-0.0017**	-0.0001	-0.0026*
	(0.006)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	12,406	80,403	112,660	40,464	27,963	23,637	13,621
R^2	0.733	0.768	0.832	0.851	0.818	0.699	0.465
Outcome	-.01	.03	.02	-.014	.032	.032	.072
SIC × LMR	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y

Note: The table shows regression results of log establishment wages on establishment size for different subsamples of multi-establishment firms (MEF). Columns (1) and (2) differentiate between small establishments with at most 5 employees and with more than 5 employees. (Appendix Table A6 presents additional variants for establishment size.) Column (3) weights the regression by the inverse of the number of plants within a firm, so that all firms receive equal weight. Columns (4) to (7) shows the results for firms with different numbers of plants. All specifications include 2-digit sector times labor market region FE and well as firm FE. Panel A shows the result for log establishment wages. Panel B shows the results for AKM establishment effects. Robust standard errors in parentheses. Significance levels: *: p<0.1, **: p<0.05, ***: p<0.01.

Table 6: Robustness to Aggregation of Establishments to County Level (From Municipality-Industry Level)

	SEF		MEF (*unique firms: 17,550*)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A: Log real wages							
Est. size	0.0747***	0.0737***	0.0252***	0.0040***		-0.0033***	-0.0037***
	(0.000)	(0.000)	(0.001)	(0.001)		(0.001)	(0.001)
Firm size				0.0380***	0.0392***		
				(0.001)	(0.001)		
Observations	814,553	814,553	70,672	70,672	70,672	70,672	70,672
R^2	0.361	0.391	0.490	0.510	0.509	0.847	0.868
Outcome	4.484	4.484	4.702	4.702	4.702	4.702	4.702
B: AKM FE							
Est. Size	0.0366***	0.0362***	0.0161***	0.0032***		-0.0016***	-0.0019***
	(0.000)	(0.000)	(0.001)	(0.001)		(0.000)	(0.001)
Firm size				0.0231***	0.0240***		
				(0.000)	(0.000)		
Observations	814,553	814,553	70,672	70,672	70,672	70,672	70,672
R^2	0.225	0.253	0.336	0.370	0.369	0.752	0.777
Outcome	-.078	-.078	.03	.03	.03	.03	.03
SIC FE	Y					Y	
LMR FE	Y					Y	
SIC × LMR		Y	Y	Y	Y		Y
Firm FE						Y	Y

Note: The table shows regression results of log establishment wages on establishment size and firm size. The unit of observation is production unit defined as establishments within the same county. Size represents the sum of all establishments in the same county. Sector affiliation represents the sector of the largest establishment. Wage and AKM effects are calculated as the weighted (by establishment size) average. Columns (2) and (3) provide the results for single-establishment firms (SEF). Columns (3) to (7) provide the results for multi-establishment firms (MEF). Control variables refer to 2-digit sector FE and labor market region (LMR) FE. Firm size in Columns (4) and (5) refers to the sum of all plants within the firm identifier. Columns (6) and (7) include firm FE to identify the effect of size variation on the outcome variable within the firm. Panel A shows the result for log establishment wages. Panel B shows the results for AKM establishment effects. Robust standard errors in parentheses. Significance levels: *: p<0.1, **: p<0.05, ***: p<0.01.

Table 7: The Role of Firm-Level Collective Bargaining Coverage

	SEF		MEF (*CBA firms: 3,381; non-CBA firms: 1,007*)			
	w/o CBA	with CBA	w/o CBA	with CBA	w/o CBA	with CBA
	(1)	(2)	(3)	(4)	(5)	(6)
A: Log real wages						
Est. Size	0.0698***	0.0755***	0.0124***	0.0137***	-0.0055	0.0036**
	(0.003)	(0.002)	(0.004)	(0.002)	(0.004)	(0.002)
Observations	7,981	15,677	4,916	27,209	4,644	26,899
R^2	0.573	0.637	0.647	0.543	0.850	0.821
Outcome	4.52	4.636	4.59	4.738	4.59	4.738
B: AKM FE						
Est. Size	0.0333***	0.0407***	0.0099***	0.0065***	0.0025	-0.0009
	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
Observations	8,412	16,038	5,154	28,485	4,902	28,237
R^2	0.429	0.516	0.437	0.347	0.661	0.622
Outcome	-.094	-.004	-.042	.078	-.042	.078
SIC × State FE	Y	Y	Y	Y	Y	Y
Firm FE					Y	Y

Note: The table shows regression results of log establishment wages on establishment size differentiating by collective bargaining agreement (CBA). CBA information are based on the Establishment Panel Survey (*IAB Betriebspanel*) over the years between 1993-2023. The closest to 2019 survey wave is selected to infer the CBA status. CBA status is imputed for establishments not observed in the survey with information on matched establishments within the same firm. Columns (1) and (2) provide the results for single-establishment firms (SEF). Columns (3) to (6) provide the results for multi-establishment firms (MEF). Control variables refer to 2-digit sector FE and Federal State FE. Columns (5) and (6) include firm FE to identify the effect of size variation on the outcome variable within the firm. Panel A shows the result for log establishment wages. Panel B shows the results for AKM establishment effects. Robust standard errors in parentheses. Significance levels: *: p<0.1, **: p<0.05, ***: p<0.01.

Table 8: Effects on Productivity and Value Added

	SEF		MEF			
	(1)	(2)	(3)	(4)	(5)	(6)
Est. size	1.0819***	1.0662***	1.0352***	0.8051***	0.7711***	0.7410**
	(0.005)	(0.006)	(0.015)	(0.079)	(0.131)	(0.326)
Observations	18,825	18,088	3,063	524	417	182
R^2	0.742	0.772	0.727	0.864	0.935	0.951
Outcome	14.12	14.12	15.542	15.542	15.542	15.542
SIC FE	Y		Y	Y	Y	
LMR FE		Y			Y	
SIC × LMR		Y				Y
Firm FE				Y	Y	Y

Note: The table shows regression results of log establishment value added on establishment size. Value added information are based on the Establishment Panel Survey (*IAB Betriebspanel*) over the years between 1993-2023. The closest to 2019 survey wave is selected to infer the value added. Columns (1) and (2) provide the results for single-establishment firms (SEF). Columns (3) to (6) provide the results for multi-establishment firms (MEF). Control variables refer to 2-digit sector FE and labor market region (LMR) FE. Columns (4) and (6) include firm FE to identify the effect of size variation on the outcome variable within the firm. Robust standard errors in parentheses. Significance levels: *: p<0.1, **: p<0.05, ***: p<0.01.

Table 9: Effects on Recruitment Effort

	Vacancy duration		Hours spent		Euro costs		Applicants	
	SEF	MEF	SEF	MEF	SEF	MEF	SEF	MEF
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Est. size	0.021***	0.004	0.076***	-0.303***	0.395***	-0.716	0.149***	0.054
	(0.007)	(0.109)	(0.008)	(0.104)	(0.028)	(0.721)	(0.005)	(0.094)
Observations	17,976	297	16,378	188	13,781	138	17,446	268
Outcome	4.956	5.006	2.932	3.116	3.362	4.006	1.368	1.6
SIC	Y	Y	Y	Y	Y	Y	Y	Y
LMR	Y	Y	Y	Y	Y	Y	Y	Y
Firm FE		Y		Y		Y		Y

Note: The table shows regression results of establishment recruitment variables on establishment size. Recruitment information are based on the Establishment Vacancy Survey (*IAB Stellenerhebung*) over the years between 2014-2019 and refers to questions on the most recent vacancy in the establishment. The most recent year of the survey is selected to infer the information. Vacancy duration refers to the (log) number of days between the opening and the closing to the vacancy. Hours spend refers to the (log) number of hours spend to fill the vacancy. Euro costs refers to the (log) euro amount spend to fill the vancancy. Applicants refers to the (log) number of applicants. Columns (1), (3), (5) and (7) provide the results for single-establishment firms (SEF). Columns (2), (4), (6) and (8) provide the results for multi-establishment firms (MEF). Control variables refer to 2-digit sector FE and labor market region (LMR) FE. Specifications with MEF units include firm FE to identify the effect of size variation on the outcome variable within the firm. Robust standard errors in parentheses. Significance levels: *: p<0.1, **: p<0.05, ***: p<0.01.

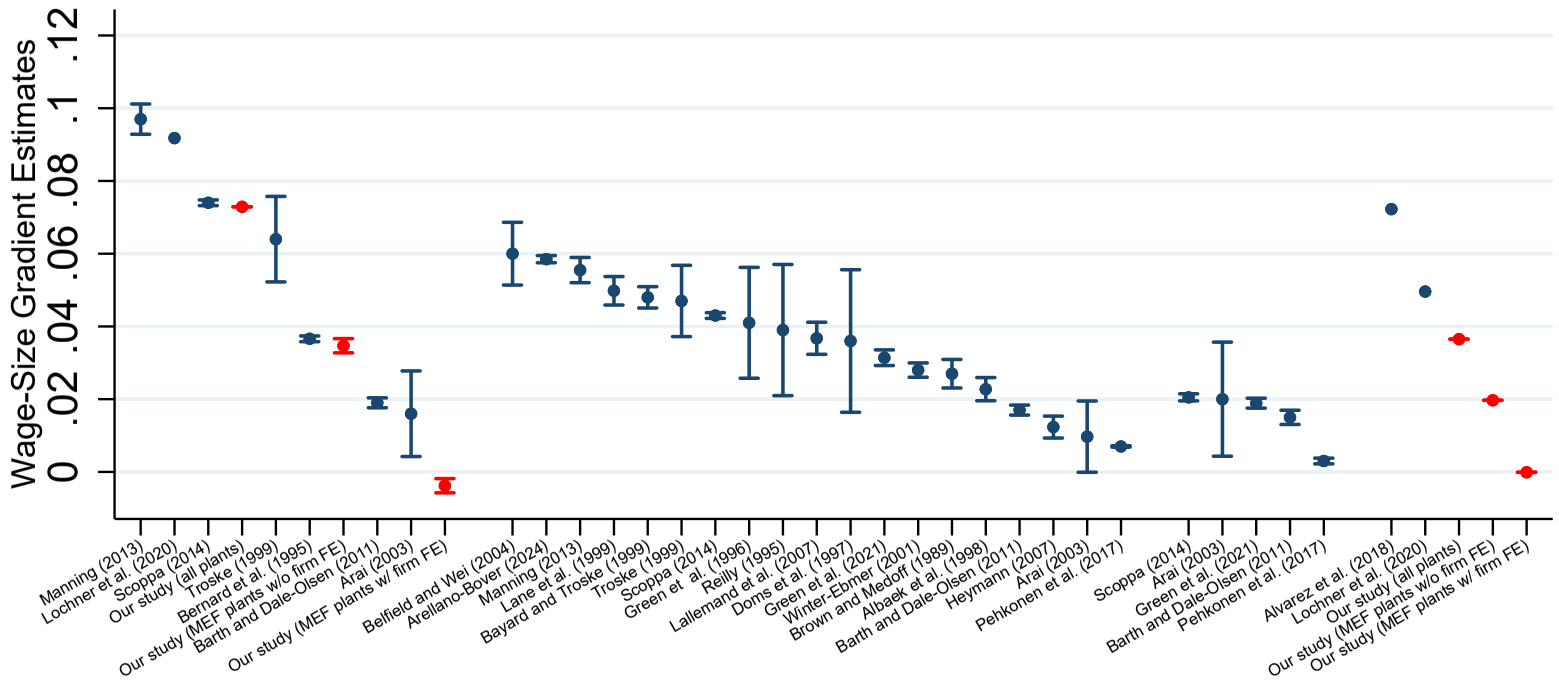
Table 10: Effects on Turnover: Hiring and Separation Rates

	SEF			MEF					
	HR	SR	TR	HR	SR	TR	HR	SR	TR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Est. size	-.0045***	-.0081***	-.0126***	-.0051***	-.0126***	-.0177***	.0041***	-.0151***	-.0109***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Obs.	719,271	719,271	719,271	98,497	98,497	98,497	98,497	98,497	98,497
R^2	0.067	0.115	0.116	0.160	0.286	0.260	0.484	0.586	0.577
Mean	.246	.208	.454	.26	.242	.502	.26	.242	.502
SIC × LMR	Y	Y	Y	Y	Y	Y	Y	Y	Y
Firm FE							Y	Y	Y

Note: The table shows regression results of hiring, separation and turnover rate on establishment size. Columns (1) to (3) provide the results for single-establishment firms (SEF). Columns (4) to (9) provide the results for multi-establishment firms (MEF). Control variables refer to 2-digit sector FE times labor market region (LMR) FE. Columns (7) to (9) include firm FE to identify the effect of size variation on the outcome variable within the firm. Hiring rate (HR) is calculated as the number of inflows in 2019 over total employment in 2018. Separation rate (SR) is calculated as the number of outflows in 2019 over total employment in 2018. Variables are trimmed at 100%. Turnover rate (TR) is calculated as the sum of inflows and outflows in 2019 over total employment in 2018. Robust standard errors in parentheses. Significance levels: *: p<0.1, **: p<0.05, ***: p<0.01.

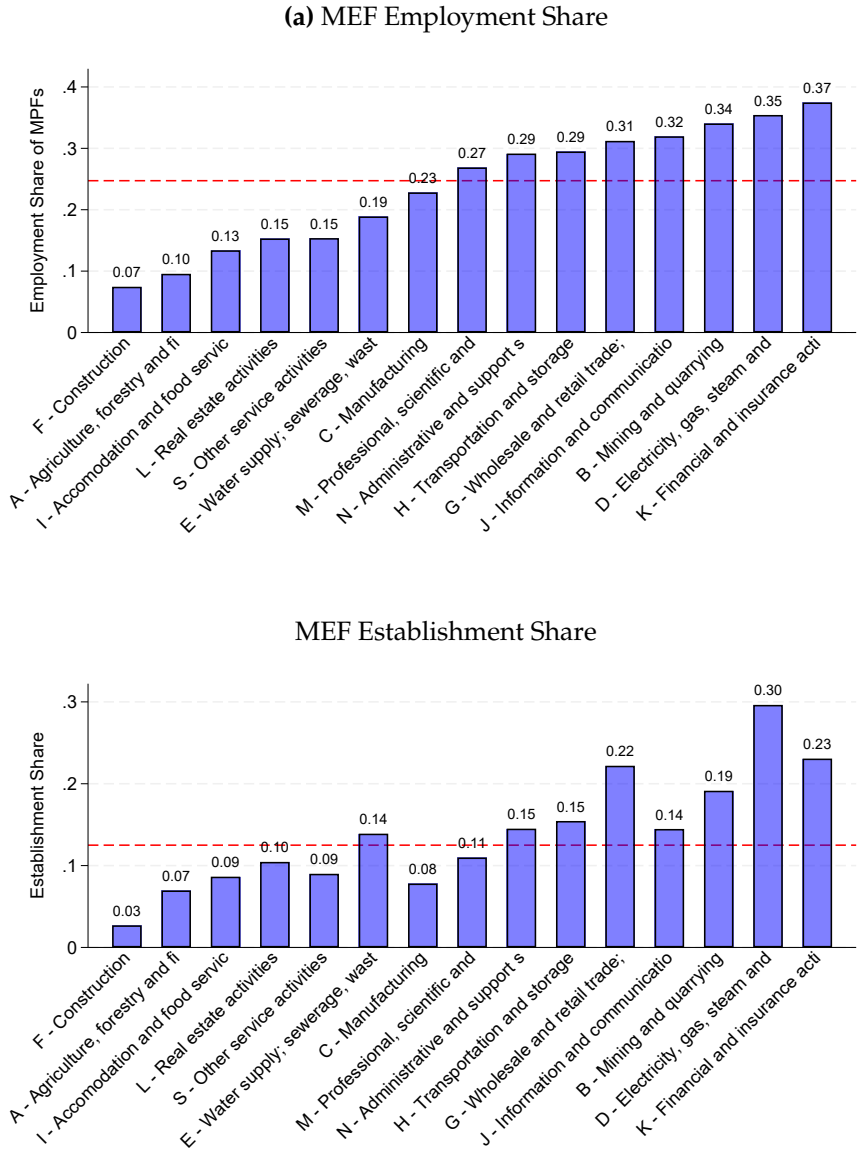
Figures

Figure 1: Meta Analysis



Note: The figure presents the results from Table 1 and incorporates our own main estimates from Table 3 in red. Studies are ordered by coefficient size within each of the four categories in Table 1. The first block includes studies that do not control for worker heterogeneity, followed by those controlling for observables, then those with worker fixed effects, and finally studies based on AKM employer effects. For estimates averaged over multiple point estimates within studies (see the notes to Table 1), we report the mean of the standard errors. Further details on the standard error calculation are provided in Footnote 7 in Section 2.

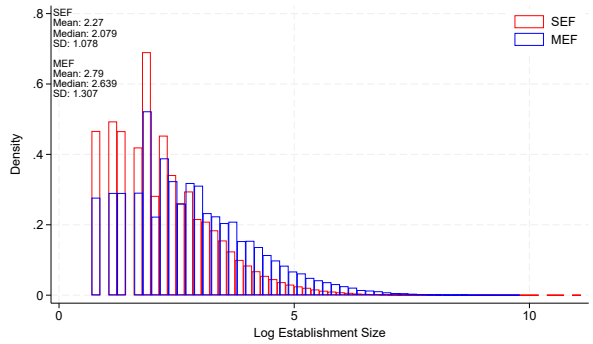
Figure 2: Employment and Plant Share of MEFs by Industry



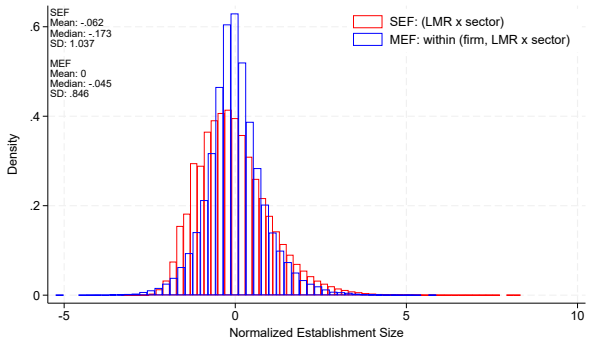
Note: The figure reports the share of multi-establishment firms (MEF) over industries for the year 2019. Excluded sectors: public & defense, education, health, art & entertainment. Sector classification refers to WZ08 classification of the German Statistical Office. Panel (a) shows the employment share. Panel (b) shows the count share. The red lines show the average across all sectors. The employment share of MEFs is equal to 25%. The share of MEFs among all establishments is equal to 12%.

Figure 3: Size, Wage, and AKM Effect Distribution across Establishments For Single- and Multi-Establishment Firms

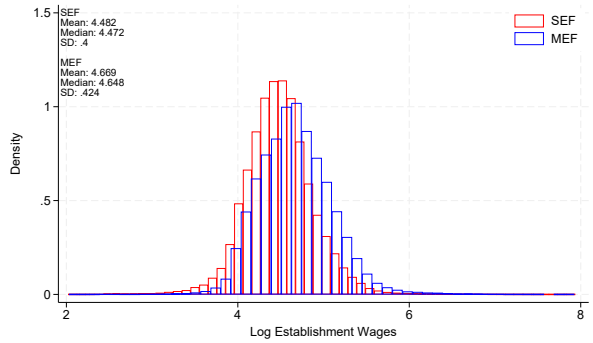
(a) Raw Log Size Distribution



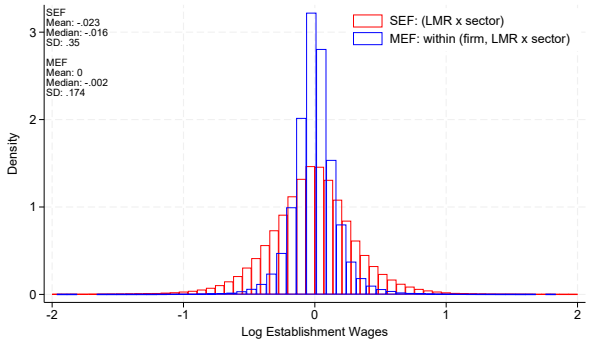
(b) Normalized Log Size Distribution



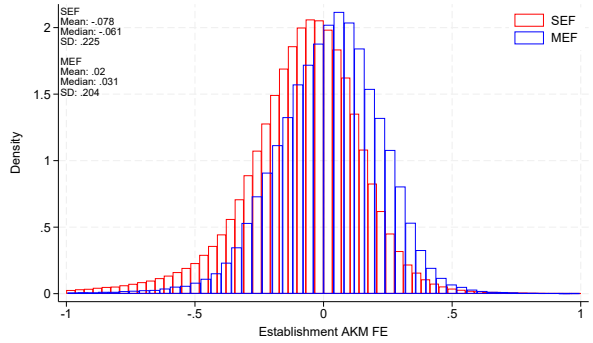
(c) Raw Wage Distribution



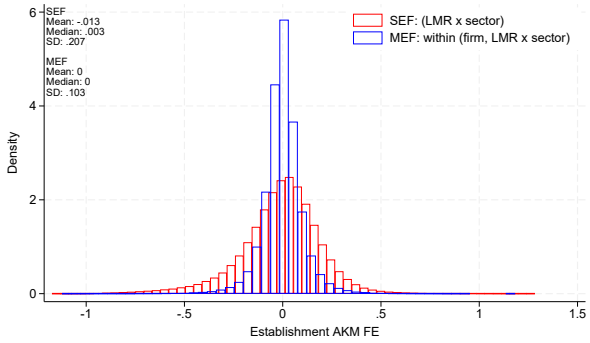
(d) Normalized Wage Distribution



(e) Raw AKM Distribution



(f) Normalized AKM Distribution



Note: The figure reports the distribution of log establishment size (employment), log wages, and AKM establishment fixed effects for single-establishment firms (SEF) in gray and multi-establishment firms (MEF) in white. Panels (a), (c), and (d) shows the raw data. Panels (b), (d), and (f) shows normalized distributions. SEF units are normalized by local labor market (LMR) times sector fixed effects. MEF units are normalized by LMR times sector fixed effects and firm fixed effects.

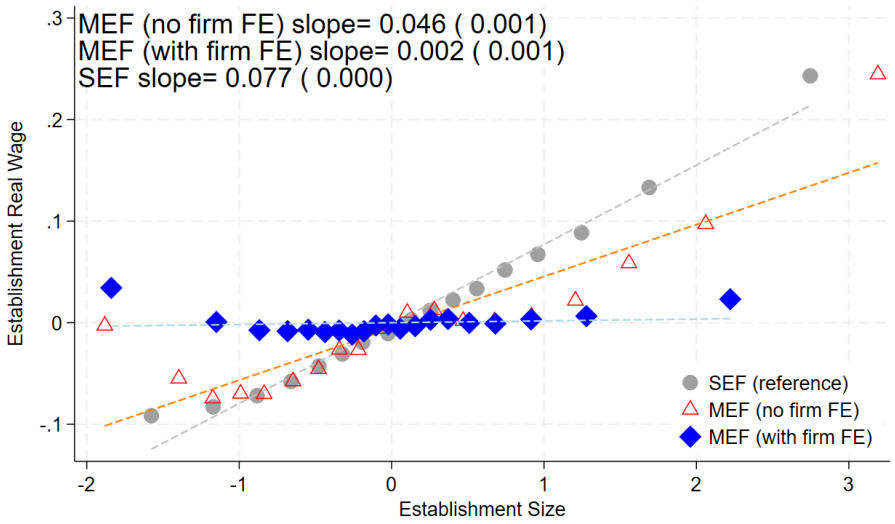
Figure 4: The Standard Employer Size Wage Effect in Germany: Across all Establishments



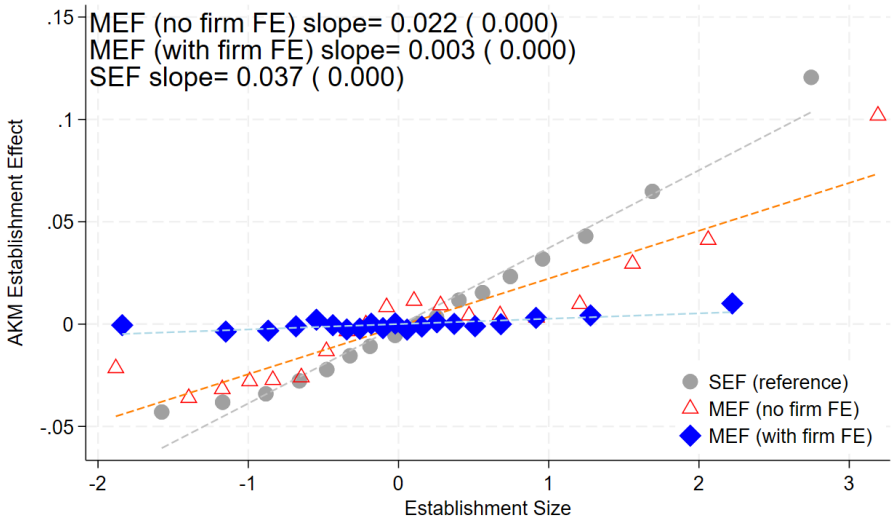
Notes: The figure shows binned scatter plots of log establishment size and log real average wages (orange dots) AKM FE (blue dots) for the year 2019. The dashed lines represent linear fits based on a univarite linear OLS model. Point estimates are shown in the top left corner with robust standard errors in parentheses. The sample covers 890,728 establishments. Each variable is normalized by a constant for ease of representation.

Figure 5: Within-Firm vs. Across Firms: The Employer Size Wage Effect

(a) Raw Wages



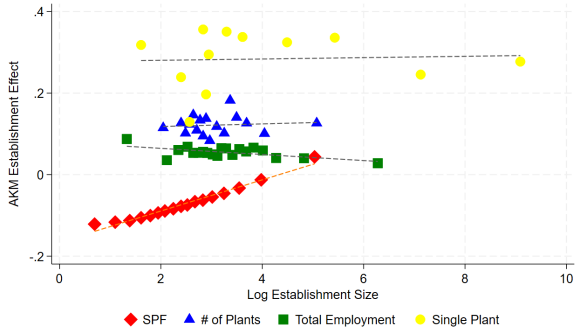
(b) AKM Establishment Effects



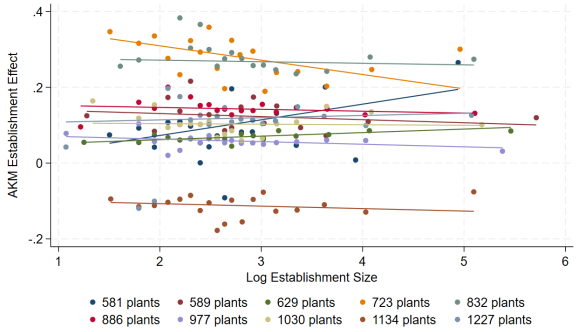
Notes: The figure shows binned scatter plots of log establishment size and log real average wages (Panel (a)) and AKM establishment effects (Panel (b)) for the year 2019 differentiating by single-establishment firms (SEF) and multi-establishment firms (MEF) with and without firm fixed effects. The dashed lines represent linear fits based on a univarite linear OLS model. Point estimates are shown in the top left corner with robust standard errors in parentheses. The SEF sample covers 778,068 establishments. The MEF sample covers 112,660 establishments. Each variable is normalized by a constant (and firm fixed effects) for ease of representation.

Figure 6: Firm-level Case Studies: ESWE (AKM) within Individual Multi-Establishment Firms

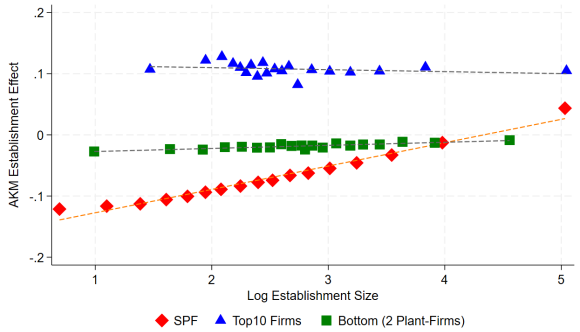
(a) Largest Firms



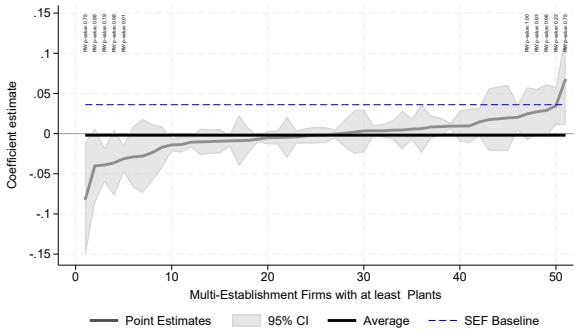
(b) Top10 Firms by # of Plants



(c) Top 10 Firms (by Establishment Count) vs. Bottom (2-Establishment MEFs)

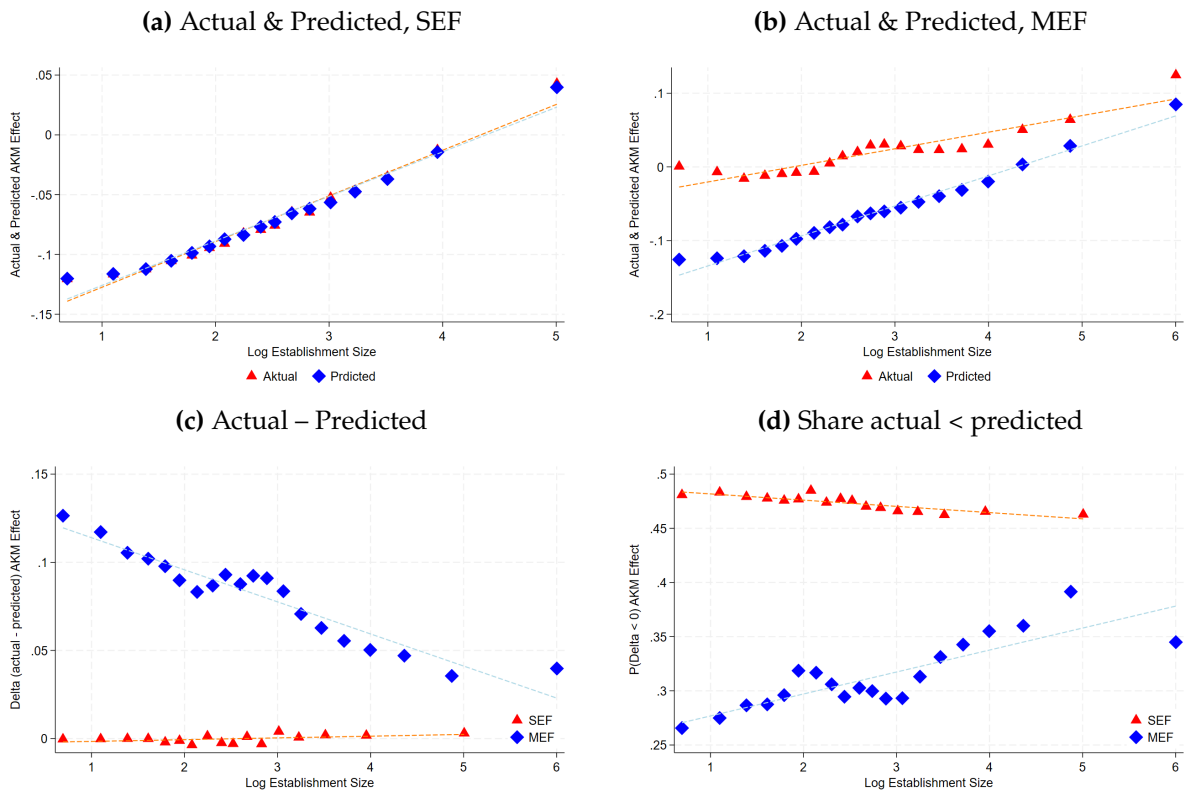


(d) ESWE Slope Estimates (AKM) in Firm with at least 100 Plants, Ranked by Point Estimate



Notes: The figure shows binned scatter plots of log establishment size and AKM establishment effects for the year 2019 for selected large firms. Panel (a) defines large by the number of plants, sum of size employment, and by the largest single plant (conditional on having at least 10 plants). For reference, single-establishment firms (SEF) are shown. Panel (b) shows the 10 largest firms based on the number of plants. Panel (c) groups firms by size groups, the top 10 largest firms in terms of the number of establishments, and the bottom firms pooling all MEFs with exactly 2 establishments. Variables are normalized within firms and average AKM establishment effect is added for illustration. For reference, single-establishment firms (SEF) are shown. Panel (d) zooms into the (51) MEFs with at least 100 plants and presents point estimates (separately estimated) and corresponding 95% CI for within firm regressions of AKM establishment effect on log establishment size for the year 2019. Point estimates are ordered by coefficient size. Thick black line shown the mean of all 51 point estimates. Romano-Wolf-corrected p-values with 1,000 bootstrap replications are shown for the lowest 5 and top 5 estimation results (Romano and Wolf, 2005;

Figure 7: Establishment AKM – LASSO Model Specification



Note: The figure reports actual and predicted values for single-establishment firms (SEF) and multi-establishment firms (MEF). We estimate a LASSO-penalized linear regression of the outcome variable AKM establishment effects on the covariate set. The covariates including 2-digit sector FE, labor market FE, log firm size, log firm size squared, interaction of log firm size with broad sector FE, and interaction of log firm size squared with broad sector FE. The penalty parameter λ is selected by 10-fold cross-validation. The lasso model takes a 75% random sample among SEF units. Selected coefficients are then used to predict the outcome variable for SEF and MEF units. Panel (a) shows actual and predicted values for the left-out 25% SEF sample along log establishment size. Panel (b) show actual and predicted values for the MEF sample (based on SEF model specification) along log establishment size. Panel (c) shows differences between actual and predicted outcomes along log establishment size for both SEF and MEF units. Panel (d) shows the share of establishments with actual outcomes being below predicted outcomes along log establishment size for both SEF and MEF units. Dashed lines represent linear fits. Appendix Figure A.4 replicates this figure for raw wages rather than AKM establishment fixed effects.

Online Appendix of:

The Employer Size Wage Effect: Within and Across Firms

André Diegmann, Steffen Müller, and Benjamin Schoefer

A Appendix Tables

Table A1: Additional Details: Meta Analysis of Estimated Size-Wage Elasticities from the Literature

Study	Design Features	Elasticity
A: Without any controls for worker heterogeneity		
Bernard, Jensen, and Lawrence (1995)	Survey of US manufacturing plants (ASM), 1981 cross section	0.037
Troske (1999)	US manufacturing workers (WECD) and plants (LRD), 1990 cross section	0.064
Arai (2003)	Swedish survey and register data, 1991 cross section, firm size	0.016
Manning (2013)	US workers (CPS), 1993,Est. size	0.108
	UK workers (BHPS),Est. size	0.086
Barth and Dale-Olsen (2011)	Norwegian workers, register data, 1991 - 1997 cross sections,Est. size	0.019
Scoppa (2014)	Italian full-time workers, social security data, 1985-2002 cross sections, firm size	0.074
Lochner, Seth, and Wolter (2020)	German full-time workers, social sec. data	
	1985-1992 cross sections	0.070
	1993-1999 cross sections	0.081
	1998-2004 cross sections	0.095
	2003-2010 cross sections	0.109
	2010-2017 cross sections	0.104
B: With controls for observable worker heterogeneity		
Brown and Medoff (1989)	US workers (CPS), 1979 cross section,Est. size	0.027
Green, Machin, and Manning (1996)	UK establishments (WIRS), full-time unskilled workers, N≥25, 1984 & 1990	0.041
Reilly (1995)	Canadian workers, Maritimes provinces, survey data, 1979 cross section,Est. size	0.039
Doms, Dunne, and Troske (1997)	US manuf. workers (WECD) and plants with N ≥ 20 (LRD), 1988 cross section	0.036
Albaek et al. (1998)	Danish workers, register data, 1991	0.025
	Finnish manuf. workers, register data, 1985	0.020
	Norwegian workers, survey data, 1989	0.025
	Swedish workers, survey data, 1991	0.021
Troske (1999)	US manufacturing workers (WECD) and plants (LRD), 1990 cross section	0.047
Lane et al. (1999)	State of Maryland, male workers (CPS),	0.050

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Study	Design Features	Elasticity
	1985-1996 cross sections, firm size	
Bayard and Troske (1999)*	US male full-time in N ≥ 20 plants, 1990, manufacturing,Est. size	0.047
	manufacturing, firm size	0.014
	retail,Est. size	0.050
	retail, firm size	0.000
	services,Est. size	0.047
	services, firm size	0.006
Arai (2003)	Swedish survey and register data 1991 cross section, firm size	0.010
Manning (2013)	US workers (CPS), 1993,Est. size	0.064
	UK workers (BHPS),Est. size	0.047
Belfield and Wei (2004)	UK workers, survey data from plants with with N ≥ 10 (WERS), 1998,Est. size	0.060
Lallemand, Plasman, and Rycx (2007)	Workers, ESE survey, 1995,Est. size	
	Belgium	0.030
	Denmark	0.006
	Ireland	0.039
	Italy	0.033
	Spain	0.045
Winter-Ebmer (2001)	Austrian male workers, social security data, 1991 cross section,Est. size	0.028
Heyman (2007)	Swedish survey and register data 1987, 1991, 1995, cross sections, firm size	0.012
Barth and Dale-Olsen (2011)	Norwegian workers, register data, 1991 - 1997 cross sections,Est. size	0.017
Scoppa (2014)	Italian full-time workers, social security data, 1985-2002 cross sections, firm size	0.043
Pehkonen et al. (2017)	Finnish workers, register data, 2003-2010 cross sections, firm size	0.007
Green, Heywood, and Theodoropoulos (2021)	UK line workers (BHPS), 1991-2016 cross sections,Est. size	0.031
Arellano-Bover (2024)	Spanish, young, male, native workers, social sec. data, 2005-2015 cross sections, firm size	0.059
C: Worker Fixed Effects		
Arai (2003)	Swedish survey and register data predicted worker fixed effects, firm size	0.020
Barth and Dale-Olsen (2011)	Norwegian workers, register data, 1991 -	0.015

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Study	Design Features	Elasticity
	1997 panel,Est. size	
Scoppa (2014)	Italian full-time workers, social security data, 1985-2002 panel, firm size	0.021
Pehkonen et al. (2017)	Finnish workers, register data, 2003-2010 panel, firm size	0.003
Green, Heywood, and Theodoropoulos (2021)	UK line workers (BHPS), 1991-2016 cross sections,Est. size	0.019
D: Estimates based on AKM Employer Effects		
Alvarez et al. (2018)	Brazilian male workers, admin. data	
	1996-2004 cross sections	0.106
	2000-2004 cross sections	0.080
	2004-2008 cross sections	0.056
	2008-2012 cross sections	0.047
Lochner, Seth, and Wolter (2020)	German full-time workers, social sec. data	
	1985-1992 cross sections	0.041
	1993-1999 cross sections	0.048
	1998-2004 cross sections	0.053
	2003-2010 cross sections	0.058
	2010-2017 cross sections	0.048

[*]Est. size and firm size enter the regression jointly.

Table A2: Meta-regressions of ESWE estimates listed in Table 1

	(1)	(2)	(3)
Reference Group: Scandinavia (10)			
Continental Europe (8)	0.036***	0.031***	0.030***
	(0.007)	(0.005)	(0.006)
Rest of World (15)	0.034***	0.031***	0.034***
	(0.006)	(0.006)	(0.008)
Reference Group: No worker heterogeneity controls (7)			
Observable heterogeneity (19)		-0.022**	-0.022**
		(0.009)	(0.009)
Worker fixed effects (5)		-0.032**	-0.034**
		(0.013)	(0.014)
AKM Employer effects (2)		-0.005	-0.007
		(0.015)	(0.019)
Reference Group: Data from 1980s or earlier (8)			
1990s (17)			0.011
			(0.008)
2000s or later (8)			0.010
			(0.012)
Constant	0.014***	0.035***	0.026**
	(0.002)	(0.008)	(0.011)
R^2	0.465	0.673	0.701

Note: Mean of dependent variable is 0.038. Estimates based on the 33 preferred estimates listed in Table 1. Numbers in () indicate the number of estimates (observations) in that group. Standard errors clustered at the study level. Significance levels: *: p<0.1, **: p<0.05, ***: p<0.01.

Table A3: Summary Statistics of SEFs and MEFs

	Mean	Standard Deviation	Minimum	Maximum
	(1)	(2)	(3)	(4)
Panel A: SEFs				
Employment	22.70	156.96	2.00	65,559
Average real daily wages	96.23	49.43	0.16	2,793
AKM FE	-0.08	0.22	-1.00	1.00
East Germany	0.19	0.39	0.00	1.00
Agriculture	0.03	0.16	0.00	1.00
Mining	0.00	0.04	0.00	1.00
Manufacturing	0.14	0.35	0.00	1.00
Energy, electricity	0.00	0.06	0.00	1.00
Water	0.01	0.08	0.00	1.00
Construction	0.19	0.39	0.00	1.00
Wholesale & Retail trade	0.20	0.40	0.00	1.00
Transportation, storage	0.06	0.23	0.00	1.00
Accomodation	0.07	0.26	0.00	1.00
ICT	0.04	0.19	0.00	1.00
Banking, insurance	0.02	0.14	0.00	1.00
Real estate	0.02	0.14	0.00	1.00
Technical service	0.11	0.32	0.00	1.00
Business service	0.07	0.26	0.00	1.00
Panel B: MEFs				
Employment	51.81	213.03	2.00	17,853
Average real daily wages	117.69	66.64	3.96	2,761
AKM FE	0.02	0.20	-1.00	1.00
East Germany	0.21	0.41	0.00	1.00
Agriculture	0.01	0.11	0.00	1.00
Mining	0.00	0.05	0.00	1.00
Manufacturing	0.08	0.27	0.00	1.00
Energy, electricity	0.01	0.10	0.00	1.00
Water	0.01	0.09	0.00	1.00
Construction	0.03	0.18	0.00	1.00
Wholesale & Retail trade	0.40	0.49	0.00	1.00
Transportation, storage	0.07	0.26	0.00	1.00
Accomodation	0.05	0.22	0.00	1.00
ICT	0.05	0.21	0.00	1.00
Banking, insurance	0.05	0.21	0.00	1.00
Real estate	0.02	0.13	0.00	1.00
Technical service	0.10	0.30	0.00	1.00
Business service	0.09	0.29	0.00	1.00

Note: The table provides summary statistics of establishments for the year 2019. Panel A provides summary statistics for single-establishment firms (SEF). Panel B provides summary statistics for multi-establishment firms (MEF). Average daily wages are measured in 2015 euros. AKM establishment effect are based on Card et al. (2018) and estimated for the period between 2014 to 2020.

Table A4: Summary Statistics by Establishment Type - Establishment Panel Survey

	N	Mean	SD	Minimum	Maximum
	(1)	(2)	(3)	(4)	(5)
Single-Establishment Firms (SEF)					
Employment	25888	112.69	624.31	2.00	44,686
Average wages	25100	107.03	46.72	0.94	1,270.33
AKM FE	25888	-0.04	0.21	-1.00	0.97
Firm age	25888	24.45	13.65	0.00	44.00
Any wage agreement	25720	0.65	0.48	0.00	1.00
Sectoral collective agreement	25695	0.33	0.47	0.00	1.00
Inhouse/company collective agreement	25695	0.05	0.22	0.00	1.00
Sectoral or inhouse agreement	25695	0.03	0.17	0.00	1.00
No membership in any chamber	22890	0.09	0.28	0.00	1.00
Orientation towards sectoral collective agreement	14291	0.43	0.49	0.00	1.00
A - Agriculture, forestry	25888	0.02	0.14	0.00	1.00
C - Manufacturing	25888	0.35	0.48	0.00	1.00
F - Construction	25888	0.10	0.31	0.00	1.00
G - Wholesale and retail trade	25888	0.15	0.35	0.00	1.00
H - Transportation and storage	25888	0.06	0.23	0.00	1.00
I - Accomodation	25888	0.04	0.20	0.00	1.00
J - Information and communication	25888	0.03	0.18	0.00	1.00
K - Financial and insurance	25888	0.03	0.17	0.00	1.00
M - Professional service	25888	0.08	0.27	0.00	1.00
N - Administrative and service	25888	0.07	0.25	0.00	1.00
S - Other service activities	25888	0.03	0.18	0.00	1.00
Multi-Establishment Firms (MEF)					
Employment	5172	283.07	764.80	2.00	17,853
Average wages	5122	130.62	63.73	22.15	1,471.29
AKM FE	5172	0.06	0.19	-0.94	0.89
Firm age	5172	26.05	14.03	0.00	44.00
Any wage agreement	5104	0.78	0.41	0.00	1.00
Sectoral collective agreement	5104	0.46	0.50	0.00	1.00
Inhouse/company collective agreement	5104	0.10	0.30	0.00	1.00
Sectoral or inhouse agreement	5104	0.07	0.26	0.00	1.00
No membership in any chamber	4245	0.11	0.32	0.00	1.00
Orientation towards sectoral collective agreement	1763	0.44	0.50	0.00	1.00
A - Agriculture, forestry	5172	0.01	0.09	0.00	1.00
C - Manufacturing	5172	0.27	0.45	0.00	1.00
F - Construction	5172	0.03	0.18	0.00	1.00
G - Wholesale and retail trade	5172	0.21	0.40	0.00	1.00
H - Transportation and storage	5172	0.08	0.26	0.00	1.00
I - Accomodation	5172	0.03	0.18	0.00	1.00
J - Information and communication	5172	0.03	0.18	0.00	1.00
K - Financial and insurance	5172	0.07	0.26	0.00	1.00
M - Professional service	5172	0.08	0.28	0.00	1.00
N - Administrative service	5172	0.12	0.33	0.00	1.00
S - Other service	5172	0.03	0.16	0.00	1.00

Note: The table provides summary statistics of establishments matched between the Establishment History Panel (BHP) for the year 2019 and the Establishment Panel Survey (Betriebspanel).

Table A5: Summary Statistics by Establishment Type - Vacancy Survey

	N	Mean	SD	Minimum	Maximum
	(1)	(2)	(3)	(4)	(5)
	Single-Establishment Firms (SEF)				
Employment	21170	72.11	389.96	2.00	44,686
Average wages	20944	105.93	44.14	11.01	1,776.96
AKM FE	21170	-0.03	0.18	-1.00	0.99
Firm age	21170	23.57	13.20	1.00	44.00
Vacancy duration	17976	109.57	96.77	0.00	609
Hours spent	16380	16.07	17.85	0.00	120
Monetary costs in Euro	13783	682.69	1680.85	0.00	15,000
Number of suitable applicants	17447	2.71	3.86	0.00	50
Number of invited applicants	17726	2.71	3.14	0.00	50
C - Manufacturing	21170	0.30	0.46	0.00	1.00
F - Construction	21170	0.07	0.26	0.00	1.00
G - Wholesale and retail trade	21170	0.06	0.23	0.00	1.00
H - Transportation and storage	21170	0.06	0.24	0.00	1.00
I - Accomodation	21170	0.06	0.23	0.00	1.00
J - Information and communication	21170	0.05	0.22	0.00	1.00
K - Financial and insurance	21170	0.03	0.16	0.00	1.00
M - Professional service	21170	0.06	0.24	0.00	1.00
N - Administrative service	21170	0.10	0.30	0.00	1.00
S - Other service	21170	0.05	0.23	0.00	1.00
	Multi-Establishment Firms (MEF)				
Employment	2630	168.08	405.51	2.00	7,869
Average wages	2621	120.44	51.54	13.20	565.68
AKM FE	2630	0.03	0.18	-0.74	0.60
Firm age	2630	22.27	13.64	1.00	44.00
Vacancy duration	2334	112.26	93.18	0.00	582
Hours spent	2009	17.89	18.56	0.00	120
Monetary costs in Euro	1714	960.22	2032.17	0.00	15,000
Number of suitable applicants	2189	3.58	4.66	0.00	50
Number of invited applicants	2230	3.47	4.20	0.00	50
C - Manufacturing	2630	0.25	0.43	0.00	1.00
F - Construction	2630	0.03	0.18	0.00	1.00
G - Wholesale and retail trade	2630	0.09	0.29	0.00	1.00
H - Transportation and storage	2630	0.05	0.22	0.00	1.00
I - Accomodation and food service	2630	0.05	0.23	0.00	1.00
J - Information and communication	2630	0.05	0.22	0.00	1.00
K - Financial and insurance activities	2630	0.07	0.25	0.00	1.00
M - Professional service	2630	0.08	0.27	0.00	1.00
N - Administrative service	2630	0.16	0.37	0.00	1.00
S - Other service	2630	0.04	0.21	0.00	1.00

Note: The table provides summary statistics of establishments matched between the Establishment History Panel (BHP) for the year 2019 and the Establishment Vacancy Survey (*Stellenerhebnung*).

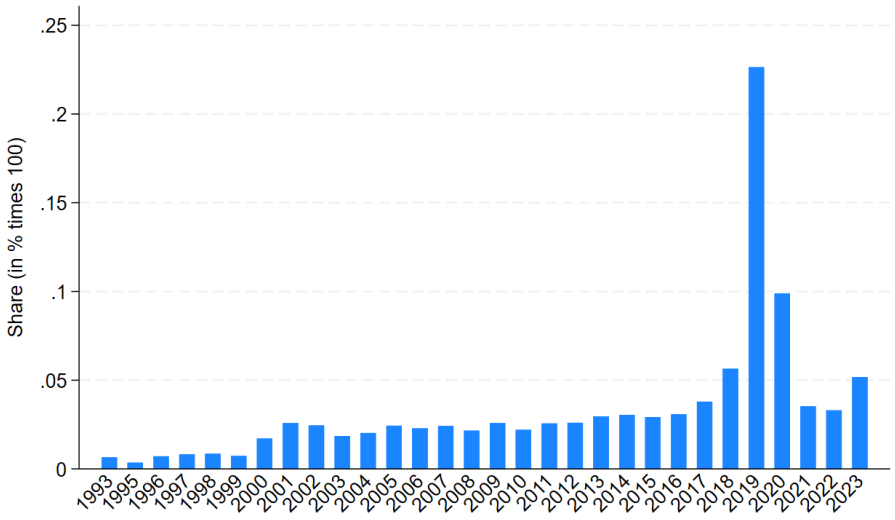
Table A6: Additional Robustness Checks for Employment Definition and Cutoffs

	SEF		MEF				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
			At least 10 employees				
A1: Log real wages							
Est. size	0.0752***	0.0739***	0.0291***	0.0143***		0.0054***	0.0031**
	(0.001)	(0.001)	(0.001)	(0.001)		(0.001)	(0.001)
Firm size				0.0433***	0.0448***		
				(0.001)	(0.001)		
B1: AKM FE							
Est. Size	0.0379***	0.0372***	0.0139***	0.0052***		0.0012**	0.0006
	(0.000)	(0.000)	(0.001)	(0.001)		(0.001)	(0.001)
Firm size				0.0256***	0.0261***		
				(0.000)	(0.000)		
Observations	350,103	350,103	57,642	57,642	57,642	57,642	57,642
			At least 20 employees				
A2: Log real wages							
Est. size	0.0747***	0.0733***	0.0299***	0.0140***		0.0077***	0.0069***
	(0.001)	(0.001)	(0.002)	(0.002)		(0.002)	(0.002)
Firm size				0.0408***	0.0427***		
				(0.001)	(0.001)		
B2: AKM FE							
Est. Size	0.0383***	0.0374***	0.0131***	0.0037***		0.0014**	0.0013
	(0.000)	(0.000)	(0.001)	(0.001)		(0.001)	(0.001)
Firm size				0.0239***	0.0244***		
				(0.001)	(0.001)		
Observations	174,150	174,150	30,945	30,945	30,945	30,945	30,945
			At least 10 full-time employees				
A3: Log real wages							
Est. size	0.0687***	0.0672***	0.0255***	0.0109***		0.0011	0.0002
	(0.001)	(0.001)	(0.002)	(0.002)		(0.002)	(0.002)
Firm size				0.0346***	0.0370***		
				(0.001)	(0.001)		
B3: AKM FE							
Est. Size	0.0360***	0.0351***	0.0117***	0.0043***		0.0004	0.0002
	(0.000)	(0.000)	(0.001)	(0.001)		(0.001)	(0.001)
Firm size				0.0173***	0.0183***		
				(0.001)	(0.001)		
Observations	199,780	199,780	32,666	32,666	32,666	32,666	32,666
SIC FE	Y					Y	
LMR FE	Y					Y	
SIC × LMR		Y	Y	Y	Y		Y
Firm FE						Y	Y

Note: The table shows regression results of log establishment wages on establishment size and firm size selecting samples at different employment thresholds. The upper part conditions establishment size of at least 10 employees or above. The middle part conditions establishment size of at least 20 employees or above. The lower part conditions establishment size of at least 10 full-time employees or above. Columns (2) and (3) provide the results for single-establishment firms (SEF). Columns (3) to (7) provide the results for multi-establishment firms (MEF). Control variables refer to 2-digit sector FE and labor market region (LMR) FE. Firm size in columns (4) and (5) refers to the sum of all plants within the firm identifier. Columns (6) and (7) include firm FE to identify the effect of size variation on the outcome variable within the firm. Panel A shows the result for log establishment wages. Panel B shows the results for AKM establishment effects. Robust standard errors in parentheses. Significance levels: *: p<0.1, **: p<0.05, ***: p<0.01.

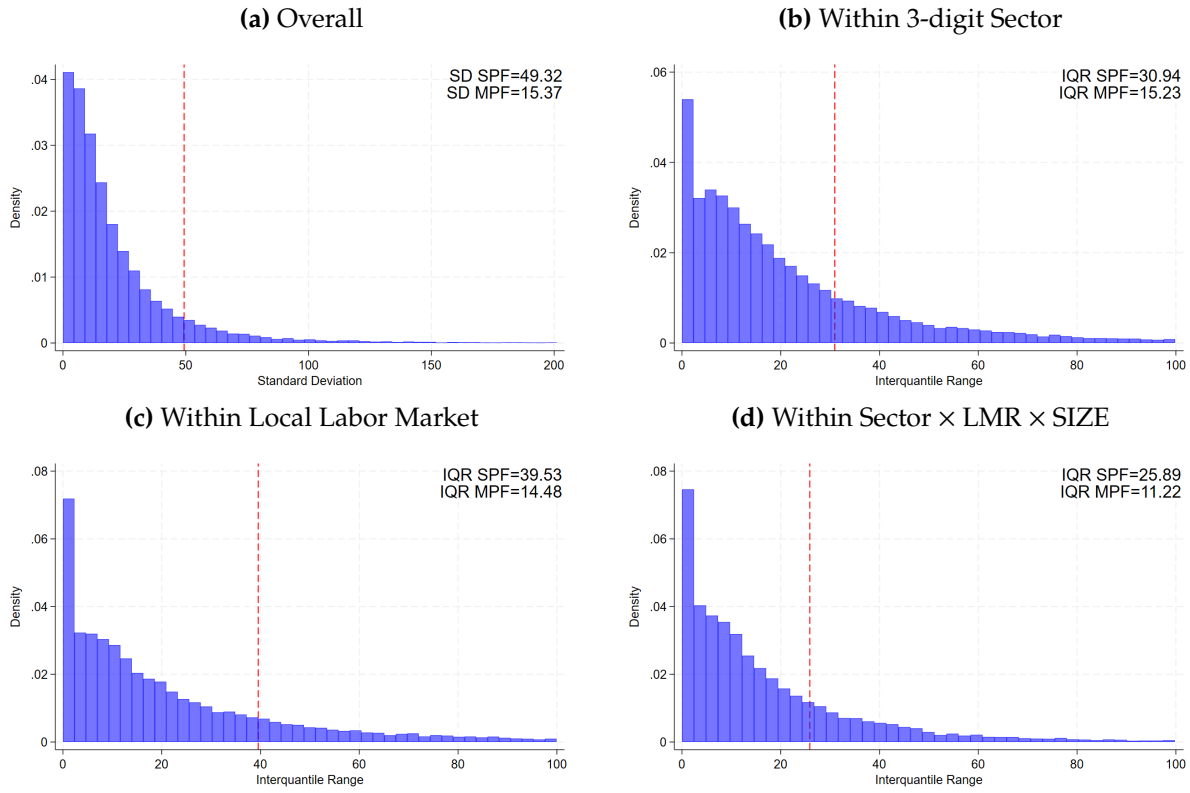
Appendix Figures

Figure A.1: Information Measured in Establishment Panel Survey



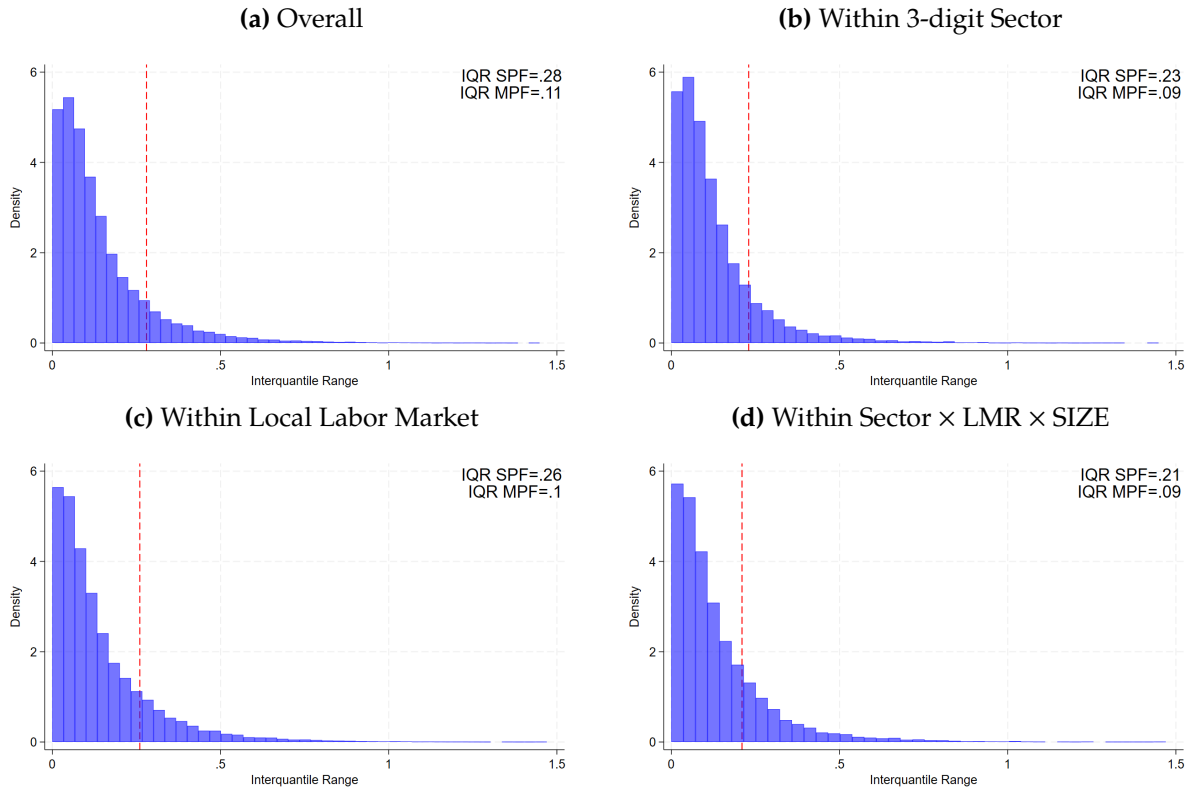
Notes: The figure shows the closest to 2019 survey wave for each establishment that provides information on collective bargaining agreements conditional on establishments observed in the Establishment History Panel (BHP) in 2019. In case of a tie situation (e.g., 2018 vs 2020), the earlier wave is selected.

Figure A.2: Establishment Wage Interquartile Range



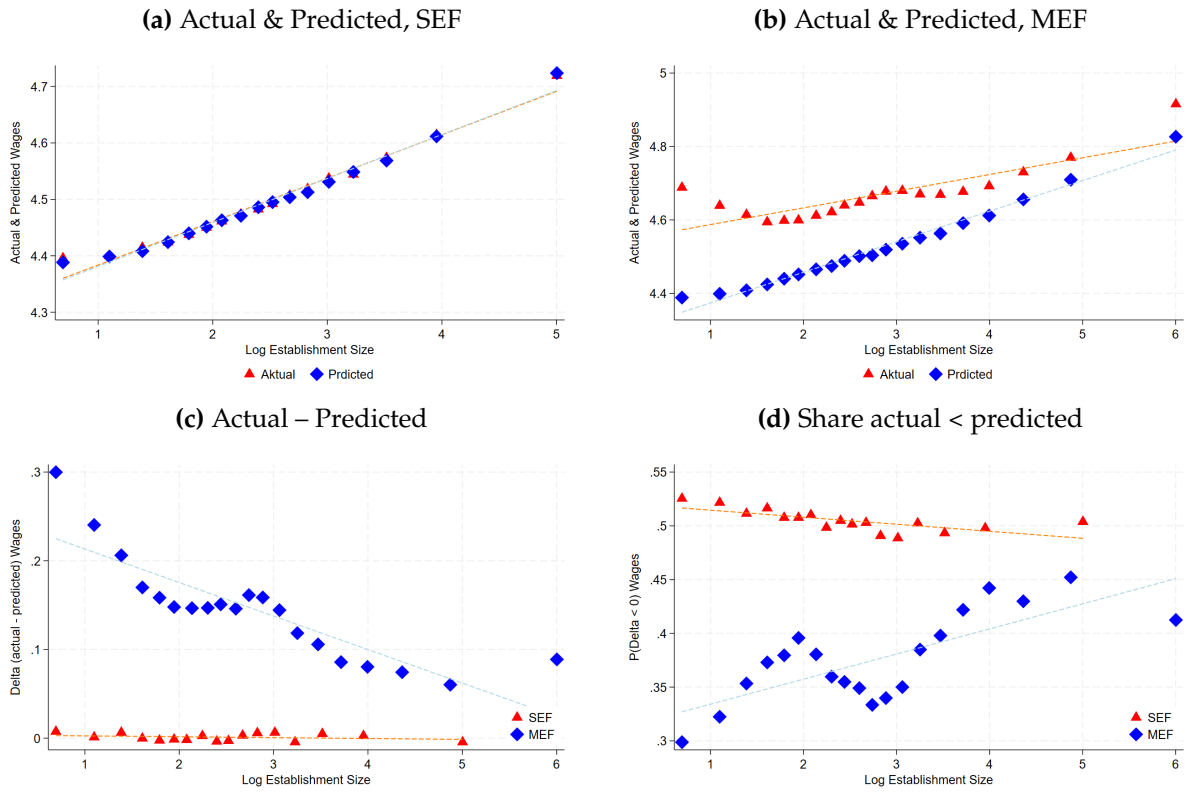
Note: The figure reports the distribution of the establishment wage interquartile range (IQR) for multi-establishment firms (MEF). Panel (a) shows IQR for the full sample. The IQR among single-establishment firms (SEF) is equal to 49.32. The median IQR among MEF is equal to 15.37. Panel (b) provides the results within 3-digit industries. The red line refers to median IQR for SEF. Panel (c) provides the results within local labor market regions (LMR). The red line refers to median IQR for SEF. Panel (c) provides the results within sector, LMR and establishment size cells. Size categories are below 50, 50-99, 100-249, and 250 and above. The red line refers to median IQR for SEF. Panel (b) and (c) condition the MEF sample on at least 2 observations within the cells.

Figure A.3: AKM Interquartile Range



Note: The figure reports the distribution of the AKM interquartile range (IQR) for multi-establishment firms (MEF). Panel (a) shows IQR for the full sample. The IQR among single-establishment firms (SEF) is equal to 0.28. The median IQR among MEF is equal to 0.11. Panel (b) provides the results within 3-digit industries. The red line refers to median IQR for SEF. Panel (c) provides the results within local labor market regions (LMR). The red line refers to median IQR for SEF. Panel (c) provides the results within sector, LMR and establishment size cells. Size categories are below 50, 50-99, 100-249, and 250 and above. The red line refers to median IQR for SEF. Panel (b) and (c) condition the MEF sample on at least 2 observations within the cells.

Figure A.4: Establishment Wage – LASSO Model Specification



Note: The figure replicates Figure 7 for raw wages rather than AKM establishment fixed effects.