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Wage Setting in Multiproduct Firms*

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Abstract

This paper reveals a new determinant of wage markdowns at the firm level, namely, the product scope. Using matched employer-employee data on Danish manufacturing firms, we document a negative elasticity between wages and firm scope, which is of a similar magnitude but opposite sign as the firm-size wage premium. We rationalize the wage discount using a theory where workers value the opportunity to switch product lines as an amenity. Multiproduct firms exercise their monopsony power to offer lower wages. Our findings have important implications for understanding labor market dynamics in times of rising concentration from the contribution of large multiproduct firms.

JEL codes: J31; J42; L25; D21; F10

Keywords: Multiproduct firms; Monopsony power; Wages; Amenities; Labor share

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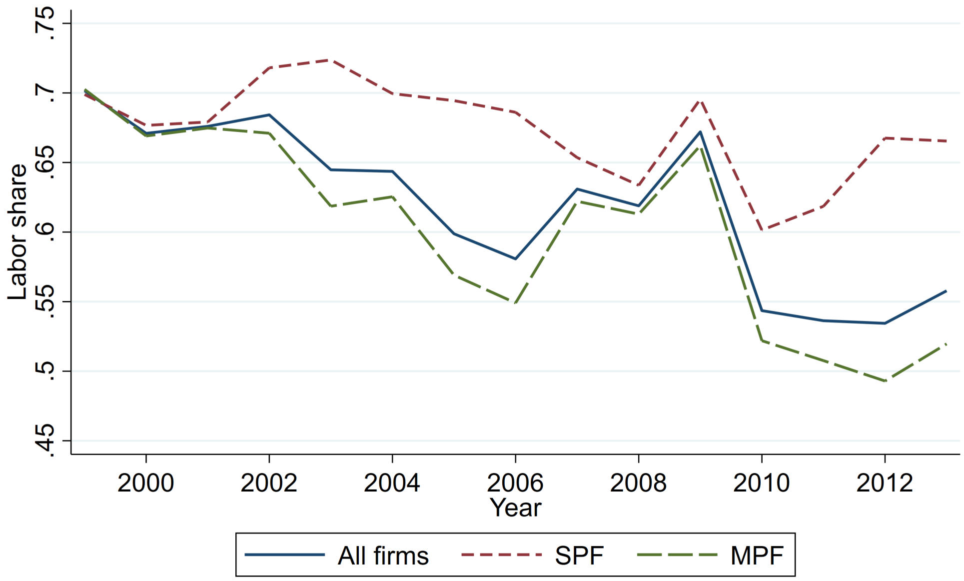
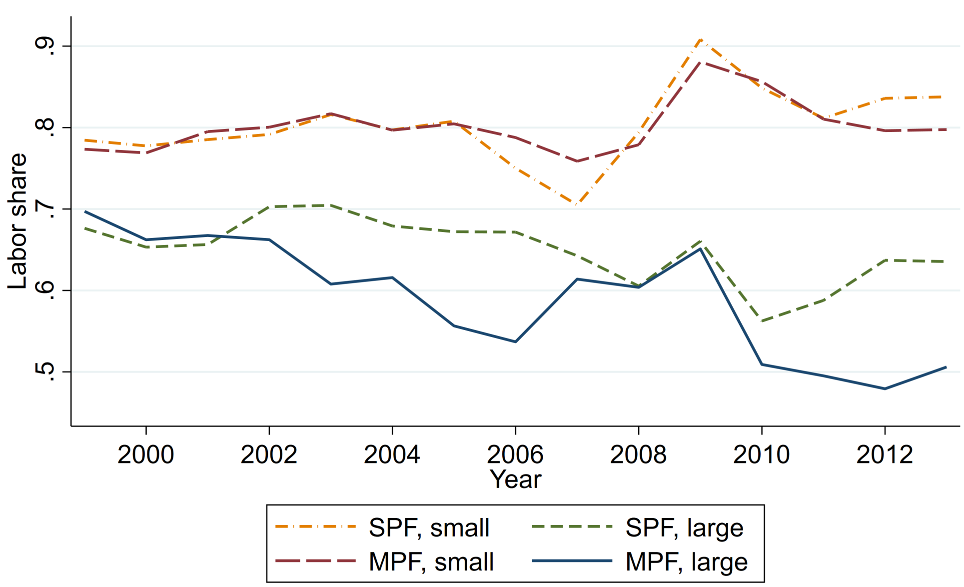
1 Introduction

Recent research has documented a substantial shift over the past few decades in the distribution of production, with the so-called "superstar firms" continuing to expand their influence (e.g., Autor et al., 2020). Since these firms are characterized by a high degree of market power both in product and labor markets, this trend helps to explain well-documented macroeconomic facts regarding the rise in markups and the decline in labor's share of income (Autor et al., 2020; Baqaee and Farhi, 2020; De Loecker et al., 2020; Kehrig and Vincent, 2021). Furthermore, complementary empirical evidence points to a concurrent increase in the markdown, i.e., a widening gap between wages and the marginal revenue product of labor (Yeh et al., 2022; Mertens, 2022). As Card (2022) states, "there is a growing consensus that firms have some wage-setting power, though many questions remain about the sources of that power." Understanding the sources of market power in the labor market is critical, and existing studies have emphasized the role of factors such as firm size and non-wage amenities (see Manning (2021) for a recent review on monopsony in labor markets). In this paper, we investigate a new determinant of markdowns at the firm level: the number of products that a firm produces, or its scope. With multiproduct firms dominating both domestic and international markets (Bernard et al., 2007) and product scope being a key contributor to the size and growth of firms (Hottman et al., 2016), understanding the relationship between a firm's scope and its labor market power bears significant implications.

A first indication of a potential link between firm scope and the labor share is presented in Figure 1, which we construct using Danish administrative data on manufacturing firms. Besides the aggregate labor share (defined as total wage earnings over aggregate value added), Figure 1(a) compares the evolution of the labor share between single-product firms (SPF) and multiproduct firms (MPF). The former (latter) is defined as firms producing one (two or more) 8-digit level product(s). While we observe a decline in the labor share among both types of firms across the years, the labor share of MPFs is on average 10 to 15 percentage points lower than that of SPFs, except during the Global Financial Crisis. Because MPFs are typically larger than SPFs, this may simply reflect the reallocation of sales and resources towards the best-performing firms that have a lower share, for example, due to higher markups (Autor et al., 2020; De Loecker et al., 2020) or a greater degree of automation (Hubmer and Restrepo, 2021; Koch and Manuylov, 2023). Indeed,



(a)



(b)

Figure 1: **Labor share of Danish manufacturing firms.** This figure plots the evolution of the labor share (defined as total wage earnings over aggregate value added) for (a) all firms, single-product firms (SPF), and multiproduct firms (MPF); and (b) small SPFs, large SPFs, small MPFs, and large MPFs. Small and large firms are defined by sales below and above the annual median in the full sample, respectively. SPF (MPF) are firms producing one (two or more) CN 8-digit level products.

in Figure 1(b), it is clear that large firms (with sales above the median) have a lower labor share compared to small firms.[1] However, comparing large SPFs against large MPFs, we still observe the striking pattern that MPFs have on average a lower labor share than SPFs.

Motivated by this stylized fact, we leverage the linked employer-employee data from Denmark to study the relationship between wages and firm scope at the micro level. Our regression includes an extensive set of fixed effects, including both worker and firm fixed effects, to account for unobserved heterogeneity. We uncover a surprising negative elasticity between wages and firm scope: comparing two firms with identical sales levels, the firm with a broader product range pays lower wages. This finding for a wage discount from product scope is unexpected and novel, contrasting with the wage premia associated with, for instance, firm size and export activity (e.g., Oi and Idson, 1999; Bernard et al., 2007; Helpman et al., 2017; Card et al., 2018). Interestingly, the wage elasticity with respect to scope mirrors the magnitude of the firm-size wage premium, albeit with the opposite sign.[2] We further demonstrate that the negative relationship is mainly driven by lower entry wages, as opposed to slower growth in post-entry wage dynamics.

Our main empirical finding for a firm-scope wage discount could potentially be explained by a number of existing theories. First, as firms' product scope expands outside their core competence, productivity declines and this may in turn lead to lower wages (Eckel and Neary, 2010; Mayer et al., 2014; Arkolakis et al., 2021). Second, the rise in product scope may increase the size as well as labor market power of MPFs, allowing them to suppress wages (Berger et al., 2022; Yeh et al., 2022). Third, diversification across product markets may increase a firm's resilience to economic shocks, enabling MPFs to offer lower wages in exchange for higher job security (e.g., Wiswall and Zafar, 2018). Controlling for the factors as suggested by these theories reduces the estimated elasticity slightly, but we find that the wage discount persists and remains robust.

Thus, we propose a new theory to explain the wage discount and to provide a micro-foundation that links a firm's product scope to its labor market power and worker efficiency. Specifically,

[1] The sample used to construct this figure contains only firms with product-level information from the Danish *VARS* register. Appendix Figure A.1 shows that the aggregate labor share also follows a similar trend when we use all manufacturing firms, including those without product information from *VARS*. In Figure 1(b), large (small) firms have annual sales above (below) the median across all firms (i.e., SPFs and MPFs). The average number of small SPFs, large SPFs, small MPFs, and large MPFs across years is 846, 567, 715, and 994, respectively. Appendix Figure A.2 displays a similar pattern when the median is computed separately for SPFs and MPFs.

[2] We also show that unlike the product scope, the numbers of establishments and export destinations are not associated with lower wages. In addition, there is no impact from the number of products that the firm "carries-along", i.e., goods that it sells but does not produce.

we develop a discrete choice model in which workers are employed at firms that produce and sell multiple products.[3] When a firm hires a worker, she is assigned to a specific product line. Each worker-product pairing is characterized by a unique wage benefit and amenity that generate utility for the worker. The amenity is broadly interpreted as non-pecuniary factors such as interpersonal relationships among coworkers, personal interests in particular products, working conditions, and skill development, all of which may be valued differently across product lines even for the same worker. For example, survey data suggests that the social climate of teams is an important source of dissatisfaction, ahead of the discontent from overtime and weekend work (see Appendix Table A.1). The option of switching across production teams within the same firm may thus appeal to workers.[4] Accordingly, in our model, we allow workers to transfer to another product line in order to achieve an improvement in utility. The worker faces uncertainty about the wage benefit and amenity of the next product line, and opts for a switch if she anticipates a better match.

The key insight of our model is that MPFs provide workers with the opportunity to switch to a different product line for a better fit.[5] Consequently, a worker's expected utility in an MPF is higher than in an SPF, where switching necessitates moving to a different firm altogether, which is assumed to be more costly than transferring within the same firm. Hence, our model suggests that a wider product range is an amenity in itself because it allows workers to switch for a better fit. As the expected utility is higher in an MPF, workers in these firms are less wage-sensitive. Given that wages equal the marginal product of labor divided by the markdown, an MPF possesses greater monopsony power over its workers and can afford to offer lower wages.

Our work brings important implications for the estimation of labor markdowns (Berger et al.,

[3]Recent developments in modeling monopsony power in labor markets have centered on three key theoretical frameworks: oligopsony, job differentiation, and search-and-matching frictions (Azar and Marinescu, 2024). Our theory includes features from the first two, allowing for strategic interactions between large employers in the labor market (i.e., oligopsony) in a discrete choice model where employees have heterogeneous preferences over differentiated jobs. This is motivated by the fact that MPFs are large not only in product markets but also in labor markets, and the product lines that they operate potentially provide job differentiation as well. Below, we further discuss the implications of vertical and horizontal job differentiation.

[4]Survey data is drawn from the European Company Survey in 2009 for employee representatives, which covers 30 countries. One of the survey questions asks: "Looking to the individual complaints the employee representation has been dealing with in the establishment the last 12 months, have the following issues been raised?" Not surprisingly, discontent related to pay is the most common complaint. Bad social climate in teams, working groups or departments is the second most common complaint, suggesting that such non-pecuniary factors contribute to job dissatisfaction.

[5]In the model proposed by Papageorgiou (2018), workers can enhance their productivity by switching tasks within a firm. Since larger firms offer more opportunities for task-switching, workers become more productive and receive higher wages. Although our empirical findings also indicate a firm-size wage premium, we observe a scope wage discount that contradicts the predictions of Papageorgiou (2018). Our model explains this discrepancy by recognizing that the ability to switch jobs within a firm is an amenity in itself, enabling firms to impose a markdown on wages.

2022; Brooks et al., 2021; Yeh et al., 2022; Mertens, 2022, 2023; Xie et al., 2024; Morlacco, 2019; Rubens et al., 2024). Similar to markup estimation, markdown estimation relies on estimating a production function and calculating the wedge between an input's supply elasticity and its cost share. Under perfect competition, these measures align; however, with market power, markups and markdowns create wedges. Although recent literature has advanced the estimation of markups by incorporating MPFs (De Loecker et al., 2016; Dhyne et al., 2022; Orr et al., 2024), similar progress for markdowns remains limited. Our results highlight the need to consider the multiproduct nature of firms in markdown estimation. Additionally, they suggest the importance of a more granular analysis of labor markdowns, which may vary across workers within a firm, for instance, because of different conditions (e.g., product scope) at the time of hiring.

Related literature

Our paper contributes to a burgeoning literature that explores markdowns and the market power of firms in labor markets. This research lies at the intersection of several fields, namely, labor economics, industrial organization, and international trade. For example, following the seminal work by Boal and Ransom (1997) and Manning (2003), numerous studies investigate the impact of monopsony power on wage dispersion and income inequality (Manning, 2011, 2021; Lentz and Mortensen, 2010; Card et al., 2018). Significant contributions have also been made in quantifying labor market concentration and markdowns across various contexts in industrial organization (Azar et al., 2022a,b; Berger et al., 2022; Brooks et al., 2021; Yeh et al., 2022). Moreover, recent work examines the relationship between international integration and monopsony power (Morlacco, 2019; Jha and Rodriguez-Lopez, 2021; Heiland and Kohler, 2022; MacKenzie, 2021; Egger et al., 2022; Macedoni, 2022b; Macedoni and Tyazhelnikov, 2024; Xie et al., 2024). Our paper contributes to these strands of the literature by introducing a previously unexplored factor that influences wages: firms' product scope.

The product scope adds to a growing list of job-level amenities identified in the literature that are associated with lower wages. These amenities include workplace hazards (Hamermesh, 1999), atypical work hours, and fringe benefits such as paid leave, pensions, and health insurance (Pierce, 2001), as well as risks like workplace fatalities (Kniesner et al., 2012), the value of schedule flexibility (Mas and Pallais, 2017) and work pressure (Nagler et al., 2025).[6] Since micro-level data that links

[6]For an in-depth review of workplace amenities and their implications, key studies include Brown (1980), Duncan

workers to these amenities—or in our setting, product lines—is generally unavailable, researchers have also relied on experimental data to gauge the value of these amenities (e.g., Maestas et al., 2023). It has long been recognized that job dissatisfaction from non-pecuniary factors may lead workers to quit and switch jobs across firms (e.g., Freeman, 1978; Akerlof et al., 1988). An MPF offers workers the opportunity to make an internal transition to another job within the firm, which is arguably less costly than quitting the firm altogether.

Traditionally, the existence of such non-wage amenities leads to vertical differentiation, which is closely associated with the concept of "compensating differentials," where workers "pay" for desirable job features through lower wages (Brown, 1980; Rosen, 1986; Sorkin, 2018; Sockin, 2024). In contrast, horizontal differentiation is linked to the idea of monopsony power (Bhaskar et al., 2002). In our model, firm-level amenities interact with monopsony power. A higher amenity reduces the labor supply elasticity, enabling firms to pay lower wages by exploiting their market power over workers. This implies that the wage gap between an MPF and SPF reflects differences in labor market power driven by the product scope. In principle, our framework can be extended to any other amenity that affects the labor supply elasticity.[7]

Our paper also relates to a large and growing body of research on MPFs, especially in the context of international trade (see Irlacher (2024) for a recent review). In choosing their product mix, firms take into account both supply and demand linkages. These refer, for instance, to flexible manufacturing, economies of scope, and cannibalization effects across products within the firm (e.g., Eckel and Neary, 2010; Mayer et al., 2014; Flach and Irlacher, 2018; Macedoni and Xu, 2022; Macedoni, 2022a; Boehm et al., 2022). Firms must also adjust their product mix in response to shocks that affect trade, demand, and competition (Bernard et al., 2011; Mayer et al., 2021; Fieler and Harrison, 2023; Macedoni et al., 2024a,b). As we have noted, MPFs are key players both in product and labor markets. Indeed, our data reveals that around 73% of workers in Danish manufacturing are employed at MPFs as opposed to SPFs.[8] Despite this fact, relatively little is

and Holmlund (1983), Wiswall and Zafar (2018), and Maestas et al. (2023).

[7]The works of Taber and Vejlin (2020) and Lamadon et al. (2022) incorporate both vertical and horizontal job differentiation in their models.

[8]We compute this statistics using firms in the *VARS* register, which has product-level information but is constrained to manufacturing firms with 10 or more employees. The product scope of manufacturing firms that are not in *VARS* (e.g., with fewer than 10 employees) is unknown. If we take the extreme assumption that all of these other firms are SPFs, then still 60% of workers are employed in MPFs. Even at the more aggregate 4-digit product level, MPFs account for 62% of workers (51% if the same extreme assumption is imposed).

known about wage setting in MPFs, with few exceptions (Eckel and Neary, 2010; Egger and Koch, 2012; Eckel and Yeaple, 2024). We contribute to this literature by providing a novel link between firm scope and wages through the effects of monopsony power under labor market imperfections.

The remainder of this paper proceeds as follows. In Section 2, we describe our data. Section 3 presents the empirical analysis, our main empirical results, as well as a series of robustness checks. Section 4 presents our theory that rationalizes the empirical findings, and Section 5 concludes.

2 Data

2.1 Description of data

For our empirical analysis, we use matched employer-employee data from Denmark starting in 1996. General information on firms is obtained from the *FIRM* register. This includes data on total revenues, value added, employment, stock of assets, industry code, etc. Importantly, we link this dataset to the *VARS* register, which provides information on firms' sales at the product level. *VARS* is the Danish version of the European PRODCOM production survey, and it covers firms with 10 or more employees in the manufacturing sector. While firms in the raw material extraction sector also appear in the dataset, the manufacturing sector accounts for the vast majority of firms in *VARS*, and we focus on this sector for our analysis. The sector classification of economic activities follows NACE Rev. 2. For our baseline analysis, we define a product at the Combined Nomenclature (CN) 8-digit level and measure firms' product scope (i.e., the number of products) accordingly.[9] Robustness checks demonstrate that our results hold for more aggregate definitions of products. Using our data, we can also examine the distribution of sales across products within the firm. Furthermore, the number of establishments within each firm is counted from *IDAS*, and we infer firms' export and import information from the *UDHI* register for customs data.

Workers at each firm are identified using the register *IDAN*, which provides the matching of employees to employers in each year. Basic information on workers is provided in *IDAP*, including

[9] CN 8-digit codes extend the Harmonized System (HS) 6-digit codes. There are approximately 9,400 8-digit product codes. For example, consider chapter 61, "Articles of apparel and clothing accessories, knitted or crocheted", which represents a particular 2-digit product. This is divided into 4-digit product categories, such as 6104 "Women's or girls' suits, ensembles, jackets, blazers, ..., knitted or crocheted." Within this category is the subcategory of "Jackets and blazers", which contains four 8-digit codes: (i) 61043100, of wool or fine animal hair; (ii) 61043200, of cotton; (iii) 61043300, of synthetic fibers; and (iv) 61043900, of other textile materials. The different levels of aggregation serve as proxies for the various definitions of the product lines that employees work at in a manufacturing firm.

their age, gender, and labor market experience. Throughout our analysis, we restrict the sample to full-time workers between the ages of 18 and 65 in their primary job. We use the variable *loenmv* from the register *IND* as our measure for wage earnings, which is the most accurately measured earnings concept in the Danish register data (Traiberman, 2019). This variable captures total labor income, including, for instance, fringe benefits and severance pay. Next, we obtain workers' education levels from *UDDA*. Using the highest level of education completed, we construct indicator variables based on five categories: missing education, no qualification, apprenticeship, some post-secondary education, and university graduate.

From *INDH*, we retrieve workers' 3-digit ISCO occupation codes which we require to compute measures of firms' labor maket power and to control for confounding factors such as the routinization, automation, and offshorability of occupations. In our regressions, we drop observations for which the information on occupations is of poor quality.[10] Note that in the years up to and including 2009, the categorization of occupations follows the ISCO-88 classification. Since 2010, Statistics Denmark has switched to the ISCO-08 classification and from 2014 onwards, the quality codes associated with workers' occupation is missing. For our baseline regressions, we focus on the period from 1996 to 2007 due to the break in the classification of occupations between 2009 and 2010 and we exclude the years of 2008 and 2009 because of the Global Financial Crisis. Indeed, as depicted in Figure 1, there appears to be a greater deviation from the trends during these years. However, we show that our results are robust to the inclusion of later years.

Summary statistics of variables both at the firm and worker levels are shown in Table 1. These statistics provide an overview of some of the firms' and workers' characteristics. In our regressions, the unit of observation is a worker-firm-year triplet, so we also present summary statistics at the worker level in Appendix Table A.2 for all of the variables used. From Table 1, we find that the average firm is an MPF that sells over three products. The majority of the sample consists of MPFs, specifically, 57%, and the remaining fraction as SPFs. Even at more aggregate levels of product codes, most firms still produce and sell multiple products. In terms of employment, MPFs account for a disproportionate 73% of the workers. In general, the product scope of a firm is highly correlated with measures of its size, including sales, employment, and productivity (i.e., value-added

[10]The source of occupation codes for *INDH* is the register *AKM*. We follow the steps in Traiberman (2019) to impute the quality codes associated with workers' occupations and keep the high quality observations.

Table 1: Summary Statistics

Firm-level variables	Mean	SD
Number of products - 8-digit level	3.424	6.554
Number of products - 6-digit level	3.003	5.335
Number of products - 4-digit level	2.295	3.352
Number of products - 2-digit level	1.602	1.541
Sales (in levels, millions of 2005 DKK)	113.1	548.9
Indicator: Exporter	0.766	0.423
Indicator: Importer	0.729	0.445
Number of establishments	1.507	2.316
Employment	90.18	301.8
Worker-level variables	**Mean**	**SD**
Wage earnings (in levels, thousands of 2005 DKK)	317.3	151.4
Indicator: Female	0.312	0.463
Age	41.08	10.66
Indicator: Missing education	0.013	0.113
Indicator: No qualification	0.311	0.463
Indicator: Apprenticeship	0.454	0.498
Indicator: Some post-secondary education	0.022	0.148
Indicator: University education	0.200	0.400
Work experience	14.88	6.688

Notes: The table reports summary statistics for our sample over the years 1996-2007. N = 32,919 and 2,108,948 for the firm and worker-level variables, respectively. The full set of summary statistics at the worker level is presented in Appendix Table A.2.

per worker). We find that exporting and importing are common in the set of firms examined.

Moreover, Table 1 reveals that the average worker in our sample earns 317,300 DKK annually (where wages are deflated into 2005 Danish kroner), or approximately 53,000 USD. As our sample is restricted to firms within the manufacturing sector, the share of female workers (31.2%) is lower than the whole Danish economy, while the fraction of workers with an apprenticeship education (45.4%) is higher. The average age is 41, and mean work experience is close to 15 years.

2.2 Product scope and the labor share

In Figure 1, we demonstrated that the fall in the labor share of large MPFs contributes significantly to the decline in the overall labor share of Denmark. Here, we further show that there has been a corresponding increase in firms' product scope over the same period. We then perform a simple decomposition exercise to link the two trends, and use this as motivational evidence for our regression analysis in the next section.

First, Figure 2(a) displays the average number of products across firms annually, and a clear positive trend stands out. It falls during the Global Financial Crisis, but rises again afterwards, resulting in a total increase of around 0.39 products, or roughly 13%, over the entire period. Importantly, Figure 2(b) shows that the rise can be attributed mainly to the activity of large MPFs; the average product scope of these firms rises from 5.6 to 7.2 (right axis), which is considerably larger than the increase of the small MPFs from 3.5 to 3.6 (left axis).

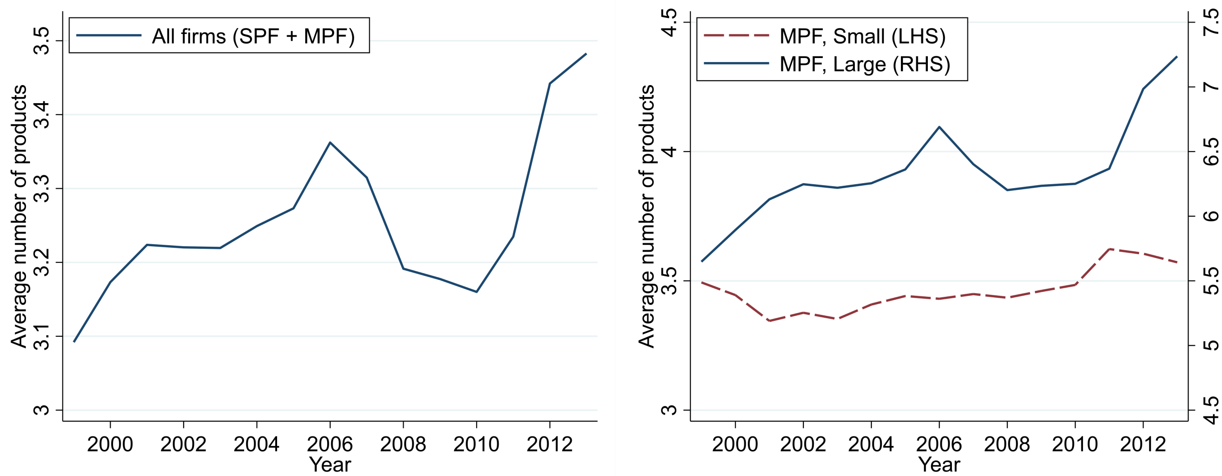
We have previously established in Figure 1 that MPFs in general have a lower labor share compared to SPFs. The decline observed within MPFs might also suggest that besides changes to the product range, there are within-firm adjustments to the wages paid to workers. To explore this idea, we perform a decomposition of the labor share in Figure 3 following Melitz and Polanec (2015) and Autor et al. (2020). Denoting LS_f as firm f's labor share (i.e., the ratio of wage earnings to value added) and ω_f as the value-added share, the change in the aggregate labor share LS between two periods $t = 0$ and $t = 1$ can be written as:

$$\Delta LS = \Delta \overline{LS}_S + \Delta \left[\sum (\omega_i - \overline{\omega})(LS_f - \overline{LS}) \right]_S + \omega_{X,0}(LS_{S,0} - LS_{X,0}) + \omega_{E,1}(LS_{E,1} - LS_{S,1}), \quad (1)$$

where subscripts S, X, and E denote survivors, exiters, and entrants, respectively, and $LS_{S,t}$, $LS_{X,0}$, and $LS_{E,1}$ are the respective aggregate labor shares of each group. Likewise, $\omega_{X,0}$ and $\omega_{E,1}$ are the aggregate value-added shares of exiters and entrants, respectively, while $\overline{LS}$ and $\overline{\omega}$ are the means of LS_f and ω_f. We break the period between 1999 and 2013 into two-year intervals, and for each component in Eq. (1), we take the average over the intervals.[11]

Figure 3 plots the total average change as well as each individual component. Because of our focus on the product scope, we rely on the sample of firms in the *VARS* database, which is a subset of all firms in the economy. Hence, we note that entry and exit here refer to the sample, and not to the economy. While these components are sizable, they should be interpreted with caution. Examining the within-firm component provides a first indication that there is a link between product scope and wage payments. Overall, this component is positive, which implies that average wages relative to value added have in fact been increasing over this period. However, contributions may vary across

[11] We have verified that the alternative Olley and Pakes (1996) decomposition without entry and exit delivers similar qualitative findings for the within and between-firm components, as does varying the interval length.



(a) (b)

Figure 2: **Average number of products**: This figure plots the evolution of the average number of products (defined at the CN 8-digit level) in Danish manufacturing across (a) all firms, and (b) small and large multiproduct firms (MPF). The simple average across firms is computed. Small and large firms are defined by sales below and above the annual median, respectively.

Figure 3: **Decomposition of labor share**: This figure plots the decomposition of the change in the labor share into the within-firm, between-firm, exit, and entry components (in percentage points). We further split the within-firm component into the contributions of small SPFs, large SPFs, small MPFs, and large MPFs. The average change of the two-year intervals between 1999 and 2013 is displayed. Small and large firms are defined by sales below and above the annual median, respectively.

different types of firms, and we further decompose the within-firm component as:

$$\Delta\overline{LS}_S = \Delta\left[\frac{N_S^{\text{SPF,small}}}{N_S}\overline{LS}_S^{\text{SPF,small}}\right] + \Delta\left[\frac{N_S^{\text{SPF,large}}}{N_S}\overline{LS}_S^{\text{SPF,large}}\right] + \Delta\left[\frac{N_S^{\text{MPF,small}}}{N_S}\overline{LS}_S^{\text{MPF,small}}\right] + \Delta\left[\frac{N_S^{\text{MPF,large}}}{N_S}\overline{LS}_S^{\text{MPF,large}}\right], \tag{2}$$

where N_S is the number of surviving firms, $N_S^{\text{SPF,small}}$ is the number of surviving small SPFs, and analogous definitions are made for the other categories. From Figure 3, we observe a major difference between large MPFs and the other categories. The within-firm component of large MPFs falls by 0.46%, accounting for close to one-quarter (0.47/2.07 = 23%) of the overall decline in the aggregate labor share. From Figure 2(b), we know that large MPFs have expanded their scope. The decomposition here indicates that over time, their average wages have decreased as well relative to the value of production.

We also find a considerably large, negative between-firm component, capturing the reallocation of market shares towards firms with lower labor shares. This is consistent with what others have documented (e.g., Hémous and Olsen, 2022).[12] Given that MPFs have significantly lower labor share than SPFs (Figure 1), this implies that the former has grown larger at the expense of the latter, and this also helps to explain the decline in the wages paid to labor.

3 Empirical analysis

3.1 Empirical specification

We use our linked employer-employee dataset to investigate the response of workers' wage earnings on their firm's product scope with the following empirical specification:

$$\log(w_{fht}) = \alpha_1 \log(\text{Number of products}_{ft}) + \beta_1 \log(\text{Sales}_{ft}) + \beta_{\mathbf{X}}\mathbf{X}_{ft} + \beta_{\mathbf{Z}}\mathbf{Z}_{ht} + c_m + c_{ost} + c_f + c_h + \varepsilon_{fht}, \tag{3}$$

where w_{hft} denotes the wage earnings of worker h in firm f at time t. The regressor of interest is the (log) number of 8-digit products of the firm, or equivalently, its product scope. As mentioned,

[12] We also follow Hémous and Olsen (2022) in this exercise to remove outlier firms with labor share above 1.4.

the number of products that a firm sells is positively correlated with its size. Therefore, we must include as a control $Sales_{ft}$ to isolate the impact of product scope, conditional on size. To mitigate omitted variable bias, we add other observable firm-level control variables $\mathbf{X}_{ft}$ (discussed below), as well as worker-level controls $\mathbf{Z}_{ht}$. The latter set of variables includes indicator variables for gender and the education groups listed in Section 2, age, age squared, age cubed, as well as linear and quadratic terms of labor market experience in years.

Our baseline specification in Eq. (3) also includes a rich set of fixed effects to account for unobserved heterogeneity. First, municipality fixed effects c_m capture location-specific factors that may influence workers' wages and firms' product scope. There are 98 municipalities in Denmark, and municipality m denotes the location of worker h. Second, c_{ost} denotes occupation-sector-year fixed effects. Occupations are defined at the 3-digit level, and we focus on manufacturing firms in our baseline estimates, for which there are 23 2-digit sectors. These fixed effects account for time-varying confounding factors specific to occupation-sector pairs, for example, trends related to the offshorability of occupations or the routinization and automation of jobs.

Importantly, our regression includes two-way fixed effects, c_f and c_h, to control for unobserved heterogeneity at the firm and worker levels, respectively, à la the canonical model in Abowd et al. (1999).[13] Thus, we exploit the within-worker variation in the number of products over time, which may be either within or across firms (e.g., if the worker moves to another company). Moreover, we also exploit the within-firm variation in product scope from yearly changes to the number of products sold. Lastly, ε_{fht} is the error term.

3.2 Baseline results

We start with simple cross-sectional regressions in Table 2. We show results for three years, t = 1997, 2002, and 2007, though similar findings are obtained in all other years. The regressions include all worker-level controls listed earlier, and firm-level control variables consisting of (log) sales, indicator variables for exporting, importing, and the (log) number of establishments.[14]

Our regressor of interest is the firm's number of products, which measures its product scope. In particular, controlling for total sales, the regression results show that in any given year, firms

[13] Time-invariant worker characteristics are dropped in those regressions that include worker fixed effects.

[14] To save on space, coefficient estimates for these worker-level controls are reported in Appendix Table A.3. In general, wages are higher for employees that are older, more educated, and more experienced.

Table 2: Wage Earnings and Product Scope, Cross-sectional Regressions

	Dependent variable: (log) wage earnings					
Year	1997		2002		2007	
	(1)	(2)	(3)	(4)	(5)	(6)
(log) Number of products	-0.0198***	-0.0186***	-0.0103**	-0.0124***	-0.0133***	-0.0126***
	(0.0035)	(0.0027)	(0.0042)	(0.0028)	(0.0039)	(0.0029)
(log) Sales	0.0300***	0.0250***	0.0253***	0.0239***	0.0221***	0.0209***
	(0.0023)	(0.0018)	(0.0026)	(0.0021)	(0.0023)	(0.0021)
Exporter		0.0062		0.0036		-0.0118
		(0.0068)		(0.0096)		(0.0098)
Importer		-0.0122*		-0.0033		0.0073
		(0.0069)		(0.0085)		(0.0086)
(log) Number of establishments		0.0002		-0.0036		0.0019
		(0.0032)		(0.0041)		(0.0041)
Worker-level controls	Y	Y	Y	Y	Y	Y
Municipality FE	Y	Y	Y	Y	Y	Y
Occupation-sector FE	Y	Y	Y	Y	Y	Y
N	218,987	218,987	226,894	226,894	170,355	170,355
R^2	0.30	0.48	0.32	0.46	0.33	0.46

Notes: Worker-level control variables include indicator variables for level of education (missing, no qualification, apprenticeship, some post-secondary, and university graduate), experience, experience squared, age, age squared, and age cubed. An occupation is defined at the ISCO-88 3-digit level, and a sector at the NACE Rev. 1 2-digit level. Standard errors (in parentheses) are clustered by firm. $***$, $**$, $*$ denote significance level at 1%, 5% and 10% respectively.

selling more products pay lower wages to their workers. In other words, *ceteris paribus*, employers with a wider scope in their product portfolio are associated with a wage discount. Perhaps not surprisingly, we find that there is a size wage premium, as larger firms with a greater volume of sales pay higher wages.

Next, Table 3 presents our baseline results for the panel regressions which exploit within-firm and within-worker variation over time. All regressions in this table include worker-level time-varying control variables, municipality and occupation-sector year fixed effects, along with two-way (i.e., firm and worker) fixed effects. Coefficients for the worker-level controls are relegated to the appendix (see Appendix Table A.4). As before, across all columns, we find that the number of products of a firm is negatively associated with the wages it pays to its employees. Therefore, our empirical results strongly suggest that workers face a wage discount with respect to their firms' product scope. The coefficients are all statistically significant at the 1% level. Here, the coefficient on (log) sales is again positive, indicating a wage premium for large firms (Oi and Idson, 1999). Interestingly, we find that the coefficients on product scope and size are of a similar magnitude, particularly in the last column with the full set of firm-level controls.

Table 3: Wage Earnings and Product Scope, Panel Regressions

	Dependent variable: (log) wage earnings					
	(1)	(2)	(3)	(4)	(5)	(6)
(log) Number of products	-0.0073***	-0.0073***	-0.0109***	-0.0115***	-0.0109***	-0.0111***
	(0.0020)	(0.0020)	(0.0032)	(0.0032)	(0.0032)	(0.0033)
(log) Sales	0.0190***	0.0191***	0.0186***	0.0181***	0.0150***	0.0149***
	(0.0022)	(0.0022)	(0.0022)	(0.0022)	(0.0022)	(0.0022)
Exporter		-0.0004	-0.0002	-0.0003	-0.0005	-0.0006
		(0.0022)	(0.0022)	(0.0022)	(0.0021)	(0.0021)
Importer		-0.0014	-0.0016	-0.0014	-0.0018	-0.0018
		(0.0024)	(0.0025)	(0.0025)	(0.0024)	(0.0024)
(log) Number of establishments		-0.0004	0.0002	-0.0003	-0.0043	-0.0042
		(0.0028)	(0.0028)	(0.0028)	(0.0028)	(0.0028)
(log) Value-added per worker			0.0071**	0.0074**	0.0014	0.0016
			(0.0032)	(0.0032)	(0.0036)	(0.0036)
(log) Theil index			0.0118	0.0129	0.0126	0.0129
			(0.0088)	(0.0089)	(0.0088)	(0.0089)
Firm's share of workers within occupation				0.2522***	0.2475***	0.2439***
				(0.0244)	(0.0241)	(0.0237)
(log) Sales volatility					0.0012	0.0012
					(0.0010)	(0.0010)
(log) Assets					0.0183***	0.0183***
					(0.0025)	(0.0025)
Share of high-skilled workers						-0.0061
						(0.0175)
Share of managers						-0.0209**
						(0.0095)
Worker-level controls	Y	Y	Y	Y	Y	Y
Municipality FE	Y	Y	Y	Y	Y	Y
Occupation-sector-year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
Worker FE	Y	Y	Y	Y	Y	Y
N	2,108,948	2,108,948	2,108,948	2,108,948	2,108,948	2,108,948
R^2	0.79	0.79	0.79	0.79	0.79	0.79

Notes: Worker-level control variables include indicator variables for level of education (missing, no qualification, apprenticeship, some post-secondary, and university graduate), experience, experience squared, age, age squared, and age cubed. An occupation is defined at the ISCO-88 3-digit level, and a sector at the NACE Rev. 1 2-digit level. The constant of 1 is added to the Theil index before taking logarithms. Standard errors (in parentheses) are clustered by firm. $***$, $**$, $*$ denote significance level at 1%, 5% and 10% respectively.

Table 3 progressively includes additional regressors across columns 1 to 6. Besides firm sales, the additional explanatory variables in column 2 are indicator variables for exporting, importing, and the (log) number of establishments. All three coefficient estimates are statistically insignificant. As in Table 2, and given the set of covariates included, we do not observe any wage premia for either exporting or importing, nor do we find a wage discount associated with the number of establishments as we do with the number of products.[15]

[15] We note that the insignificant coefficient on firms' export status does not necessarily contradict findings in the literature on the exporter wage premium. As, for instance, documented in Bernard et al. (1995, 1999), exporting firms typically pay higher wages relative to non-exporting firms. However, for our sample of manufacturing firms in Denmark, we have little variation in the export status across firms, as more then 90% of workers are employed in

By definition, the wage paid to an employee is equal to the value of her marginal product of labor divided by the markdown charged by the firm. The negative relationship between wage earnings and product scope obtained thus far could potentially be explained by more traditional theories related either to productivity and/or the source of the wage markdown. For instance, if a larger product range is associated with lower firm (and worker) productivity, wages would be driven down. Moreover, the product scope may be correlated with other measures of the size of a firm, including its presence in the labor market, pushing up the markdown. Table 3 rules out such other mechanisms in explaining the negative elasticity with respect to product scope.

Consider an MPF's production as the combination of a core competence and a flexible manufacturing technology. Then, as the firm increases its product scope, the products that it adds tend to be farther away from its core competence and are characterized by higher marginal costs of production. Thus, a higher product range might be associated with lower overall firm productivity (Eckel and Neary, 2010; Mayer et al., 2014). Moreover, firm efficiency and wages have been shown to be positively linked (see, e.g., Card et al., 2018; Lochner and Schulz, 2024). Taken together, these findings suggest that a decline in the firm's productivity from an expansion of the product range may be associated with lower wages paid to its workers. In Table 3 column 3, we include two measures of productivity as controls. First, we use as a standard measure (log) value-added per worker. Second, we add the Theil index (in logarithms) of the sales distribution across the firm's product portfolio. A higher Theil index would indicate that firm sales are more skewed and more concentrated towards the core product. This would reflect a higher productivity (Arkolakis et al., 2021). However, both variables do not affect our finding for the negative association between wages and product scope, while they do confirm that more productive firms pay higher wages.

Besides product scope, a firm's size may be correlated with its labor market power and workers are therefore not paid their marginal product (see, for example, Berger et al., 2022; Yeh et al., 2022). Models of oligopsony predict that the markdown that a firm applies to its workers' wages increases with respective to its demand share in the labor market (Morlacco, 2019; Macedoni and Tyazhelnikov, 2024). In other words, large firms, which are more likely to be MPFs, could reduce wages if they account for a significant share of workers in the market, for instance, in a given occupation. Although we have included firm sales as a proxy for size, to control for this alternative

exporting (and importing) firms (see Appendix Table A.2).

channel more explicitly, we employ as a measure of labor market power the firm's share of workers in Denmark for a given 3-digit occupation and year. However, in column 4, we continue to observe that the wider a firm's product scope, the lower its workers' wage earnings. Below, we also show that similar results are obtained with alternative measures of the firm's labor demand.[16]

Yet another channel through which product scope may influence wages is the possibility for the firm to achieve diversification across product markets and become more resilient to shocks. Therefore, MPFs may offer more secure jobs compared to SPFs, and workers might accept a lower wage when working in a firm that is active in different product markets.[17] We show that there remains a negative impact of the product scope on wages beyond this effect. Specifically, in column 5, we include as regressors the (log) total assets of the firm and its sales volatility. The latter is measured by the (log) standard deviation of the growth rate of sales within a 5-year window. Lastly, column 6 includes additional controls related to the worker composition of the firm, in terms of skill (i.e., share of workers with at least some post-secondary education) and the share of managers (with 3-digit occupation codes between 100 and 200). We summarize our main finding with the following:

Empirical Result 1 *All else equal, workers face a wage discount in firms with a greater product scope.*

3.3 Robustness

We perform a series of robustness checks to corroborate our finding for the negative association between wages and product scope. First, in Table 4, we modify our baseline specification by varying the set of regressors and fixed effects and thereby show that our results are not driven by the inclusion of our choice of control variables. For ease of comparison, the baseline result from Table 3 (column 6) is included as column 8. The first two columns are regressions that only control for the differences across regions and industry-time trends. Column 3 omits worker-level characteristics and worker

[16] As a firm's labor demand share increases, its wages are shaped by two effects predicted in models of oligopsony power. First, moving up the labor supply curve results in higher wages. Second, a higher demand share reduces the elasticity of labor supply, which amplifies the wedge between wages and the marginal product of labor, potentially leading to lower wages. However, wages may still increase if the first effect outweighs the second. This dynamic is evident in Table 3, where the coefficient on the firm's share of workers within an occupation is positive and statistically significant.

[17] Comparing labor markets in European countries, Bertola (1990) provides evidence that wages tend to be lower in countries with higher job security. In Appendix Table A.5, we present evidence that firms' product scope is negatively correlated with sales volatility.

Table 4: Robustness Checks with Alternative Specifications

	Dependent variable: (log) wage earnings								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(log) Number of products	-0.0163***	-0.0139**	-0.0004	-0.0154***	-0.0169***	-0.0187***	-0.0134***	-0.0111***	-0.0104***
	(0.0034)	(0.0055)	(0.0046)	(0.0018)	(0.0019)	(0.0032)	(0.0021)	(0.0033)	(0.0031)
(log) Sales	0.0190***	0.0147***	0.0070***	0.0179***	0.0235***	0.0148***	0.0118***	0.0149***	0.0160***
	(0.0024)	(0.0036)	(0.0026)	(0.0012)	(0.0013)	(0.0024)	(0.0016)	(0.0022)	(0.0021)
Municipality FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Sector-year FE	Y	Y	Y	Y					
Occupation-sector-year FE					Y	Y	Y	Y	Y
Firm-level controls		Y	Y			Y	Y	Y	Y
Firm FE			Y					Y	
Worker-level controls				Y	Y	Y	Y	Y	Y
Worker FE							Y	Y	
Firm-worker FE									Y
N	2,108,948	2,108,948	2,108,948	2,108,948	2,108,948	2,108,948	2,108,948	2,108,948	1,970,526
R^2	0.16	0.17	0.22	0.40	0.50	0.50	0.78	0.79	0.82

Notes: Firm-level control variables include indicator variables for exporter and importer, (log) number of establishments, (log) value-added per worker, (log) Theil index, the share of workers within an occupation, (log) sales volatility, (log) assets, the share of high-skilled workers, and the share of managers. Worker-level control variables include indicator variables for level of education (missing, no qualification, apprenticeship, some post-secondary, and university graduate), experience, experience squared, age, age squared, and age cubed. An occupation is defined at the ISCO-88 3-digit level, and a sector at the NACE Rev. 1 2-digit level. Standard errors (in parentheses) are clustered by firm. $***$, $**$, $*$ denote significance level at 1%, 5% and 10% respectively.

fixed effects, and we obtain a small and statistically insignificant coefficient on product scope. These controls seem to be crucial for our main findings, and the result suggests that workers may sort into firms of differing product ranges. Moreover, comparisons of columns 2 versus 3, as well as 7 versus 8, reveal that exploiting the cross-sectional variation in product scope in addition to the within-firm variation increases the size of the coefficient magnitude and precision of the estimates. This is not surprising since adjustments to the product range do not vary substantially from year-to-year for a given firm. The average variance in product scope within a firm across years is small relative to the mean product scope. Finally, in column 9 we show that our results are also robust to the inclusion of firm-worker pair fixed effects, thus controlling for persistent differences in compensation between individuals, firms, and matches.

So far, we have defined the firm's product scope as the number of products produced and sold. However, many firms actually export products that they themselves do not produce. This is known as carry-along trade and the associated goods are the so-called "CAT" products (e.g., Bernard et al., 2019; Eckel and Riezman, 2020; Eckel et al., 2024). Table 5 investigates whether wage earnings have a similar response to these CAT products. Specifically, we distinguish between non-CAT and CAT products, in which the former refers to the same set of products that we have analyzed up to now. We might expect CAT products not to have a similar impact as non-CAT products because they are not manufactured by the firm, and workers are hence not involved in their production. The regressions may then be interpreted as a type of placebo test. Indeed, our results show that the number of CAT products does not have a statistically significant impact on workers' wages, while the effect from the number of non-CAT products remains. In columns 3 and 4, we instead include the (log) number of export destinations as a regressor. We obtain a similar finding that there is no correlation with wage earnings. Taking stock, Table 5 suggests that lower wages are paid by firms selling multiple products, and not multiple establishments, CAT products, nor export markets.

In Appendix Table A.6, we examine alternative measures of the product scope by counting instead the number of products at the 6, 4, and 2-digit levels. Given less variation in product scope when a product is defined more broadly, the coefficients are less precisely estimated, but remain statistically significant at the 5% level. Next, we consider alternative measures of firms' labor demand in Appendix Table A.7. This includes the (log) number of workers in a firm for a given

Table 5: Wage Earnings, CAT Products, and Number of Destinations

	Dependent variable: (log) wage earnings			
	(1)	(2)	(3)	(4)
(log) Number of non-CAT products		-0.0111***		-0.0111***
		(0.0033)		(0.0033)
(log) Number of CAT products	0.0004	0.0002		
	(0.0011)	(0.0011)		
(log) Number of destinations			-0.0001	0.0002
			(0.0019)	(0.0019)
(log) Sales	0.0142***	0.0149***	0.0142***	0.0149***
	(0.0022)	(0.0022)	(0.0022)	(0.0021)
Firm-level controls	Y	Y	Y	Y
Worker-level controls	Y	Y	Y	Y
Municipality FE	Y	Y	Y	Y
Occupation-sector-year FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
Worker FE	Y	Y	Y	Y
N	2,108,948	2,108,948	2,108,948	2,108,948
R^2	0.79	0.79	0.79	0.79

Notes: Firm-level control variables include indicator variables for exporter and importer, (log) number of establishments, (log) value-added per worker, (log) Theil index, the share of workers within an occupation, (log) sales volatility, (log) assets, the share of high-skilled workers, and the share of managers. Worker-level control variables include indicator variables for level of education (missing, no qualification, apprenticeship, some post-secondary, and university graduate), experience, experience squared, age, age squared, and age cubed. An occupation is defined at the ISCO-88 3-digit level, and a sector at the NACE Rev. 1 2-digit level. Standard errors (in parentheses) are clustered by firm. $***$, $**$, $*$ denote significance level at 1%, 5% and 10% respectively.

occupation-year, as well as variants of our baseline measure, namely, the firm's share of workers for a given occupation in the same industry, or same municipality, or the same industry-municipality pair. Appendix Table A.8 further establishes that our results do not depend on the particular sample period chosen. We extend the sample to include the years of the Global Financial Crisis in 2008 and 2009. We also examine the period from 2010 to 2013 with occupations classified by the ISCO-08 system, as well as include firms in the raw material extraction industries.

In Appendix Table A.9, we split the sample by the size of the firm. Given that larger firms generally employ more workers, we consider the median as well as the 75th percentile of sales amongst firms in our sample as the threshold to split the sample. The results strongly indicate that our findings for the negative relationship between the number of products and wages is driven primarily by large firms, which is in line with our previous findings from the decomposition exercise in Section 2.2. Lastly, Appendix Table A.10 examines the potential heterogeneity of various worker characteristics. In particular, we define layers of hierarchy based on a mapping of the Caliendo et al. (2020) hierarchies to ISCO-88 occupations, and split the sample between the first layer (i.e., workers) and all other layers (e.g., supervisors, managers, and senior managers). We also split the sample at the age of 40 to compare younger versus older employees, more versus less educated employees, and men versus women. In general, the differences in the coefficients of interest between the split samples are not statistically significant. However, we find some evidence that the impact of product scope on wage earnings is weaker for supervisors and managers, as well as women, who are less likely to appear in our sample of manufacturing firms.

3.4 Entry and post-entry wages

Our results thus far have indicated a robust and statistically significant negative relation between a firm's product scope and its workers' wages. This wage discount may be attributed to lower starting wages upon entering a firm with greater product scope, and/or adjustments to post-entry wages as firms change their product scopes over time. To examine each case, we split the sample between the employee's first year at a firm and all other subsequent years.

We begin with workers' entry wages in Table 6. The estimated specification remains as Eq. (3), with both firm and worker fixed effects. Therefore, workers must have started in at least two new jobs to be included in this sample. This allows us to continue to exploit the within-worker variation in product scope between different jobs (i.e., at different firms). In other words, for a given worker, we compare her entry wages between jobs, controlling for other covariates. In column 1, we find a negative relationship between product scope and entry wages at the firm. Thus, when workers enter a firm, their wages are lower in firms with a greater product range. Appendix Table A.11 shows similar qualitative findings without worker fixed effects, in which the sample also includes employees with only one new job over the sample period.

A potential concern with our estimate in Table 6 column 1 is the endogeneity of firm scope and how a firm may choose its product range. For example, the firm may make new hires with the intent of changing its product portfolio. Moreover, we cannot control for unobserved heterogeneity that is time-varying at the firm-level. We deal with such endogeneity concerns from reverse causality and omitted variable bias in two ways. First, we use the lagged product scope in column 2 as the regressor of interest. For instance, the application and hiring process take place before the job begins, and therefore, also the wage negotiations. This mitigates concerns that the firm hires low wage workers to expand the number of products in its portfolio.

Second, we employ an instrumental variable (IV) strategy to formally address endogeneity problems. Specifically, we instrument for the (log) number of products with (the logarithm of) "import demand growth", defined as:

$$\text{Import demand growth}_{ft} = \sum_{j \in \Phi_{ft}} \text{Sales share}_{jft} \sum_{i \in \phi_{jft}} \mathbf{1}\Big[\Delta\text{Nordic imports}_{it} > 0\Big].$$

Our idea is that a positive demand shock to a product should increase the likelihood that the firm produces and sells that product. Moreover, this should be especially true for products that are similar to what the firm already produces. Therefore, we want to count the number of products relevant to the firm that experiences some positive shock.

In order to isolate the demand-side effect from any potential supply-side effects, we examine the imports of comparable countries to Denmark. To this end, we use the combined imports of Sweden, Norway, and Finland (i.e., Nordic countries *excluding* Denmark) from all non-Nordic countries. We obtain data on imports from the BACI database of CEPII, which is available at the 6-digit level.[18] Thus, we first aggregate up the value of sales from the 8-digit to 6-digit level for each firm. Denote a 6-digit product by i and a 4-digit product category by j. For firm f in year t, each one of its products i belongs to some product category set ϕ_{jft}, and the set of all product categories is denoted by Φ_{ft}. Now, for product i, we define an indicator variable if the change in imports of Nordic countries excluding Denmark is positive, $\mathbf{1}\Big[\Delta\text{Nordic imports}_{it} > 0\Big]$. Then, for each product category ϕ_{jft}, we count the number of products for which Nordic import growth is positive. We take a weighted sum across all categories j to aggregate up to the firm level, with weights defined by the share of j's sales within the firm. Lagged import demand growth is computed analogously.

In columns 3 and 4, the first stage coefficient estimate on the instrument is positive and highly statistically significant. The F-statistic is large, and we can easily reject the null hypothesis that the proposed instrument is only weakly related to the endogenous variable. Importantly, we continue to find that product scope has a negative effect on the entry wages of the worker.

In Table 7, we investigate the relationship between post-entry wages and product scope. The OLS and IV methods deliver similar qualitative results. The contemporaneous product scope has

[18] The BACI database contains data on trade flows at the Harmonized System (HS) 6-digit level. The first 6 digits of the CN classification in the Danish data are equivalent to the HS classification.

Table 6: Entry Wages and Product Scope

Stage II dependent variable	(log) Entry wage earnings			
	OLS		IV	
	(1)	(2)	(3)	(4)
(log) Number of products	-0.0299**		-0.0979***	
	(0.0149)		(0.0373)	
(log) Lagged number of products		-0.0246***		-0.0464**
		(0.0095)		(0.0187)
(log) Sales	0.0122	0.0108	0.0152*	0.0107
	(0.0078)	(0.0078)	(0.0078)	(0.0078)
Stage I dependent variable:			(log) Number of products	(log) Lagged number of products
(log) Import demand growth			0.2685***	
			(0.0153)	
(log) Lagged import demand growth				0.4584***
				(0.0242)
(log) Sales			0.0341**	-0.0167
			(0.0134)	(0.0113)
Firm-level controls	Y	Y	Y	Y
Worker-level controls	Y	Y	Y	Y
Municipality FE	Y	Y	Y	Y
Occupation-sector-year FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
Worker FE	Y	Y	Y	Y
N	82,042	82,042	82,042	82,042
R^2	0.81	0.81	0.99	0.99
Kleibergen-Paap *rk* Wald *F*-statistic			307.5	357.3

Notes: The regression sample is restricted to workers in their first year at a firm. Firm-level control variables include indicator variables for exporter and importer, (log) number of establishments, (log) value-added per worker, (log) Theil index, the share of workers within an occupation, (log) sales volatility, (log) assets, the share of high-skilled workers, and the share of managers. Worker-level control variables include indicator variables for level of education (missing, no qualification, apprenticeship, some post-secondary, and university graduate), experience, experience squared, age, age squared, and age cubed. An occupation is defined at the ISCO-88 3-digit level, and a sector at the NACE Rev. 1 2-digit level. Standard errors (in parentheses) are clustered by firm. $***$, $**$, $*$ denote significance level at 1%, 5% and 10% respectively.

a negative impact on post-entry wages, statistically significant at the 5% level, while the impact of lagged product scope remains negative but is not statistically significant. Importantly, compared to Table 6, the coefficient magnitudes are all substantially smaller. For example, taking the IV estimates from columns 3 and 4, the marginal effects are roughly 7 and 12 times smaller, respectively. Hence, we can conclude that the wage discount associated with firms' product scope is primarily driven by workers' first year at a firm and their entry wages.

Empirical Result 2 *The wage discount associated with product scope is attributed mainly to lower entry wages, while post-entry wages are less sensitive to changes in firms' product scope.*

Table 7: Post-Entry Wages and Product Scope

Stage II dependent variable	(log) Post-entry wage earnings			
	OLS		IV	
	(1)	(2)	(3)	(4)
(log) Number of products	-0.0080**		-0.0145**	
	(0.0038)		(0.0071)	
(log) Lagged number of products		-0.0027		-0.0039
		(0.0021)		(0.0037)
(log) Sales	0.0174***	0.0172***	0.0176***	0.0172***
	(0.0028)	(0.0029)	(0.0029)	(0.0029)
Stage I dependent variable:			(log) Number of products	(log) Lagged number of products
(log) Import demand growth			0.2210***	
			(0.0186)	
(log) Lagged import demand growth				0.4116***
				(0.0363)
(log) Sales			0.0237*	0.0207
			(0.0136)	(0.0181)
Firm-level controls	Y	Y	Y	Y
Worker-level controls	Y	Y	Y	Y
Municipality FE	Y	Y	Y	Y
Occupation-sector-year FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
Worker FE	Y	Y	Y	Y
N	1,625,907	1,625,907	1,625,907	1,625,907
R^2	0.84	0.84	0.99	0.98
Kleibergen-Paap *rk* Wald *F*-statistic			141.7	128.4

Notes: The regression sample excludes workers in their first year at a firm. Firm-level control variables include indicator variables for exporter and importer, (log) number of establishments, (log) value-added per worker, (log) Theil index, the share of workers within an occupation, (log) sales volatility, (log) assets, the share of high-skilled workers, and the share of managers. Worker-level control variables include indicator variables for level of education (missing, no qualification, apprenticeship, some post-secondary, and university graduate), experience, experience squared, age, age squared, and age cubed. An occupation is defined at the ISCO-88 3-digit level, and a sector at the NACE Rev. 1 2-digit level. Standard errors (in parentheses) are clustered by firm. $***$, $**$, $*$ denote significance level at 1%, 5% and 10% respectively.

3.5 Wage growth and the initial product scope

We have seen that, all else equal, workers start with a lower wage when entering a firm that sells more products. What happens to their wage growth and specifically, how does this depend on their firms' product scope? For example, a wider product scope may allow workers to switch across products within the firm to achieve higher monetary compensation (even if they were to be paid lower entry wages). We examine this relationship in a last step of our empirical analysis. We modify our baseline specification and estimate:

$$\log(w_{fht}^{\tau=T}) - \log(w_{fht}^{\tau=0}) = a_1 \log(\text{Number of products}_{ft}^{\tau=0}) + b_1 \log(\text{Sales}_{ft}^{\tau=0}) + b_2 \log(\text{Tenure}_{fh}) + b_{\mathbf{X}}\mathbf{X}_{ft}^{\tau=0} + b_{\mathbf{Z}}\mathbf{Z}_{ht}^{\tau=0} + c_m + c_{ost} + c_f + c_h + e_{fht}. \quad (4)$$

We replace the dependent variable with the difference in log wages between the final year of the worker's tenure at a firm, denoted by $\tau = T$, and their initial year $\tau = 0$. To maximize the sample size, we make use of the full linked employer-employee dataset up to and including 2018 in computing workers' tenure. For all worker-firm pairs observed in our sample up to the year 2007, we then take two approaches to measure the length of their relationships. In the first approach, if the relationship is ongoing in 2018, we use 2018 as the end point to calculate the worker's tenure at her firm. In the second approach, we only select the observations for which the entire duration of the worker-firm relationship is observed; in other words, we only include worker-firm pairs with observed terminations before 2018. For example, if a firm-worker relationship ends in say 2014, this observation would be included. However, if it ends in 2018, we cannot determine whether this is a true termination or not, so this observation would be excluded. Results between the two approaches are generally similar; findings from the first approach are shown in Table 8, and the second in Appendix Table A.12.

Wages are deflated by the Danish consumer price index before taking the difference. Furthermore, in Eq. (4), the regressors are also measured in the initial year that the worker starts working at a particular firm, i.e., $\tau = 0$. This is also reflected in Table 8, with the regressor of interest labeled now as the initial number of products. Because wages tend to grow with the number of years that a worker is employed at a given firm, we also control for the worker's tenure (in logarithms). In this regression, we exploit the variation in the initial product scope at different firms for a given worker. This contrasts with the earlier Table 7, which exploited not only differences between firms, but also variation for the same employer-employee pair over time.

In Table 8 column 1, the coefficient on the initial number of products is small and statistically insignificant. As hypothesized, wages grow with tenure. In column 2, we use the lagged product scope instead, i.e., in the year prior to the initial year. The coefficient is now positive but remains statistically insignificant. Columns 3 and 4 employ the earlier IV strategy. In the first stage, we continue to find a very strong relationship between import demand growth and the number of products. In the second stage, product scope and its lag have a positive effect on wage growth, but is only statistically significant at the 10% level in column 4. Overall, the empirical evidence suggests that there is only a weak, positive relationship between product scope and wage growth

Table 8: Wage Growth and Initial Product Scope

Stage II dependent variable:	Wage growth			
	OLS		IV	
	(1)	(2)	(3)	(4)
(log) Initial number of products	-0.0121		0.0485	
	(0.0289)		(0.0755)	
(log) Lagged initial number of products		0.0156		0.0708*
		(0.0202)		(0.0389)
(log) Initial sales	-0.0044	-0.0047	-0.0073	-0.0035
	(0.0167)	(0.0167)	(0.0172)	(0.0167)
(log) Tenure	0.0982***	0.0980***	0.0980***	0.0977***
	(0.0077)	(0.0077)	(0.0077)	(0.0077)
Stage I dependent variable:			(log) Initial number of products	(log) Lagged initial number of products
(log) Import demand growth			0.2691***	
			(0.0155)	
(log) Lagged import demand growth				0.4524***
				(0.0260)
(log) Initial sales			0.0377***	-0.0319**
			(0.0144)	(0.0131)
(log) Tenure			0.0024	0.0056*
			(0.0023)	(0.0033)
Firm-level controls	Y	Y	Y	Y
Worker-level controls	Y	Y	Y	Y
Municipality FE	Y	Y	Y	Y
Occupation-sector-year FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
Worker FE	Y	Y	Y	Y
N	32,616	32,616	32,616	32,616
R^2	0.72	0.72	0.99	0.99
Kleibergen-Paap rk Wald F-statistic			301.9	303.5

Notes: Firm-level control variables include indicator variables for exporter and importer, (log) number of establishments, (log) value-added per worker, (log) Theil index, the share of workers within an occupation, (log) sales volatility, (log) assets, the share of high-skilled workers, and the share of managers. Worker-level control variables include indicator variables for level of education (missing, no qualification, apprenticeship, some post-secondary, and university graduate), experience, experience squared, age, age squared, and age cubed. Both firm-level and worker-level controls are measured in the worker's initial year in the firm. An occupation is defined at the ISCO-88 3-digit level, and a sector at the NACE Rev. 1 2-digit level. Standard errors (in parentheses) are clustered by firm. $***$, $**$, $*$ denote significance level at 1%, 5% and 10% respectively.

during the worker's tenure at a firm.[19]

Empirical Result 3 *Firms' product scope does not affect individual wage growth dynamics within firms.*

To summarize, our empirical analysis reveals a surprising inverse relationship between firms'

[19]The correlation between product scope and firm age is 0.07. Given our result for the negative elasticity on scope, this might suggest that (all else equal) wages should decline over time. However, the correlation between the initial product range and change in the number of products over workers' tenure is roughly -0.19. Hence, for workers at firms with an initial product scope that is larger, the growth in the product portfolio tends to be smaller. Thus, by Table 7, workers' wages in these firms should decline relatively less, or equivalently, increase relatively more.

product scope and worker wages, with MPFs paying systematically lower wages than their single-product counterparts, even after controlling for firm size and various fixed effects. This pattern persists across different subsets of the data and cannot be explained by traditional factors linking firm scope to productivity, labor market power, or resilience to shocks. To deepen our understanding of this phenomenon, we now turn to a theoretical framework that rationalizes our empirical findings.

4 Theory

This section develops a micro-foundation that links employers' product scope to their employees' wages. After presenting the theory and deriving theoretical results in line with the earlier empirical findings, we discuss the implications of our study for the estimation of markdowns.

4.1 Setup

Consider an economy populated by a measure H of workers, where each worker h provides one unit of labor to a firm. Firms, indexed by $f = 1, ..., F$, produce a range of I_f products. We assume that the product scope is exogenous and fixed to study its impact on wages.[20] We further assume that the firm is a price taker in the final goods markets in order to focus on the implications of scope for the labor market. Within a firm, each worker contributes labor exclusively for the production of a single product, denoted by $i = 1, ..., I_f$. In other words, workers cannot work on multiple products simultaneously.[21]

The utility of worker h when employed by firm f is:

$$u_{hf} = \gamma \ln\Big(\theta w_f + E_{I_f}[u_{hfi}] + \mu_f\Big) + \xi_{hf}. \tag{5}$$

w_f is the base wage paid by firm f to all of its workers regardless of which product they work on. The variable μ_f denotes an amenity level common to all workers of firm f, independent from the scope of the firm, which may include, e.g., overall workplace hazards and scheduling flexibility. The

[20] Alternatively, firms may choose their product scope in a prior stage of their decision-making process. The marginal cost of adding an additional product would be equated to the marginal benefit of, among other potential factors, the lower wages paid due to the firm's markdown. Thus, at stage of the hiring decisions, the costs associated with setting the product range are already sunk.

[21] In general, one could extend the model by considering labor (and other intermediates) inputs that are common for all products. What we impose and highlight in our framework is that at least some content of the work is related to a specific product, e.g., production, product development, marketing, or accounting, etc.

random variable ξ_{hf} encapsulates the individual preference of worker h to be employed by firm f, which can be influenced by factors such as proximity to the workplace. We assume that there is a continuum of workers, such that ξ_{hf} has a well-defined density function. γ and θ are positive constants, with θ functioning as a parameter that determines how dollars, in the form of wages, convert into units of utility. The functional form for utility is deliberately chosen to ensure that the collective labor supply for firm f can be represented by a generalized CES function.[22]

The term $E_{I_f}[u_{hfi}]$ represents the expected product-specific utility that worker h achieves when employed at a firm with I_f products. Once a worker is employed at a firm, there is the potential to switch to another product within the firm to achieve a higher product-specific utility, given by:

$$u_{hfi} = \theta b_{hfi} + a_{hfi}. \tag{6}$$

Here, b_{hfi} denotes the wage benefit or "bonus" for worker h involved in the production of product i. This bonus is a random variable and the worker does not have prior knowledge about which product will yield the highest bonus. The unconditional expected value of b_{hfi} is denoted $E[b_{hfi}]$ (i.e., this is independent of the scope), and without loss of generality, we normalize it to be zero, $E[b_{hfi}] = 0$. While this implies that the bonus may take negative values, the normalization has no bearing on the theoretical results. Meanwhile, a_{hfi} is also a random variable that represents the level of product-specific amenity associated with worker h for product i. This is the unique value that worker h attributes to working in product line i and captures factors related to, for instance, interpersonal relations with the manager or coworkers in her team and preferences towards certain products. We also assume that the unconditional expected value of this variable is zero, $E[a_{hfi}] = 0$. The distributions of the two random variables b_{hfi} and a_{hfi} are common across workers within a firm and, without loss of generality, we assume that they are common across firms. Finally, we assume that switching to another product involves a switching cost denoted by c, which for simplicity is

[22] An alternative specification for utility could be $u_{hf} = E_{I_f}\left[\ln(\theta w_f + u_{hfi} + \mu_f)^\gamma\right] + \xi_{hf}$. While this yields similar results qualitatively, it tends to be less analytically tractable. In a standard IO framework of discrete choice, utility is often assumed to be linear, represented as $u_{hf} = \theta w_f + E_{I_f}[u_{hfi}] + \mu_f + \xi_{hf}$. We deviate from this approach for two primary reasons. First, such a formulation produces a constant labor supply elasticity in the presence of monopsonistic competition, implying that wage markdowns remain constant across firms. Second, when oligopolistic competition is present, the effect of the scope of a firm on the markdown is entirely regulated by the labor demand share of workers by firm f. Our empirical analysis, however, contradicts this result as we found a persistent negative effect on wages due to firm scope, even when controlling for the firm's labor demand share.

constant across firms.[23] This term captures the costs associated with changing product lines within a firm (e.g., moving offices, learning product-specific tasks, etc.).

The timing of the model is as follows. Firms maximize their profits and offer a base wage w_f, given a firm-specific labor supply and the number of products they produce. Given the firms' wages and amenities, workers choose the firm where they wish to allocate their labor. Once employed, workers have the flexibility to switch between different products within the same firm. We solve the model backwards, starting from the analysis of a worker's decision to switch products within a firm. This step allows us to determine how the firm's product scope affects the worker's expected product-specific utility. We then derive the labor supply by solving the discrete choice problem of workers. Finally, we find the equilibrium wages by maximizing firms' profits.

4.2 Stay or switch?

In this section, we explore the decision-making process of a worker when considering switching to a different product line within the same firm. For simplicity, the discount rate is assumed to be zero. Because our goal is to understand how the multiproduct nature of a given firm influences the wages that it pays, we focus solely on switches within the firm and rule out switches across firms by assuming a prohibitive cost of changing employers. As in Papageorgiou (2018), the decision to switch is made by the employee (as opposed to a joint decision between the employer and employee).

Let $E[u_{hfi}]$ denote the unconditional expected utility of switching from v to another product i. Note that this contrasts with $E_{I_f}[u_{hfi}]$, the expected product-specific utility that worker h achieves when employed at a firm with I_f products, considering all possible switches. Consider a worker h working on product v. Taking the expected value of Eq. (6) and incorporating the normalizations previously introduced (i.e., $E[b_{hfi}] = E[a_{hfi}] = 0$), $E[u_{hfi}]$ is equal to zero:

$$E[u_{hfi}] = \theta E[b_{hfi}] + E[a_{hfi}] = 0. \tag{7}$$

Thus, worker h opts to remain with product v if $u_{hfv} > E[u_{hfi}] - c$, or equivalently:

$$\theta b_{hfv} + a_{hfv} > -c. \tag{8}$$

[23] The model can be readily extended to incorporate firm-specific switching costs. In this extension, firms with lower switching costs, holding the scope constant, have higher markdowns.

In essence, the worker decides to stay if the sum of the product-specific bonus and amenity exceeds the anticipated utility if they were to switch to another product line (normalized to zero) minus the switching cost c.

Eq. (8) holds for any product, including product i. Rewriting this equation from the perspective of a worker in product line i, we can further define p as the probability that she stays in the current product as:

$$p = \text{Prob}(u_{hfi} > -c) = \text{Prob}(\theta b_{hfi} + a_{hfi} > -c). \tag{9}$$

Given our assumptions about the right-hand side (i.e., the distributions of b_{hfi} and a_{hfi} and switching costs c are common across firms), p is naturally also the same in all firms. Heterogeneity can be introduced by relaxing any one of the assumptions. Furthermore, this formulation is flexible and can accommodate both a discrete distribution for the two random variables or a continuous distribution. Next, we denote with $\bar{u}$ the expected value of u_{hfi} conditional on $u_{hfi} > c$, i.e.,

$$\bar{u} = E\big[u_{hfi} \big| u_{hfi} > -c\big]. \tag{10}$$

Therefore, if a firm produces multiple products, a worker will receive the expected utility $\bar{u}$ with a probability of p. Conversely, with probability $1 - p$, the worker decides to switch. Upon switching to the next product line, the worker is faced with the same decision to either stay (with probability p) or switch again, given that there are remaining product lines to switch to.

4.3 Scope-driven firm-level amenity

Consider the expected product-specific utility that worker h gains from firm f producing I_f products, represented by $E_{I_f}[u_{hfi}]$. Beginning with a single-product firm, i.e., $I_f = 1$, the worker does not have the option to switch product lines. Thus, the expected product-specific utility is determined by Eq. (7), and is equal to zero:

$$E_1[u_{hfi}] = E[u_{hfi}] = 0.$$

Next, for an MPF with two products ($I_f = 2$), the worker first receives $\bar{u}$ with probability p, and with probability $1 - p$ they switch products. When switching, the worker expects to receive an average level of bonus and amenity (which we have established is equal to zero) and pays the switching cost. The expected utility in this case is:

$$E_2[u_{hfi}] = p\bar{u} - (1-p)c.$$

It is straightforward to show that $E_2[u_{hfi}]$ is positive, which implies that $p\bar{u} > (1-p)c$.[24]

If a firm has three products ($I_f = 3$), the worker initially gains $\bar{u}$ with probability p and opts to switch with probability $1-p$. Upon switching to the second product, the same probabilities apply, meaning that with probability p, the worker gains $\bar{u}$, and with probability $1-p$, she decides to switch again. When switching to the final product, the worker anticipates obtaining the expected level of bonus and amenities (which equals zero). Moreover, for every switch, the worker pays the switching cost c. Therefore, the expected utility for a worker at a firm with three products is:

$$E_3[u_{hfi}] = p\bar{u} + (1-p)p\bar{u} - (1-p)c - (1-p)^2 c.$$

Generalizing to the case of any $I_f > 1$ gives:

$$E_{I_f}[u_{hfi}] = p\bar{u}\sum_{j=0}^{I_f-2}(1-p)^j - c\sum_{j=1}^{I_f-1}(1-p)^j = \left(\bar{u} - c\left(\frac{1-p}{p}\right)\right)\left(1-(1-p)^{I_f-1}\right), \qquad (11)$$

which is again positive since $p\bar{u} > (1-p)c$. Eq. (11) represents our first key result, which we summarize in the following proposition:

Proposition 1 *The expected utility of a worker in a firm increases with the firm's product scope.*

The mathematical derivation is provided in Theoretical Appendix B.1. This proposition indicates that the opportunity for a worker to switch products can be beneficial, especially in the case of an unfavorable match. The potential for such improvements is solely constrained by the number of products that the firm offers.[25]

[24] In fact, if the worker decides to stay, with probability p she obtains $\bar{u}$, while with probability $1-p$ she obtains $\underline{u}_f = E[\theta b_{hfi} + a_{hfi} | \theta b_{hfi} + a_{hfi} < -c]$, which is lower than $-c$ by definition. Since our normalization implies that $p\bar{u} + (1-p)\underline{u}_f = 0$, and $\underline{u}_f < -c$, then $p\bar{u} - (1-p)c > 0$.

[25] Although our empirical analysis rules out job security in MPFs (proxied by lower sales volatility) as the driver of our stylized fact, our model offers some intuition for this channel. A negative shock to a product, which might result in lower bonuses or even job termination in a SPF, can be mitigated by switching to another product line. Whether the negative shock can be absorbed by other product lines is complicated by the degree of labor market rigidities and the correlation of shocks across products within the MPF. These extensions are, however, outside the scope of the current paper.

To summarize, the expected product-specific utility from firm f is given by:

$$E_{I_f}[u_{hfi}] = \begin{cases} 0 & \text{if } I_f = 1 \\ \left(\bar{u} - c\left(\frac{1-p}{p}\right)\right)\left(1 - (1-p)^{I_f - 1}\right) & \text{if } I_f > 1. \end{cases} \tag{12}$$

Note that both the possibility of attaining a higher amenity *and* a higher bonus contribute to a higher value of $E_{I_f}[u_{hfi}]$.

4.4 Labor supply, labor demand, and wages

To derive labor supply, consider the preferences of a worker choosing between two firms. A worker prefers firm f over firm k if $u_{hf} > u_{kf}$, or equivalently:

$$\gamma \ln\Big(\theta w_f + \underbrace{E_{I_f}[u_{hfi}] + \mu_f}_{A_{I_f}}\Big) + \xi_{fh} > \gamma \ln\Big(\theta w_k + \underbrace{E_{I_k}[u_{hki}] + \mu_k}_{A_{I_k}}\Big) + \xi_{kh}. \tag{13}$$

Here, A_{I_f} encapsulates all the amenities provided by firm f, including its scope.

Assuming that ξ_{fh} are independently and identically distributed (i.i.d.) random variables drawn from a Type I extreme value distribution, we derive the firm-specific labor supply as:

$$s_f = \frac{\exp\Big(\gamma \ln(\theta w_f + A_{I_f})\Big)}{\sum_{k=1}^{F} \exp\Big(\gamma \ln(\theta w_k + A_{I_k})\Big)} = \frac{\left(\theta w_f + A_{I_f}\right)^{\gamma}}{\sum_{k=1}^{F} \left(\theta w_k + A_{I_k}\right)^{\gamma}}, \tag{14}$$

where s_f is the share of workers employed at firm f.

The firm's problem. Suppose that each worker hired produces φ_f units of output for any product i of firm f. Then, the profitability of all products within a firm is identical and we can treat them equally in the firm's maximization problem.[26] Given these conditions, firm profits are:

$$\pi_f = (\varphi_f - w_f) s_f H. \tag{15}$$

[26]For simplicity, we abstract from differences in efficiency across products, which could arise from factors such as core competencies and flexible manufacturing. Our empirical analysis ruled out these factors (proxied by the Theil index of sales concentration within a firm) as explanations for the wage discount in MPFs. Nonetheless, our model can accommodate differences in efficiency across products through heterogeneity in the ex-post realizations of bonus shocks. However, a key assumption of our model is that workers are unaware of which products are most productive. If workers could identify and prefer switching to higher-productivity products, the model would lose tractability, as it would have to account for product-specific wages and markdowns (i.e., due to a product-specific labor supply curve). Furthermore, these variables are not measured in the available datasets.

Here, $s_f H$ equals the number of workers employed at firm f.[27] Firms compete in labor markets à la Bertrand. The first-order condition of the firm's problem with respect to w_f provides the implicit labor demand function (see Theoretical Appendix B.2):

$$\frac{\partial \pi_f}{\partial w_f} = -s_f + (\varphi_f - w_f)\frac{\partial s_f}{\partial w_f} = 0. \tag{16}$$

Defining the labor supply elasticity of firm f as $\epsilon_f = \frac{\partial s_f}{\partial w_f}\frac{w_f}{s_f}$ allows us to rewrite the first-order condition as follows:

$$w_f = \frac{\epsilon_f}{\epsilon_f + 1}\varphi_f = \frac{\varphi_f}{\psi_f}, \tag{17}$$

which implies that the wage of firm f depends on two variables: the marginal revenue product of labor (φ_f) and elasticity of labor supply to firm f (ϵ_f). As firms have market power in the labor market, wages are set as a markdown $\psi_f = \frac{\epsilon_f + 1}{\epsilon_f}$ on the marginal product of labor. Notably, in our setting, the markdown ψ_f is endogenous, as the labor supply elasticity is not constant. The latter can be computed as:

$$\epsilon_f = \frac{\theta\gamma\varphi_f(1 - s_f) - A_{I_f}}{\theta\varphi_f + A_{I_f}}. \tag{18}$$

Using Eq. (18), we derive the markdown as:

$$\psi_f = \frac{1 + \gamma(1 - s_f)}{\gamma(1 - s_f) - \dfrac{A_{I_f}}{\theta\varphi_f}}, \tag{19}$$

which depends, among other factors, on the level of the amenity A_{I_f}. This relationship leads us to our second key finding, which we summarize in the following proposition:[28]

Proposition 2 *A higher amenity A_{I_f} reduces the labor supply elasticity ϵ_f and hence, firms increase the markdown ψ_f by exploiting their market power on workers.*

[27] Because $s_f H$ is the total number of workers at the firm, and not the number of workers per product, the scope does not directly appear in the profit function. In fact, the number of workers per product is $s_f H/I_f$. Hence, the profits of the firm can be written as $\pi_f = I_f(\varphi_f - w_f)s_f H/I_f$.

[28] Proposition 2 is stated with the implicit condition that s_f is held fixed. This is consistent with our empirical specifications which included proxies for firm size. If s_f also responds to I_f, then the effect on the markdown is amplified through this secondary channel as the firm obtains even more oligopsony power. The detailed analytical results can be found in Theoretical Appendix B.3.

4.5 Product scope, wages, and labor shares

Base wage. We can now examine how product scope affects wages and relate the theory to our empirical findings. Combining Eqs. (17) and (18), the base wage of firm f paid across all workers is:

$$w_f = \frac{\gamma\varphi_f(1-s_f)}{1+\gamma(1-s_f)} - \frac{A_{I_f}}{\theta\big(1+\gamma(1-s_f)\big)}. \tag{20}$$

This equation reveals that the base wage increases with firm productivity (φ_f) and decreases with firm market power in the labor market (as represented by s_f). Importantly, the wage decreases with the level of amenity (A_{I_f}), which is in turn positively related to the scope of the firm I_f (see Eq. (13)). This relationship leads us to our third key finding, which we summarize in the following proposition:

Proposition 3 *The base wage decreases with the firm's product scope.*

This theoretical finding provides a rationale for both Empirical Results 1 and 2, i.e., a product-scope wage discount that is attributed primarily to lower entry wages. Workers are willing to accept a lower entry wage in MPFs in exchange for the opportunity to switch to products with potentially better amenities or bigger bonuses. We refer to this channel as the *monopsony power effect*. While Empirical Result 1 (i.e., Table 3) refers to the average wage at a firm, it is by construction a function of workers' entry wages. Hence, the monopsony power effect also explains why the average wage is driven down at MPFs.

A wider product scope may suppress base wages, but it also presents workers the chance to draw higher bonuses, raising the average wage at a firm.[29] Thus, we must examine Empirical Result 1 more closely. In particular, the average wage combines the base wage set by firm and the expected product-specific bonus:

$$E_{I_f}[w_{hf}] = w_f + E_{I_f}[b_{hfi}]. \tag{21}$$

The latter term $E_{I_f}[b_{hfi}]$ represents the expected bonus a worker could receive from working at a

[29] To simplify the analysis, bonuses are excluded from the firm's problem. This simplification can be justified by assuming that bonuses are tied to a product-worker-specific productivity shock, which is entirely passed on to the worker without any markdowns. We adopt this assumption to maintain tractability while preserving the model's key insights. The bonus in our model serves two purposes: first, to align our framework with the model by Papageorgiou (2018), where workers increase their wages by switching tasks, and second, to demonstrate that even with product-specific bonuses, initial wages remain lower in MPFs.

firm with scope I_f:

$$E_{I_f}[b_{hfi}] = \begin{cases} 0 & \text{if } I_f = 1 \\ E_{I_f}\left[b_{hfi} \middle| \theta b_{hfi} + a_{hfi} > -c\right]\left(1 - (1-p)^{I_f - 1}\right) & \text{if } I_f > 1 \end{cases} \tag{22}$$

In the case where a firm only offers one product ($I_f = 1$), the expected bonus is zero. For MPFs ($I_f > 1$), the expected bonus is determined by the expected value of the bonus conditional on a positive overall benefit (bonus and amenity), scaled by the likelihood probability of obtaining a positive overall benefit by switching across products. Depending on the distributions of the amenity and the bonus, the conditional expectation $E_{I_f}\left[b_{hfi} \middle| \theta b_{hfi} + a_{hfi} > -c\right]$ can be either positive or negative. Consequently, the expected bonus may increase or decrease with the scope. In the extreme case where the distribution of a_{hfi} collapses to a single point (i.e., to its average of zero), the conditional expectation simplifies to $E_{I_f}\left[b_{hfi} \middle| \theta b_{hfi} > -c\right]$, which is strictly positive and implies that the expected bonus increases with scope. We refer to this second channel as the *bonus accumulation effect*: the possibility of product switching can lead to higher average wages in the long run. As workers switch products, they are more likely to land on a product line that offers a higher bonus. Consequently, their wages may increase over time, which in turn boosts the average wage in the firm in the steady state. Wage growth resulting from better matches is a channel that is also present in the model of Papageorgiou (2018). However, as we discuss below, the data does not support the presence of this channel.

Wage growth. The prospect of product switching creates a dynamic trade-off in the labor market. Initially, because of the monopsony power effect, it can lead to lower base wages. However, over time, it can elevate average wages due to the bonus accumulation effect. Empirically, we find that the former channel dominates the latter, as there is a negative relationship between firms' scope and average wages (i.e., Empirical Result 1).

This leads to a natural question about the relevance of the bonus accumulation effect and how Empirical Result 3 can be explained in the context of our model. The total wage of worker h assigned to a specific product i is determined by $w_{hfi} = w_f + b_{hfi}$. This wage comprises of two components: the base wage w_f set by the firm and a product-specific bonus b_{hfi}. Again, workers switch products for the chance to obtain either a higher bonus b_{hfi}, higher amenity a_{hfi}, or both. Hence, there are potential monetary and non-monetary benefits associated with each product. On the one hand, if the primary incentive for workers to switch products is the prospect of a bigger bonus and thus, a higher overall wage w_{hfi}, then we should observe a positive relationship between wage growth and product scope. A wider product scope presents more opportunities for switching to promote wage growth. On the other hand, if workers are motivated to switch product lines for non-pecuniary benefits a_{hfi}, then we would not observe any link between wage growth and firm scope. Indeed, we find in Empirical Result 3 that there is little connection between workers' wage growth and firm scope. This implies that workers are drawn to the non-monetary amenities that different products may offer (e.g., relations with coworkers in the production team, job satisfaction). It further suggests that changes in productivity from switches (through the bonus) have less of an impact on worker compensation quantitatively compared to the different levels of amenities achieved.

Labor share. In Figure 1 and the subsequent discussion in Section 2.2, we demonstrated that the fall in the labor share of large MPFs contributes significantly to the decline in the overall labor share in Denmark. MPFs have a lower labor share compared to SPFs (even when they are of a similar size), and their product scopes have, on average, further expanded over the sample period. In a final step of our theoretical analysis, we investigate the relationship between the product scope and labor share at the firm-level. For simplicity, and in line with Empirical Result 3, let us assume that the expected bonus at a firm with I_f products is zero.[30] The labor share is defined as the ratio of labor income to firm revenues:

$$\text{Labor Share} = \frac{\text{Labor Income}}{\text{Revenues}} = \frac{w_f s_f H}{\varphi_f s_f H} = \frac{w_f}{\varphi_f} = \frac{\epsilon_f}{\epsilon_f + 1} = \frac{1}{\psi_f}. \tag{23}$$

Thus, in our framework, the labor share corresponds to the inverse of the markdown ψ_f introduced above. Referring to the analysis following Eq. (17), we conclude that an increase in the product scope and the implied increase in the level of amenity are associated with a lower labor share at the level of the firm (i.e., due to a higher markdown ψ_f). Analytical details for this result are provided in Theoretical Appendix B.3.

[30]Theoretical Appendix B.3 provides a general formula for the labor share.

Proposition 4 *An increase in the number of products induces a fall in the labor share at the firm level.*

4.6 Implications for markdown estimation

Our model provides a micro-foundation linking employers' product scope to their employees' wages, and we have demonstrated how its results can rationalize our empirical findings from Section 3. As this is the aim of our theory, we leave it to future studies to integrate our novel micro-foundation into more complex models with, for example, endogenous product scope, or a general equilibrium framework.

What we want to emphasize here is that our empirical and theoretical findings have significant implications for research in industrial organization, particularly in the efforts of estimating labor markdowns. Similar to the standard approach used in markup estimation, the prevailing models in markdown estimation rely on first estimating a production function, which then allows the wedge between the supply elasticity of an input and its cost share to be computed. Under perfect competition, these two measures align; however, the presence of markups and markdowns creates a discrepancy between them. To estimate markdowns, most studies rely on a relative measure, computing the ratio between the wedge for labor and that for materials.

This method, while common, is not without its limitations. For instance, Mertens (2022, 2023) demonstrate that markdowns estimated using this approach can be observationally equivalent to adjustment frictions, such as costs related to training or union coordination. Furthermore, Rubens et al. (2024) argue that wage markdowns and labor-augmenting productivity are not separately identifiable. Many of these challenges are being actively addressed. However, while recent literature has incorporated MPFs into production function estimation to better estimate markups (De Loecker et al., 2016; Dhyne et al., 2022; Orr et al., 2024), similar advances have not been made for markdown estimation.[31] Our empirical and theoretical results highlight the importance of considering the multiproduct nature of firms in this context. Additionally, our findings on entry wages suggest that labor markdowns may be worker, or at least cohort, specific, varying based on the seniority of the worker. Exploring these directions in future research has the potential to understand wage setting

[31] It is important to note that markdowns are estimated at the firm level; therefore, analyzing the correlation between markdowns and the number of products using the existing approaches does not allow for the control of worker characteristics.

and markdowns at more granular level.

5 Conclusion

MPFs play a dominant role both in product and labor markets. In this paper, we draw a link between the two markets by studying the relationship between firms' product scope and the wages paid to workers. Our empirical analysis relies on detailed administrative data from Denmark, and we control for firm and worker unobserved heterogeneity through two-way fixed effects. While our results indicate a firm-size wage premium consistent with prior literature, we also obtain a novel, robust finding for a product-scope wage discount.

To rationalize these findings, we introduce a discrete choice model with internal job mobility. We demonstrate theoretically that MPFs leverage their broader scope to exercise greater monopsony power, offering workers lower wages due to the higher expected utility from the possibility of product switching. Our findings underscore the importance of considering firm scope when analyzing labor market dynamics and monopsony power, providing new insights into how MPFs shape wage structures and contribute to the aggregate trends in the labor share.

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Online Appendix

Wage Setting in Multiproduct Firms

Jackie M.L. Chan, Michael Irlacher, Michael Koch, and Luca Macedoni

A Empirical Appendix

Figure A.1: **Labor share of all manufacturing firms.** This figure plots the evolution of the labor share for all manufacturing firms, including those without product information from *VARS*.

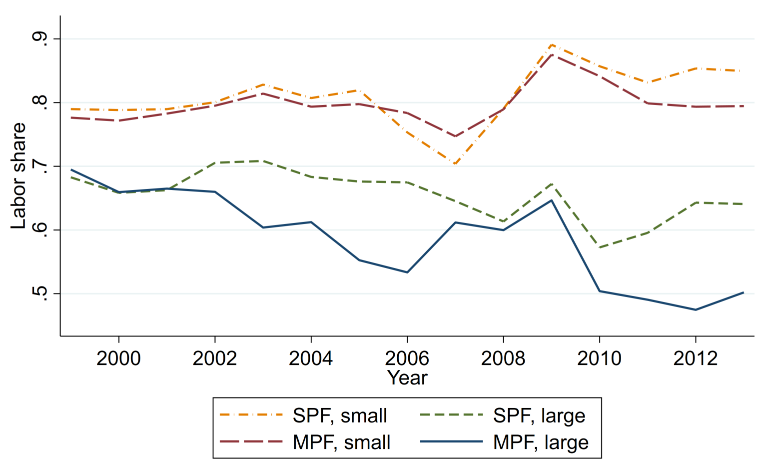

Figure A.2: **Labor share of SPFs and MPFs.** This figure plots the evolution of the labor share for small SPFs, large SPFs, small MPFs, and large MPFs. Small and large firms are defined by sales below and above the annual median separately among SPFs and MPFs, respectively.

Table A.1: Most Common Employee Complaints (European Company Survey)

		Share of responses (%)		
		Often	Seldom	Never
1	Discontent related to pay levels or pay systems	37.4	32.8	29.9
2	Bad social climate in teams, working groups or departments	16.1	39.5	44.5
3	Discontent with career development possibilities	15.4	32.5	52.1
4	Discontent regarding the discretion about when to work or take time off in flexible working time systems	10.4	40.3	49.3
5	Increased overtime without much consultation	9.9	25.2	64.9
6	Discontent with the Health and Safety situation	9.4	36.6	54.1
7	Too much weekend work	9.0	23.6	67.4
8	Rejected requests for further education or training	6.8	28.7	64.5
9	Night or shift workers desiring but not getting a day job	4.4	20.8	74.8
10	Full-time workers desiring but not getting a part-time job	3.1	18.3	78.6

Notes: The source of the data is the European Company Survey in 2009. The interview question asked to the employee representative is: "Looking to the individual complaints the employee representation has been dealing with in the establishment the last 12 months, have the following issues been raised?" Shares are computed taking into account the weighting factors.

Table A.2: Summary Statistics of Sample, All Variables

Firm-level variables	Mean	SD
(log) Number of products - 8-digit level	1.381	1.285
(log) Number of products - 6-digit level	1.234	1.184
(log) Number of products - 4-digit level	0.961	1.037
(log) Number of products - 2-digit level	0.620	0.749
(log) Sales	12.51	1.983
Indicator: Exporter	0.916	0.278
Indicator: Importer	0.920	0.272
(log) Number of establishments	0.905	1.065
(log) Value-added per worker	13.10	0.462
(log) Theil Index	0.383	0.346
Firm's share of workers within 3-digit occupation	0.022	0.061
(log) Sales volatility	-2.025	0.803
(log) Assets	19.59	2.112
Share of high-skilled workers	0.198	0.148
Share of managers	0.242	0.193

Worker-level variables	Mean	SD
(log) Wage earnings	12.51	0.437
Age	41.08	10.66
Age^2	1801	890.6
Age^3	83.37	59.29
Indicator: Female	0.312	0.463
Indicator: Missing education	0.013	0.113
Indicator: No qualification	0.311	0.463
Indicator: Apprenticeship	0.454	0.498
Indicator: Some post-secondary education	0.022	0.148
Indicator: University education	0.200	0.400
Work experience	14.88	6.688
Work $experience^2$	2.663	1.948

Notes: The table reports summary statistics for our sample over the years 1996-2007. N = 2,108,948. High-skilled workers are workers with a university degree. Managers are workers with 3-digit occupation codes between 100 and 200. Age^3 is divided by 1000 and work $experience^2$ is divided by 100.

Table A.3: Wage Earnings and Product Scope, Cross-sectional Regressions– All Regressors

	Dependent variable: (log) wage earnings					
Year	1997		2002		2007	
	(1)	(2)	(3)	(4)	(5)	(6)
(log) Number of products	-0.0198***	-0.0186***	-0.0103**	-0.0124***	-0.0133***	-0.0126***
	(0.0035)	(0.0027)	(0.0042)	(0.0028)	(0.0039)	(0.0029)
(log) Sales	0.0300***	0.0250***	0.0253***	0.0239***	0.0221***	0.0209***
	(0.0023)	(0.0018)	(0.0026)	(0.0021)	(0.0023)	(0.0021)
Exporter		0.0062		0.0036		-0.0118
		(0.0068)		(0.0096)		(0.0098)
Importer		-0.0122*		-0.0033		0.0073
		(0.0069)		(0.0085)		(0.0086)
(log) Number of establishments		0.0002		-0.0036		0.0019
		(0.0032)		(0.0041)		(0.0041)
Female		-0.1789***		-0.1831***		-0.1767***
		(0.0058)		(0.0062)		(0.0063)
Age		0.0386***		0.0967***		0.0997***
		(0.0056)		(0.0053)		(0.0047)
Age^2		-0.0009***		-0.0023***		-0.0022***
		(0.0001)		(0.0001)		(0.0001)
Age^3		0.0071***		0.0167***		0.0152***
		(0.0010)		(0.0009)		(0.0008)
Education: no qualification		-0.0537***		-0.0319***		-0.0303***
		(0.0093)		(0.0077)		(0.0106)
Education: apprenticeship		-0.0043		0.0077		0.0031
		(0.0095)		(0.0083)		(0.0110)
Education: some post-secondary		-0.0219*		0.0048		-0.0020
		(0.0120)		(0.0096)		(0.0117)
Education: university graduate		0.1268***		0.1237***		0.1121***
		(0.0129)		(0.0097)		(0.0127)
Experience		0.0903***		0.0488***		0.0334***
		(0.0017)		(0.0014)		(0.0012)
$Experience^2$		-0.2800***		-0.1140***		-0.0625***
		(0.0070)		(0.0042)		(0.0028)
Worker-level controls	Y	Y	Y	Y	Y	Y
Municipality FE	Y	Y	Y	Y	Y	Y
Occupation-sector FE	Y	Y	Y	Y	Y	Y
N	218,987	218,987	226,894	226,894	170,355	170,355
R^2	0.30	0.48	0.32	0.46	0.33	0.46

Notes: The indicator variable for missing education is omitted as the base category. An occupation is defined at the ISCO-88 3-digit level, and a sector at the NACE Rev. 1 2-digit level. The constant of 1 is added to the Theil index before taking logarithms. Standard errors (in parentheses) are clustered by firm. $***$, $**$, $*$ denote significance level at 1%, 5% and 10% respectively.

Table A.4: Wage Earnings and Product Scope– All Regressors

	Dependent variable: (log) wage earnings					
	(1)	(2)	(3)	(4)	(5)	(6)
(log) Number of products	-0.0073***	-0.0073***	-0.0109***	-0.0115***	-0.0109***	-0.0111***
	(0.0020)	(0.0020)	(0.0032)	(0.0032)	(0.0032)	(0.0033)
(log) Sales	0.0190***	0.0191***	0.0186***	0.0181***	0.0150***	0.0149***
	(0.0022)	(0.0022)	(0.0022)	(0.0022)	(0.0022)	(0.0022)
Exporter		-0.0004	-0.0002	-0.0003	-0.0005	-0.0006
		(0.0022)	(0.0022)	(0.0022)	(0.0021)	(0.0021)
Importer		-0.0014	-0.0016	-0.0014	-0.0018	-0.0018
		(0.0024)	(0.0025)	(0.0025)	(0.0024)	(0.0024)
(log) Number of establishments		-0.0004	0.0002	-0.0003	-0.0043	-0.0042
		(0.0028)	(0.0028)	(0.0028)	(0.0028)	(0.0028)
(log) Value-added per worker			0.0071**	0.0074**	0.0014	0.0016
			(0.0032)	(0.0032)	(0.0036)	(0.0036)
(log) Theil index			0.0118	0.0129	0.0126	0.0129
			(0.0088)	(0.0089)	(0.0088)	(0.0089)
Firm's share of workers within occupation				0.2522***	0.2475***	0.2439***
				(0.0244)	(0.0241)	(0.0237)
(log) Sales volatility					0.0012	0.0012
					(0.0010)	(0.0010)
(log) Assets					0.0183***	0.0183***
					(0.0025)	(0.0025)
Share of high-skilled employees						-0.0061
						(0.0175)
Share of managers						-0.0209**
						(0.0095)
Age^2	-0.0015***	-0.0015***	-0.0015***	-0.0015***	-0.0015***	-0.0015***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Age^3	0.0097***	0.0097***	0.0097***	0.0097***	0.0097***	0.0097***
	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)	(0.0006)
Education: no qualification	-0.0836***	-0.0836***	-0.0836***	-0.0835***	-0.0831***	-0.0830***
	(0.0154)	(0.0154)	(0.0154)	(0.0154)	(0.0154)	(0.0154)
Education: apprenticeship	0.2204***	0.2204***	0.2203***	0.2204***	0.2209***	0.2209***
	(0.0192)	(0.0192)	(0.0192)	(0.0192)	(0.0192)	(0.0192)
Education: some post-secondary	-0.0766***	-0.0766***	-0.0767***	-0.0768***	-0.0767***	-0.0767***
	(0.0232)	(0.0232)	(0.0232)	(0.0232)	(0.0232)	(0.0232)
Education: university graduate	0.3624***	0.3624***	0.3624***	0.3624***	0.3627***	0.3628***
	(0.0195)	(0.0195)	(0.0195)	(0.0194)	(0.0194)	(0.0194)
Experience	0.0754***	0.0754***	0.0754***	0.0754***	0.0753***	0.0753***
	(0.0042)	(0.0042)	(0.0042)	(0.0042)	(0.0042)	(0.0042)
$Experience^2$	-0.1141***	-0.1141***	-0.1141***	-0.1140***	-0.1138***	-0.1137***
	(0.0024)	(0.0024)	(0.0024)	(0.0024)	(0.0024)	(0.0024)
Municipality FE	Y	Y	Y	Y	Y	Y
Occupation-sector-year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
Worker FE	Y	Y	Y	Y	Y	Y
N	2,108,948	2,108,948	2,108,948	2,108,948	2,108,948	2,108,948
R^2	0.79	0.79	0.79	0.79	0.79	0.79

Notes: The indicator variable for missing education is omitted as the base category. Note that the level of *Age* is absorbed by worker fixed effects. An occupation is defined at the ISCO-88 3-digit level, and a sector at the NACE Rev. 1 2-digit level. The constant of 1 is added to the Theil index before taking logarithms. Standard errors (in parentheses) are clustered by firm. $***$, $**$, $*$ denote significance level at 1%, 5% and 10% respectively.

Table A.5: Sales Volatility and Product Scope

	Dependent variable: (log) Sales volatility			
	(1)	(2)	(3)	(4)
(log) Number of products	-0.0602***	-0.0538***	-0.0498**	-0.0503**
	(0.0211)	(0.0189)	(0.0231)	(0.0222)
(log) Sales	-0.0653***	-0.0276**	-0.0717***	-0.0719***
	(0.0100)	(0.0118)	(0.0154)	(0.0160)
Exporter	-0.0483**	-0.0411	0.0069	0.0070
	(0.0216)	(0.0270)	(0.0196)	(0.0199)
Importer	0.0295	0.0314	0.0008	0.0005
	(0.0174)	(0.0204)	(0.0131)	(0.0132)
(log) Number of establishments	-0.0542***	-0.0183	0.0215	0.0212
	(0.0145)	(0.0181)	(0.0321)	(0.0340)
(log) Value-added per worker	-0.0352	-0.0282	-0.0295	-0.0313
	(0.0212)	(0.0214)	(0.0208)	(0.0192)
(log) Theil index	0.0874	0.0885*	0.1366***	0.1383***
	(0.0556)	(0.0510)	(0.0421)	(0.0410)
(log) Assets		-0.0736***		0.0036
		(0.0149)		(0.0170)
Share of high-skilled workers		0.6549***		0.1923
		(0.1663)		(0.1665)
Share of managers		-0.0403		-0.0120
		(0.0388)		(0.0234)
Sector-year FE	Y	Y	Y	Y
Firm FE			Y	Y
N	34,666	34,666	34,666	34,666
R^2	0.06	0.07	0.58	0.58

Notes: A sector is defined at the NACE Rev. 1 2-digit level. Standard errors (in parentheses) are clustered by sector. $***$, $**$, $*$ denote significance level at 1%, 5% and 10% respectively.

Table A.6: Robustness Checks with Alternative Definitions of Products

Product definition	HS 6-digit		HS 4-digit		HS 2-digit	
	Dependent variable: (log) wage earnings					
	(1)	(2)	(3)	(4)	(5)	(6)
(log) Number of products	-0.0072***	-0.0117***	-0.0065***	-0.0092**	-0.0057**	-0.0116**
	(0.0021)	(0.0033)	(0.0021)	(0.0037)	(0.0026)	(0.0049)
(log) Sales	0.0190***	0.0149***	0.0188***	0.0148***	0.0185***	0.0145***
	(0.0022)	(0.0022)	(0.0022)	(0.0022)	(0.0021)	(0.0021)
Firm-level controls		Y		Y		Y
Worker-level controls	Y	Y	Y	Y	Y	Y
Municipality FE	Y	Y	Y	Y	Y	Y
Occupation-sector-year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
Worker FE	Y	Y	Y	Y	Y	Y
N	2,108,948	2,108,948	2,108,948	2,108,948	2,108,948	2,108,948
R^2	0.79	0.79	0.79	0.79	0.79	0.79

Notes: Firm-level control variables include indicator variables for exporter and importer, (log) number of establishments, (log) value-added per worker, (log) Theil index, the share of workers within an occupation, (log) sales volatility, (log) assets, the share of high-skilled workers, and the share of managers. Worker-level control variables include indicator variables for level of education (missing, no qualification, apprenticeship, some post-secondary, and university graduate), experience, experience squared, age, age squared, and age cubed. An occupation is defined at the ISCO-88 3-digit level, and a sector at the NACE Rev. 1 2-digit level. Standard errors (in parentheses) are clustered by firm. $***$, $**$, $*$ denote significance level at 1%, 5% and 10% respectively.

Table A.7: Robustness Checks with Alternative Measures of Labor Market Power

	Dependent variable: (log) wage earnings			
	(1)	(2)	(3)	(4)
(log) Number of products	-0.0106***	-0.0107***	-0.0108***	-0.0108***
	(0.0033)	(0.0033)	(0.0033)	(0.0033)
(log) Sales	0.0144***	0.0150***	0.0148***	0.0151***
	(0.0021)	(0.0022)	(0.0022)	(0.0022)
Number of workers in occupation	0.0073***			
	(0.0007)			
Share of workers in occupation-sector		0.0467***		
		(0.0064)		
Share of workers in occupation-municipality			0.0170***	
			(0.0024)	
Share of workers in occupation-sector-municipality				0.0045***
				(0.0008)
Firm-level controls	Y	Y	Y	Y
Worker-level controls	Y	Y	Y	Y
Municipality FE	Y	Y	Y	Y
Occupation-sector-year FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
Worker FE	Y	Y	Y	Y
N	2,108,948	2,108,948	2,108,948	2,108,948
R^2	0.79	0.79	0.79	0.79

Notes: Firm-level control variables include indicator variables for exporter and importer, (log) number of establishments, (log) value-added per worker, (log) Theil index, the share of workers within an occupation, (log) sales volatility, (log) assets, the share of high-skilled workers, and the share of managers. Worker-level control variables include indicator variables for level of education (missing, no qualification, apprenticeship, some post-secondary, and university graduate), experience, experience squared, age, age squared, and age cubed. An occupation is defined at the ISCO-88 3-digit level, and a sector at the NACE Rev. 1 2-digit level. Standard errors (in parentheses) are clustered by firm. $***$, $**$, $*$ denote significance level at 1%, 5% and 10% respectively.

Table A.8: Robustness Checks with Alternative Samples

	Dependent variable: (log) wage earnings					
Sample	1996–2009, manufacturing		2010–2013, manufacturing		1996–2007, manufacturing and raw material extraction	
	(1)	(2)	(3)	(4)	(5)	(6)
(log) Number of products	-0.0046*	-0.0094***	-0.0173**	-0.0240***	-0.0073***	-0.0110***
	(0.0024)	(0.0030)	(0.0069)	(0.0092)	(0.0020)	(0.0033)
(log) Sales	0.0193***	0.0143***	0.0293***	0.0260***	0.0190***	0.0149***
	(0.0020)	(0.0020)	(0.0069)	(0.0073)	(0.0022)	(0.0022)
Firm-level controls		Y		Y		Y
Worker-level controls	Y	Y	Y	Y	Y	Y
Municipality FE	Y	Y	Y	Y	Y	Y
Occupation-sector-year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
Worker FE	Y	Y	Y	Y	Y	Y
N	2,303,657	2,303,657	555,588	555,588	2,113,370	2,113,370
R^2	0.78	0.78	0.90	0.91	0.79	0.79

Notes: Firm-level control variables include indicator variables for exporter and importer, (log) number of establishments, (log) value-added per worker, (log) Theil index, the share of workers within an occupation, (log) sales volatility, (log) assets, the share of high-skilled workers, and the share of managers. Worker-level control variables include indicator variables for level of education (missing, no qualification, apprenticeship, some post-secondary, and university graduate), experience, experience squared, age, age squared, and age cubed. An occupation is defined at the ISCO-88 3-digit level, and a sector at the NACE Rev. 1 2-digit level. Standard errors (in parentheses) are clustered by firm. $***$, $**$, $*$ denote significance level at 1%, 5% and 10% respectively.

Table A.9: Heterogeneity Analysis by Firm Size

	Dependent variable: (log) wage earnings			
Split	Below median	Above median	Below 75th perc.	Above 75th perc.
	(1)	(2)	(3)	(4)
(log) Number of products	0.0025	-0.0131***	-0.0086*	-0.0128***
	(0.0058)	(0.0038)	(0.0044)	(0.0043)
(log) Sales	0.0142***	0.0213***	0.0184***	0.0200***
	(0.0032)	(0.0032)	(0.0026)	(0.0040)
Firm-level controls	Y	Y	Y	Y
Worker-level controls	Y	Y	Y	Y
Municipality FE	Y	Y	Y	Y
Occupation-sector-year FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
Worker FE	Y	Y	Y	Y
N	198,876	1,869,997	461,301	1,585,935
R^2	0.84	0.79	0.83	0.79

Notes: Firm-level control variables include indicator variables for exporter and importer, (log) number of establishments, (log) value-added per worker, (log) Theil index, the share of workers within an occupation, (log) sales volatility, (log) assets, the share of high-skilled workers, and the share of managers. Worker-level control variables include indicator variables for level of education (missing, no qualification, apprenticeship, some post-secondary, and university graduate), experience, experience squared, age, age squared, and age cubed. An occupation is defined at the ISCO-88 3-digit level, and a sector at the NACE Rev. 1 2-digit level. Standard errors (in parentheses) are clustered by firm. $***$, $**$, $*$ denote significance level at 1%, 5% and 10% respectively.

Table A.10: Heterogeneity Analysis by Worker Characteristics

	Dependent variable: (log) wage earnings							
Characteristic	Layer hierarchy		Age		Education		Gender	
Split	Layer = 0	Layer > 0	Age <= 40	Age > 40	No post-secondary	At least some post-secondary	Male	Female
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(log) Number of products	-0.0113***	-0.0078*	-0.0110***	-0.0105***	-0.0109***	-0.0087**	-0.0120***	-0.0081
	(0.0038)	(0.0042)	(0.0039)	(0.0031)	(0.0035)	(0.0043)	(0.0031)	(0.0051)
(log) Sales	0.0155***	0.0131***	0.0157***	0.0139***	0.0155***	0.0139***	0.0135***	0.0178***
	(0.0024)	(0.0029)	(0.0027)	(0.0020)	(0.0022)	(0.0032)	(0.0019)	(0.0038)
Firm-level controls	Y	Y	Y	Y	Y	Y	Y	Y
Worker-level controls	Y	Y	Y	Y	Y	Y	Y	Y
Municipality FE	Y	Y	Y	Y	Y	Y	Y	Y
Occupation-sector-year FE	Y	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y
Worker FE	Y	Y	Y	Y	Y	Y	Y	Y
N	1,501,752	582,329	1,030,916	1,035,184	1,636,675	464,031	1,450,760	654,385
R^2	0.70	0.85	0.76	0.84	0.74	0.84	0.80	0.73

Notes: Firm-level control variables include indicator variables for exporter and importer, (log) number of establishments, (log) value-added per worker, (log) Theil index, the share of workers within an occupation, (log) sales volatility, (log) assets, the share of high-skilled workers, and the share of managers. Worker-level control variables include indicator variables for level of education (missing, no qualification, apprenticeship, some post-secondary, and university graduate), experience, experience squared, age, age squared, and age cubed. An occupation is defined at the ISCO-88 3-digit level, and a sector at the NACE Rev. 1 2-digit level. Standard errors (in parentheses) are clustered by firm. $***$, $**$, $*$ denote significance level at 1%, 5% and 10% respectively.

Table A.11: Initial Wage Earnings, Without Worker Fixed Effects

Stage II dependent variable	(log) Wage earnings			
	OLS		IV	
	(1)	(2)	(3)	(4)
(log) Number of products	-0.0126		-0.0689***	
	(0.0088)		(0.0210)	
(log) Lagged number of products		-0.0186***		-0.0301***
		(0.0059)		(0.0111)
(log) Sales	0.0167***	0.0164***	0.0196***	0.0166***
	(0.0052)	(0.0054)	(0.0052)	(0.0054)
Stage I dependent variable:			(log) Number of products	(log) Lagged number of products
(log) Import demand growth			0.2665***	
			(0.0197)	
(log) Lagged import demand growth				0.4611***
				(0.0326)
(log) Sales			0.0393**	-0.0021
			(0.0167)	(0.0127)
Firm-level controls	Y	Y	Y	Y
Worker-level controls	Y	Y	Y	Y
Municipality FE	Y	Y	Y	Y
Occupation-sector-year FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
N	300,535	300,535	300,535	300,535
R^2	0.46	0.46	0.99	0.98
Kleibergen-Paap rk Wald F-statistic			182.1	199.5

Notes: Firm-level control variables include indicator variables for exporter and importer, (log) number of establishments, (log) value-added per worker, (log) Theil index, the share of workers within an occupation, (log) sales volatility, (log) assets, the share of high-skilled workers, and the share of managers. Worker-level control variables include indicator variables for level of education (missing, no qualification, apprenticeship, some post-secondary, and university graduate), experience, experience squared, age, age squared, and age cubed. An occupation is defined at the ISCO-88 3-digit level, and a sector at the NACE Rev. 1 2-digit level. Standard errors (in parentheses) are clustered by firm. $***$, $**$, $*$ denote significance level at 1%, 5% and 10% respectively.

Table A.12: Wage Growth and Initial Product Scope, Observed Terminations

Stage II dependent variable:	Wage growth			
	OLS		IV	
	(1)	(2)	(3)	(4)
(log) Number of products	-0.0087		0.1495	
	(0.0341)		(0.0943)	
(log) Lagged number of products		0.0195		0.1001**
		(0.0242)		(0.0482)
(log) Sales	-0.0207	-0.0207	-0.0295	-0.0186
	(0.0203)	(0.0202)	(0.0208)	(0.0203)
(log) Tenure	0.0746***	0.0746***	0.0748***	0.0744***
	(0.0107)	(0.0107)	(0.0107)	(0.0107)
Stage I dependent variable:			(log) Initial number of products	(log) Lagged initial number of products
(log) Import demand growth			0.2639***	
			(0.0157)	
(log) Lagged import demand growth				0.4537***
				(0.0255)
(log) Sales			0.0448***	-0.0369***
			(0.0153)	(0.0128)
(log) Tenure			-0.0002	-0.0001
			(0.0031)	(0.0043)
Firm-level controls	Y	Y	Y	Y
Worker-level controls	Y	Y	Y	Y
Municipality FE	Y	Y	Y	Y
Occupation-sector-year FE	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y
Worker FE	Y	Y	Y	Y
N	25,466	25,466	25,466	25,466
R^2	0.75	0.75	0.99	0.99
Kleibergen-Paap rk Wald F-statistic			280.7	316.8

Notes: Firm-level control variables include indicator variables for exporter and importer, (log) number of establishments, (log) value-added per worker, (log) Theil index, the share of workers within an occupation, (log) sales volatility, (log) assets, the share of high-skilled workers, and the share of managers. Worker-level control variables include indicator variables for level of education (missing, no qualification, apprenticeship, some post-secondary, and university graduate), experience, experience squared, age, age squared, and age cubed. An occupation is defined at the ISCO-88 3-digit level, and a sector at the NACE Rev. 1 2-digit level. Standard errors (in parentheses) are clustered by firm. $***$, $**$, $*$ denote significance level at 1%, 5% and 10% respectively.

B Theoretical Appendix

The Theoretical Appendix contains mathematical steps to derive essential equations in the main text.

B.1 Expected utility and firm scope

In the following steps, we derive the expected utility in Eq. (11) for a worker employed in a firm offering more than one product ($I_f > 1$):

$$\begin{aligned}
E_{I_f}[u_{hfi}] &= p\bar{u}\sum_{j=0}^{I_f-2}(1-p)^j - c\sum_{j=1}^{I_f-1}(1-p)^j \\
&= p\bar{u}\sum_{j=0}^{I_f-2}(1-p)^j - c\sum_{j=0}^{I_f-2}(1-p)^j + c - c(1-p)^{I_f-1} \\
&= (p\bar{u}-c)\sum_{j=0}^{I_f-2}(1-p)^j + c\big(1-(1-p)^{I_f-1}\big) \\
&= \left(\bar{u}-\frac{c}{p}\right)\big(1-(1-p)^{I_f-1}\big) + c\big(1-(1-p)^{I_f-1}\big) \\
&= \left(\bar{u}-c\left(\frac{1-p}{p}\right)\right)\big(1-(1-p)^{I_f-1}\big). \qquad \text{(B.1)}
\end{aligned}$$

A central mechanism in our model is that the expected utility $E_{I_f}[u_{hfi}]$ and hence, the firm level amenity $A_{I_f} = E_{I_f}[u_{hfi}] + \mu_f$ increases in scope I_f. This can be seen in the following derivatives:

$$\frac{\partial E_{I_f}[u_{hfi}]}{\partial I_f} = -\ln(1-p)(1-p)^{I_f-1}\left(\bar{u}-c\left(\frac{1-p}{p}\right)\right) > 0 \qquad \text{(B.2)}$$

$$\frac{\partial^2 E_{I_f}[u_{hfi}]}{\partial I_f^2} = -\big(\ln(1-p)\big)^2(1-p)^{I_f-1}\left(\bar{u}-c\left(\frac{1-p}{p}\right)\right) < 0. \qquad \text{(B.3)}$$

The expected utility $E_{I_f}[u_{hfi}]$ is characterized as a concave relationship with respect to scope I_f. Hence, firm-level amenities increase in scope:

$$\frac{\partial A_{I_f}}{\partial I_f} > 0. \qquad \text{(B.4)}$$

B.2 The firm problem

Firms compete in labor markets à la Bertrand. The first-order condition of the firm's problem with respect to w_f is:

$$
\begin{aligned}
&-s_f + \theta\gamma(\varphi_f - w_f)\left(\theta w_f + A_{I_f}\right)^{-1}\left(\frac{\left(\theta w_f + A_{I_f}\right)^{\gamma}}{\sum_{k=1}^{F}\left(\theta w_k + A_{I_k}\right)^{\gamma}} - \left(\frac{\left(\theta w_f + A_{I_f}\right)^{\gamma}}{\sum_{k=1}^{F}\left(\theta w_k + A_{I_k}\right)^{\gamma}}\right)^{2}\right) = 0 \\
&\Rightarrow -1 + \theta\gamma(\varphi_f - w_f)\left(\theta w_f + A_{I_f}\right)^{-1}(1 - s_f) = 0 \\
&\Rightarrow -\theta w_f - A_{I_f} + \theta\gamma(\varphi_f - w_f)(1 - s_f) = 0 \\
&\Rightarrow -w_f\theta\big(1 + \gamma(1 - s_f)\big) + \theta\gamma\varphi_f(1 - s_f) - A_{I_f} = 0. \qquad \text{(B.5)}
\end{aligned}
$$

Solving for the base wage w_f yields:

$$
w_f = \frac{\varphi_f\gamma(1 - s_f)}{1 + \gamma(1 - s_f)} - \frac{A_{I_f}}{\theta\big(1 + \gamma(1 - s_f)\big)}. \qquad \text{(B.6)}
$$

B.3 Markdown and labor share

The markdown is defined $\psi_f = \frac{\epsilon_f + 1}{\epsilon_f}$. Substituting the labor supply elasticity ϵ_f from Eq. (18), we derive the markdown as:

$$
\psi_f = \frac{1 + \gamma(1 - s_f)}{\gamma(1 - s_f) - \dfrac{A_{I_f}}{\theta\varphi_f}}.
$$

Differentiating with respect to scope I_f and using information from Eq. (B.4), we find that the markdown is increasing in the scope:

$$
\frac{\partial\psi_f}{\partial I_f} = \frac{1 + \gamma(1 - s_f)}{\theta\varphi_f\left[\gamma(1 - s_f) - \frac{A_{I_f}}{\theta\varphi_f}\right]^2}\underset{(+)}{\frac{\partial A_{I_f}}{\partial I_f}} > 0. \qquad \text{(B.7)}
$$

Note that the latter result is a partial derivative, which is derived for a constant share of workers employed at firm f (s_f). If we further take into account the impact of a change in product scope I_f on s_f, the effect on the markdown is amplified as the firm obtains even more oligopsony power, which is shown in this additional effect:

$$\frac{\partial \psi_f}{\partial I_f} = \frac{\gamma\left(1 + \frac{A_{I_f}}{\theta\varphi_f}\right)}{\left[\gamma(1-s_f) - \frac{A_{I_f}}{\theta\varphi_f}\right]^2} \underbrace{\frac{\partial s_f}{\partial I_f}}_{(+)} > 0. \tag{B.8}$$

The labor share of firm f is defined as the ratio between total labor income and the firm's revenues. Total labor income is the product of the average wage at the firm, $E_{I_f}[w_{hfi}] = w_f + E_{I_f}[b_{hfi}]$, and the number of workers employed at the firm, $s_f H$. Similarly, total revenues are calculated as the product of the firm's average productivity and its total workforce, since the price of the final good is normalized to one.

To link the firm's average productivity to the bonuses paid to workers, we assume that each worker in a firm-product pair is associated with a productivity shock φ_{hfi}. Specifically, each worker produces $\phi_f + \varphi_{hfi}$ units of output. The value of the productivity shock is fully transferred to the worker as a bonus, with no markdowns, implying $b_{hfi} = \varphi_{hfi}$. Therefore, the expected value of the productivity shock is equal to the expected bonus, $E_{I_f}[\varphi_{hfi}] = E_{I_f}[b_{hfi}]$. The firm's average productivity, given its scope I_f, is expressed as $E_{I_f}[\varphi_{hfi}] = \varphi_f + E_{I_f}[b_{hfi}]$. Using these definitions, the labor share in our model is derived as:

$$\text{Labor Share} = \frac{\text{Labor Income}}{\text{Revenues}} = \frac{E_{I_f}[w_{hfi}]s_f H}{E_{I_f}[\varphi_{hfi}]s_f H} = \frac{w_f + E_{I_f}[b_{hfi}]}{\varphi_f + E_{I_f}[b_{hfi}]}. \tag{B.9}$$

Based on our empirical findings (i.e., Empirical Result 3), we assume in the main text that $E_{I_f}[b_{hfi}] = 0$. Under this assumption, the labor share simplifies to:

$$\text{Labor Share} = \frac{w_f}{\varphi_f} = \frac{\epsilon_f}{\epsilon_f + 1} = \frac{1}{\psi_f}. \tag{B.10}$$

The result presented in Eq. (B.8) implies that an increase in the number of products leads to a decrease in the labor share at the firm level, as ψ_f increases with I_f.

However, the labor share as expressed in Eq. (B.9) increases with the expected bonus $E_{I_f}[b_{hfi}]$. Thus, depending on the size of the expected bonus, the labor share may be higher in MPFs. This result is not surprising: firms with greater scope tend to pay higher bonuses (because workers have more opportunities to switch product lines), which are not subject to markdowns. If these bonuses are sufficiently large, they can offset the negative impact of markdowns on the labor share. Nevertheless, a sufficient condition for the labor share to still decline with scope, even in the presence of bonuses, is that the average wage $E_{I_f}[w_{hfi}]$ decreases with scope. This assumption is consistent with our empirical findings.