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Unraveling the Wage-Output Disconnect: The Role of Labor Market Power

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Unraveling the Wage-Output Disconnect: The Role of Labor Market Power

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ABSTRACT: In this paper, we theoretically and empirically explore the role of firm labor market power in the wage-output relationship. We start by laying out a theoretical model with imperfect labor mobility between firms and sectors, which implies upward-sloping labor supply curves that firms face, allowing firms to have labor market power (i.e., wage markdown). Assuming firm heterogeneity under oligopsony, markdowns can be represented as a function of firm labor market share. The model implies that firms with higher labor market share, indicated by a higher payroll share in their respective sectors, exhibit a weaker relationship between the changes in wages and output. We test the model's prediction using data from the European subsample of the ORBIS dataset spanning from 2000 to 2018. We find that: (i) the pass-through of firm value added growth to wage growth is lower for firms with a higher payroll share in their sectors, with about one-fifth of the pass-through disappearing in firms at the top 1 percentile of the payroll share distribution, relative to an atomic firm; (ii) this pattern holds across various subsamples and timeframes, and also after accounting for several alternative explanations; and (iii) the weakening in the link between value added and wages growth due to firm labor market power intensifies during the downturns in the labor market or in the overall economy.

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WORKING PAPERS

Unraveling the Wage-Output Disconnect: The Role of Labor Market Power

Prepared by Melih Firat and Can Sever[1]

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1. Introduction

Economic theory predicts that under perfect competition, firms have no power in wage-setting, and real wages paid to the workers should be equal to the marginal product of labor. However, empirical evidence suggests that wages often are below the marginal product of labor, indicating a wage markdown. This discrepancy contributes to a decline in the labor share of output and stagnant wage growth, with potential ramifications for fueling inequality, dampening private consumption, and reducing welfare (e.g., ILO-OECD-WB 2014, ILO 2015, ILO-OECD 2015). Thus, it is important to understand the drivers of the pass-through of output to wages. A potential explanation for a lower wage share of output is the presence of firms with large labor market power. In particular, firms with substantial labor market power may exert downward pressure on wages, thereby potentially weakening the link between the output and wage dynamics.

In this paper, we explore the role of labor market power in the pass-through of firm output to wages, both theoretically and empirically. The theoretical model assumes imperfect labor mobility across firms and sectors, which generates upward-sloping labor supply curves and wage markdowns below the marginal product of labor. Firm heterogeneity and oligopsony assumptions imply that the pass-through of value added to wages is lower in firms with higher labor market share (i.e., higher payroll share in their sectors). We test model’s prediction using firm-level data from the ORBIS database for 14 advanced European countries over the period of 2000-2018. We empirically show that the positive association between value added and wage growth significantly weakens in firms with higher payroll share in their sectors.[2] Importantly, this pattern remains similar after controlling for various other potential channels, including other firm-level characteristics and secular trends. Finally, we explore how the role of labor market power in wage and output growth relationship varies based on shifting economic conditions. Our findings suggest that the role of firm labor market power in the pass-through of value added to wages becomes more pronounced during the periods of unfavorable labor market outcomes and economic downturns. To our knowledge, this is the first paper which documents systematic evidence on the role of firm labor market power in wage-output disconnect in a cross-country setting based on firm-level data.

To theoretically examine the role of labor market power in the wage-output relationship, we adopt a framework drawing from Atkeson and Burstein (2008) and Berger et al. (2022). We assume that finite number of firms use only labor in production, alongside infinite number of industries in a country. Firms are ex-ante heterogeneous in terms of productivity levels, allowing for variation in their labor market shares (i.e., payroll shares) in the respective industries. A representative household allocates the labor across differentiated jobs provided by firms in different industries under the imperfect labor mobility assumption.

[2] Note that, for simplicity, in our empirical analyses throughout the paper, firm “wage” refers to total “wage-bill” of that firm, which is the total cost of employees.

The double-stage labor allocation process is generated with nested constant elasticity of substitution (CES) functions which incorporate different elasticities of substitution across firms and industries. Intuitively, we assume that workers have higher mobility across firms within industries than across industries. Imperfect mobility of the labor across firms and sectors implies an upward-sloping labor supply curve that firms face, which then gives rise to wages being set below the marginal product of labor (wage markdown). In addition, firms with higher labor market share face flatter (more inelastic) labor supply curves.

Solving the heterogeneous firms' profit maximization problem, under oligopsony, the theoretical model provides a closed-form expression showing that wage markdowns are a function of firms' labor market share, suggesting that the disconnect between wages and output depends on the level of firm labor market share. Importantly, the model suggests that the disconnect between wages and firm value added is higher for firms with higher labor market share in their industry (a proxy for firm labor market power). Using this result from the model, we aim to fill the gap in empirical literature by documenting systematic evidence on the role of firm labor market power in the wage-output disconnect.

To test the main implication of the theoretical model, we use data from a large sample of firms from the ORBIS database. ORBIS is a unique cross-country longitudinal dataset that includes both large, listed, and small, unlisted firms. This differentiates ORBIS from other datasets that provide information only on large, listed companies, such as Compustat, or Worldscope. Hence, among other cross-country firm-level datasets, ORBIS is the best fit for our research question by providing the most comprehensive information to compare firm panels in a cross-country setting. The main sample covers non-farm, non-financial economic activities including both service and non-service industries (with the NACE codes ranging between 5-82) in 14 advanced European economies over the period of 2000-2018.

We empirically examine whether the pass-through of firm value added growth to wage growth varies based on firm's labor market power, as proxied by firms' payroll share in their (narrowly-defined 4-digit NACE) sectors in the country. The results show that firms' wage growth and value added growth are positively associated, but the relationship becomes weaker for the firms with a relatively higher payroll share in their sector, aligning with the model's prediction. The findings suggest that this link is substantially eroded for firms with large labor market power, i.e., firms that are at the high end of payroll share distribution. We find that for an atomic firm with payroll share (in its sector) of around zero, a 10 percentage points higher growth in value added translates into a 3.3 percentage points boost in the wage-bill growth within the same year. However, for instance, almost one fifth of this pass-through disappears for the firm at the 99th percentile of the payroll share distribution across the sample (corresponding to a 7.5 percent payroll share in a 4-digit sector).

Although it is hard to make a causal claim based on our empirical tests, firm-level data allows us to isolate the underlying variation in firm wage growth arising from various factors at a very granular level, thereby alleviating the issue of omitted variables to a large extent. In particular, we include firm fixed effects to control for the impact of all firm-level time-invariant variables on wage growth. We also include country-sector-year fixed effects to absorb the impact of all trends, developments, or shocks (such as supply or demand shocks), that affect firm wage growth similarly within each country, narrowly defined 4-digit NACE sector, and year cell.

Moreover, we account for several alternative explanations for our results – addressing various factors discussed in the literature on the wage-output disconnect. We first account for the role of firm-level characteristics in the pass-through of value added to wages. For instance, the literature discussed that firm productivity (Kügler et al. 2018), innovative activities (Grossmand and Oberfield 2022, Harrison et al. 2014), age (Haltiwanger et al. 2016, Decker et al. 2016), or exposure to export (Fryges and Wagner 2008) can affect the link between wage and output. Controlling for the implications of these firm-level characteristics on the pass-through of value added to wages, we show that the role of firm labor market power in this relationship remains significant. Next, we consider secular trends, such as globalization (Elsby et al. 2013), changes in demography and education (Grossman and Oberfield 2022), and technological change (Karabarbounis and Neiman 2014), which may influence the association between wage and output growth. Accounting for all such slow-moving variables by testing the roles of a common trend, as well as country-, and industry-specific trends in the wage-output disconnect, we show that our main result remains similar, mitigating concerns about a large set of alternative explanations to our main finding.

Finally, we investigate whether the role of labor market power in the pass-through of firm value added to wages varies in response to economic cycle. Using fear and threat argument from Blanchard (1991), which suggests that unemployment affects bargaining between firms and workers, we argue that labor bargaining power in wage determination weakens during economic downturns or periods of higher labor market slack. To test this argument that the role of firm labor market power is likely to be stronger during downturns (thereby weakening the pass-through), we extend our empirical specification with triple interactions including firm value added, labor market share and the change in unemployment rate. Our findings suggest that the disconnect between wages and value added growth attributed to firm labor market power becomes more pronounced during periods of increasing unemployment rates. Importantly, this pattern remains similar, when we use an extended definition of labor market slack beyond unemployment rates, or when we consider real GDP growth as an alternative measure of the economic cycle.

Our results have important policy implications, suggesting that policies aimed at enhancing competition and mobility in the labor market can strengthen the link between output and wage dynamics. These include efforts to effectively implement merger controls, enhance antitrust enforcement in legislation, curb lobbying activities by larger firms, and reduce entry barriers. It is also important to improve restrictions and enforcement of prohibitions against non-compete agreements and collusive behavior among employers, which include no-poaching agreements between firms not to hire each other's employees, or wage-fixing agreements through which employers agree to fix wages or other benefits, which can limit available opportunities for workers, ultimately hindering their bargaining power (e.g., Akcigit et al. 2021, Manning 2021). Cognizant of their cruciality, policy makers have continued to pay attention to these policies.

For instance, in 2024, the European Commission published a policy brief on antitrust in the labor market focusing on no-poaching agreements and wage-fixing, and the US Federal Trade Commission banned noncompete agreement nationwide to improve competitiveness in the labor market.[3]

Alongside the competition policies, regulatory interventions can play a role in fostering competition under some circumstances. Moreover, some of these measures, such as regulatory intervention or merger controls, require a careful and case by case assessment, given that it is not straightforward to determine a uniform, “critical”, level of labor market share of firms after which it starts to noticeably erode the link between the output and wage dynamics. It is also important for national competition authorities to coordinate across-borders and work together to address challenges in globally interconnected markets (such as international fragmentation). Finally, on the supply side, reskilling and upskilling the labor force can facilitate labor mobility, thereby increasing the pass-through of output growth to wage growth. In this regard, policies improving the accessibility of internet (which can decrease the cost of job search) or supporting flexible work arrangements (such as work from home), can also improve labor mobility (e.g., Karabarbounis 2024).

Our results on the role of firm labor market power in the disconnect of the wage-output dynamics imply that measures along these lines are poised to yield positive welfare outcomes, as they enable workers benefit more from economic growth (i.e., by bolstering the pass through of output growth to wage growth). The advantages of pro-competition measures in the labor market become even more pronounced during the economic downturns, as our results on the role of economic cycles in this relationship suggest. Moreover, fostering support for smaller firms can bolster labor market resilience and alleviate potential welfare losses when economic growth or labor market performance is weak.

The remainder of this paper is organized as follows. The rest of this section discusses the literature and our contributions. Section 2 lays out the theoretical model. Section 3 explains the data. Section 4 introduces the empirical methodology. Section 5 illustrates the results. Finally, Section 6 concludes.

1.1. Literature

Our paper contributes to several strands of the literature. On the theoretical side, we adopt the nested CES framework, which was previously used by Atkeson and Burstein (2008) to model variable markups in product markets. However, in contrast to their focus on modeling incomplete pass-through from costs to prices in a general equilibrium framework within the trade literature, we leverage the model’s features to explore the role of firm labor market share in determining the relationship between firm value added and wages. Our theoretical approach bears similarities to Berger et al. (2022), wherein they quantitatively solve a general equilibrium model incorporating firm heterogeneity and oligopsony. However,

[3] See Araki et al. (2023) for a comprehensive review of existing laws and regulations along these lines globally.

our objective differs from theirs. While they aim to quantitatively replicate imperfect productivity-wage pass-through and strategic wage-setting dynamics among dominant employers, we use more parsimonious assumptions within the model to illustrate how the sensitivity of wages to value added diminishes in firms with a higher labor market share.

A relatively recent, but well-established body of literature has documented the decline in labor share, both theoretically and empirically. Grossman and Oberfield (2022) provides a comprehensive review of this strand of the literature. Karabarbounis and Neiman (2014) attributes the decline in the relative price of investment goods as the key factor behind decreasing labor share in the U.S. IMF (2017) and Dao et al. (2020) examine the role of exposure to routinization, (the automation of labour in occupations highly exposed to substitution by computer capital) and find that technological progress and exposure to routinization explain over half of the overall labor share decline in advanced economies. Elsby et al. (2013) explores globalization as an explanation for the decline in labor share in the U.S. Their findings reveal a negative association between exposure to globalization and labor share across industries. Autor et al. (2020) investigates the impact of the “China shock” on labor share and finds no evidence that industries which are more exposed to import penetration from China experienced a greater decline in labor share. Another perspective considers the diminishing bargaining power of workers due to deunionization (Stansbury and Summers 2020). Other explanations point to the changing composition of the labor force, including population aging and a rise in educational attainment (Grossman et al. 2021, Acemoglu and Restrepo 2022). D’Albis et al. (2021) analyze the impact of exogenous changes in both the rate of natural increase and the net migration rate on labor income as a share of total income and find that the response of the labor income share to an exogenous change in the rate of natural increase is significantly negative a few years after the shock, whereas its response to an exogenous change in the net migration rate is significantly positive. Ciminelli et al. (2022) assesses the impact of job protection deregulation on the labor share in a sample of 26 advanced economies during the 1970–2013 period and finds significant negative effects of deregulation on the labor share, contributing to about a tenth of its observed decline in advanced economies. In our paper, we concentrate on the role of labor market power in explaining the decreasing sensitivity of wage dynamics to the changes in firm output. Our approach utilizes a comprehensive firm-level data, enabling us to incorporate country-sector-year fixed effects to mitigate concerns about omitted variables at a granular level. Moreover, we account for various alternative explanations for the wage-output disconnect, including at the firm-level and also secular trends discussed above. Our findings closely align with Autor et al. (2020), which discusses that the rise of superstar firms has contributed to the decline in labor share in the U.S., and other countries. Our paper is the first to provide a systematic examination of the role of labor market share in diminishing the sensitivity of wages to firm activity in a cross-country setting.[4]

Finally, an expanding body of literature has been investigating the consequences of rising labor market power on workers' wages. Benmelech et al. (2020) utilizes plant-level U.S. Census data and finds a negative relationship between local employer concentration and wages, consistent with the presence of monopsony power. Abel et al. (2018) shows that higher levels of labor market concentration are associated with lower pay amongst workers not covered by a collective bargaining agreement. Bassanini et al. (2023) finds that concentration negatively affects both new hires' and incumbents' wages with varying elasticities using administrative data for France. Azar et al. (2020, 2022) analyzes the data from online job postings and demonstrates a negative correlation between real wages and market concentration. Berger et al. (2022) constructs a model incorporating labor market oligopsony and shows that labor market power leads to significant welfare and output losses when compared to an assumption of efficient allocation. Marinescu et al. (2021) computes the concentration of new hires by occupation and commuting zone in France using linked employer-employee data and find that an increase in labor market concentration decreases the number of hires and their hourly wage. Yeh et al. (2022) estimates plant-level markdowns and find that most manufacturing plants operate in a monopsonistic environment, implying a worker earning significantly below the marginal product of output generated. Diez et al. (2022) estimates firm-level markdowns across 10 European countries and highlights the increasing trend in firm markdowns over 2010-2017 led by top firms. Arnold (2019) uses a difference-in-difference approach to document that increased concentration resulting from mergers and acquisitions induces relative wage declines compared to the initial level of concentration. To the best of our knowledge, our paper is the first in the literature by explicitly testing the role of firm labor market power in the pass-through of output to wages by using a comprehensive cross-country firm-level dataset, illustrating that the increase in labor market share result in a weakened relationship between wage growth and firm value-added growth.

2. Theoretical Underpinnings

Our theoretical setup is built on the nested-CES aggregation in labor supply assuming imperfect elasticity of substitution within and across sectors in a country. These models have originally been used in trade literature (Atkeson and Burstein 2008) and more recently adopted for labor markets by Berger et al. (2022). The model allows us to derive labor supply elasticity and markdowns as a function of firms' labor

[4] Recent literature as cited above uses regional data to examine the labor market power in the U.S. (e.g., Azar et al. 2022 and Berger et al. 2022). It is worth noting that while our paper's main advantage is to provide a cross-country examination on the effects of labor market power on wage-output disconnect, we are not able to capture the regional aspect of labor market power in Europe, due to data limitation.

market share. Specifically, using the nested-CES aggregation of labor within and across sectors, and assuming firm heterogeneity (together with the finite number of firms assumption), we study the role firm labor market share in the relationship between wages and value added.

2.1. Environment

In each country, there is a continuum of sectors $s \in [0,1]$. Each sector contains finite number of firms $f \in \{1,2,\dots,N\}$ which are heterogeneous in terms of their productivity levels.[5] For simplicity, in the context of this study, we assume product markets are perfectly competitive, and firms use only labor for production. The representative household allocates homogeneous workers across firms and sectors. We assume imperfect labor mobility across firms and sectors governed by the model's structural parameters. This assumption will allow firms to extract labor market power, increasing with their market share, and exert downward pressure on wages.

2.2. Household Labor Supply

The representative household allocates labor across *N* firms in each sector *s*. We assume that workers have imperfect mobility within and across sectors. The aggregate labor L_t is assumed to have a CES aggregation from sectoral labor supply, as follows:

$$L_t = \left[\int_0^1 l_{st}^{\frac{\epsilon+1}{\epsilon}} ds\right]^{\frac{\epsilon}{\epsilon+1}}$$

where l_{st} is the labor supply allocated to sector s, and $0 < \epsilon < \infty$ denotes the elasticity of substitution across sectors. Taking the sectoral wages as given and with the CES aggregation assumption above, the solution to optimal sectoral labor supply allocation implies the following sectoral labor supply function:

$$l_{st} = \left(\frac{w_{st}}{W_t}\right)^{\epsilon} L_t$$

where w_{st} and W_t stand for sectoral and aggregate wage level, respectively.[6] Furthermore, the household allocates sectoral labor across *N* firms in the sector *s* using a CES aggregation as follows:

$$l_{st} = \left[\sum_1^N l_{fst}^{\frac{\theta+1}{\theta}}\right]^{\frac{\theta}{\theta+1}}$$

[5] Note that we do not solve the model quantitatively. Our purpose is to derive partial equilibrium results to motive the empirical analysis that we conduct in subsequent sections. Firm heterogeneity assumption allows model to display firms with different market shares.

[6] Note that the sectoral wages and labor supply satisfy the condition that $\int_0^1 w_{st} l_{st} = W_t L_t$.

where l_{fst} represents the labor supply to firm *f* in sector s, and $0 < \theta < \infty$ is the elasticity of substitution across firms within sector s. The solution to the firm-level labor allocation problem yields the following expression:

$$l_{fst} = \left(\frac{w_{fst}}{w_{st}}\right)^{\theta} l_{st}$$

Combining the firm- and sector-level labor supply equations, the households' labor supply function and the inverse labor supply curve can be written, as follows:

$$l_{fst} = \left(\frac{w_{fst}}{w_{st}}\right)^{\theta} \left(\frac{w_{st}}{W_t}\right)^{\epsilon} L_t$$

$$w_{fst} = \left(\frac{l_{fst}}{l_{st}}\right)^{\frac{1}{\theta}} \left(\frac{l_{st}}{L_t}\right)^{\frac{1}{\epsilon}} W_t$$

Note that the expression above implies upward-sloping labor supply curves that firms face. Using the labor supply function above, we can represent the elasticity of labor supply with respect to wages as follows:[7]

$$\frac{\partial \ln l_{fst}}{\partial \ln w_{fst}} = \theta - (\theta - \epsilon) s_{fst} \tag{1}$$

where the elasticity of labor supply curve is governed by structural parameters (i.e., θ, ϵ), and firm's labor market share $s_{fst} = \frac{w_{fst} l_{fst}}{\sum_1^N w_{fst} l_{fst}}$. Note that the labor supply elasticity that firms face varies across firms and this feature of the model will have important implications on the heterogeneity of wage markdowns that we discuss in the next subsections.

2.3. Firms

Perfectly competitive firms (in product markets) use only labor and produces final consumption goods y_{fst} using the following technology:

$$y_{fst} = z_{fst} l_{fst}^{\alpha}$$

where $\alpha \in (0,1)$ is labor share and z is exogenous firm productivity. As it is discussed in Appendix B, the heterogeneity in productivity generates differentiation in firm labor market shares with more productive firms having a greater market share than others. Note that perfect competition assumption in product markets implies same prices across firms such that $p_{fst} = p_{st} = p_t$, and for simplicity we assume that $p_t = 1$. Under these assumptions, firms solve the following profit maximization problem:

$$\max_{l_{fst}} z_{fst} l_{fst}^{\alpha} - w_{fst} l_{fst}$$

[7] This result holds under consideration of "open-loop" strategies with respect wage-decision of firms. Therefore, the equilibria here are open-loop Nash equilibria, which are not necessarily subgame perfect as in Alpanda et al. (2021).

subject to,

$$w_{fst} = \left(\frac{l_{fst}}{l_{st}}\right)^{\frac{1}{\theta}} \left(\frac{l_{st}}{L_t}\right)^{\frac{1}{\epsilon}} W_t$$

The first order conditions of the firms' problem after several iterations yield the following expression presenting the wages as a function of marginal product of labor and a markdown, as follows:

$$w_{fst} = \mu(s_{fst})\alpha \frac{y_{fst}}{l_{fst}}$$

where firm markdown $\mu(s_{fst})$ is a function of firm labor market share s_{fst}, together with the elasticity parameters θ and ϵ. We discuss the implications of this equation in the next subsection.

2.4. Partial Equilibrium

Rearranging the expression above for the purpose of our research question, we have the following equation representing markdowns determining the relationship between firm labor cost (wage compensation) and value added:

$$w_{fst} l_{fst} = \mu(s_{fst})\alpha y_{fst} \tag{2}$$

where firm markdowns are derived as a function of labor market share and elasticities of substitution parameters as follows:

$$\mu(s_{fst}) = \frac{1}{1+\frac{1}{\theta}+\left(\frac{1}{\epsilon}-\frac{1}{\theta}\right)s_{fst}} \tag{3}$$

Note that within-sector and across-sector elasticities of substitution parameters determine the level of markdowns, and the labor market power of the firms. These elasticities represent the labor mobility costs, since households face greater constraints while allocating labor across firms and sectors as these costs increase ($\theta \to 0$ or $\epsilon \to 0$). Conversely, as $\theta \to \infty$ or $\epsilon \to \infty$, labor markets exhibit perfect competition (i.e., perfect labor mobility), thereby eliminating firm labor market power.

Furthermore, following Atkeson and Burstein (2008) and Berger et al. (2022), we assume that workers are less mobile across sectors than within sectors. This means that it would be easier for a worker to switch jobs between two firms in the same industry than moving to a firm in a different industry (since, for instance, it would require a training and different skill set). This assumption implies that the elasticity of substitution is lower across sectors than within sectors across firms (i.e., $\epsilon < \theta$). Based on this assumption, first, equation (1) implies that the firms with higher labor market share face more inelastic labor supply curves. Therefore, larger firms take advantage of inelastic labor supply curves to exert labor market power. In line with this argument, this assumption also implies that the denominator term in markdown equation above $\left(\frac{1}{\epsilon}-\frac{1}{\theta}\right)$ becomes positive, and firm markdowns decreases with firms' labor market share:[8]

[8] Note that the assumption on within and across sector elasticities implies the following: $\left(\frac{1}{\epsilon}-\frac{1}{\theta}\right) > 0$

$$\frac{\partial \mu(s_{fst})}{\partial s_{fst}} < 0$$

Therefore, the model implies that firms with higher labor market share has a weaker relationship between value added and labor cost. Due to imperfect labor mobility and oligopsony assumption in the model, firms with higher labor market share suppress wages below their marginal product of labor, thereby generating a stronger disconnect between value added and labor costs. Using the equation (2) above, we will test this argument across 14 European countries using firm-level data from the ORBIS database.

3. Data

3.1. Firm-level Data

Firm-level data is from the ORBIS database which is a unique cross-country longitudinal dataset. It includes both listed and unlisted firms. It is compiled by the Bureau van Dijk Electronic Publishing (BvD) through a detailed data collection process from a wide set of providers. It provides rich and harmonized information on firm production activities (such as employment and sales) and balance sheet variables (such as liabilities and assets). Around 99 percent of firms in the dataset set are private. This is the main differentiating feature of ORBIS, compared to other data sets which are extensively used in the economics literature, e.g., Compustat for the US, Compustat Global, or Worldscope which have information only on large and publicly listed companies. This feature of the database is particularly important in the context of this study, since it increases the coverage and provides a more comprehensive representation of sectors along with firm-level labor market variables such as wages and employment.

In this regard, the use of the European subsample of ORBIS is particularly sensible, since company reporting is regulatory including for small and private firms for many countries. As a result, ORBIS covers a reasonable share of the aggregate economic activity and is viewed as representative in terms of the firm distribution and representation of SMEs in many European countries, as illustrated in detail by Kalemli-Ozcan et al. (2024). Moreover, it is important to capture SMEs in the context for Europe, since SMEs are defined as “the backbone of Europe's economy” and play a crucial role on job creation and growth.[9, 10]

Our sample cover the period of 2000-2018. The raw data requires a multi-step process to ensure internal consistency and clean basic reporting errors (such as negative employment), as well as merging several vintages. The dataset used in this study is processed as proposed by Gopinath et al. (2017), Diez et al. (2021), and Kalemli-Ozcan et al. (2024). The main sample covers non-farm, non-financial industries

[9] For instance, see https://single-market-economy.ec.europa.eu/smes_en.

[10] It is still worth noting that our approach ideally requires data from the universe of firms. While ORBIS is the best source for our purpose as noted, coverage and representativeness can vary across countries, time and industries.

(restricted by NACE 2-digit codes with the range of 5-82) including both several service (e.g., real estate and professional/scientific/technical activities) and non-service industries (e.g., manufacturing and mining), as listed in the Appendix (Table A.1). The sample consists of 14 advanced European economies which have more than 10,000 firm-year observations with the related data available during the sample period: Belgium, Czechia, Denmark, Finland, France, Germany, Italy, Norway, Portugal, Slovakia, Slovenia, Spain, Sweden, the United Kingdom. The main sample has around 2.4 million firms.

We adopt firm value added, labor cost, sales, total revenues and export revenues, as well as the number of employees. To calculate firm payroll share in each industry, we use narrowly-defined 4-digit (NACE) industries. Leverage is the ratio of total liabilities to total assets. We estimate firm-level TFP using the methodology proposed by Ackerberg et al. (2015). We also use firm age and total assets. Intangibility ratio is the ratio of intangible fixed assets to total fixed assets. All firm-level variables are winsorized at the 2.5^{th} and 97.5^{th} percentile levels to reduce the influence of outliers, but we confirm that the findings throughout the paper are not driven by this step. The Appendix provides the summary statistics (Table A.2).

Table 1 provides information of the firm payroll shares distribution in 4-digit NACE sectors across the sample. We note that the distribution is highly skewed, with firms with a payroll share of less than 0.5 percent in their 4-digit NACE sectors accounting for about 89 percent of all observations. Firms with a wage bill share above 5 percent amounts to about 1.6 percent of the overall distribution. The shape of this distribution will have important implications for interpreting our results, which will be discussed later.

Table 1: Distribution of firm payroll share

Payroll share (percent, range)	Percent of observations
[0, 0.5]	89.0
[0.5, 1]	4.3
[1, 2]	2.9
[2, 5]	2.2
[5, 10]	0.9
[10, 100]	0.7

Notes: Table reports the percentage of firms in the sample in each payroll share bins (in their 4-digit NACE sector).

3.2. Country-level Data

We test whether the role of firm labor market power in the pass-through of value added to wages changes based on various macroeconomic factors, proxying the cycles in the labor market or in the overall economy. For this purpose, we adopt unemployment rate (as share of labor force, national estimates) and real GDP growth (log change of real GDP) from the World Bank's World Development Indicators (WDI) database. We also pull data on labor market slack from the Eurostat, which provides a broader measure of unemployment by including part-time and involuntary unemployment. We use the average of quarterly rates to construct annual series (based on people ages 15-74). We adopt this variable for the UK from ONS (Office for National Statistics, based on ages 16 and over). We note that data on labor market slack is available starting from 2009.

4. Empirical Methodology

Motivated by the main implication of the theoretical model as presented in equation (2), our goal is to test the role of firm's labor market power in the pass-through of value added to wages. We adopt a panel specification with fixed effects, as follows:

$$\Delta\log(W)_{f,c,s,t} = \beta_1\Delta\log(Y)_{f,c,s,t} + \beta_2\Delta\log(Y)_{f,c,s,t} \times S_{f,c,s,t-1} + \beta_3 S_{f,c,s,t-1} + \gamma_f + \gamma_{c,s,t} + \epsilon_{f,c,s,t} \quad (4)$$

where f, c, s and t stand for firm, country, (4-digit NACE) sector and year, respectively. The dependent variable $\Delta\log(W)_{f,c,s,t}$ is the log change in firm's total wages from $t-1$ to t. $\Delta\log(Y)_{f,c,s,t}$ is the change in firm's value added during the same period. The changes are expressed in percent. $S_{f,c,s,t-1}$ is firm's payroll share in its (4-digit NACE) industry at $t-1$. We use the lagged value of payroll share following Berger et al. (2022), to avoid the mechanical, contemporaneous relationship between wage growth and payroll share. We also control for the direct role of the payroll share on firm wage growth to avoid the omitted variable bias. "Sector" refers to NACE 4-digit sectors throughout the rest of the paper, unless otherwise noted.

We expect β_1 to be positive to the extent that there exists a positive association between the changes in firm value added to wage growth. Moreover, we expect β_2 to be negative, if higher labor market power weakens the pass-through of value added to wages, as implied by the theoretical model. Although it is not our main interest in this paper, if wage-bill tends to grow less in the firms with initially larger wage-bill compared to their peers, we expect β_3 to be negative, pointing to convergence of wage-bill across firms within sectors over time.

A major advantage of using firm-level data is to be able to absorb the underlying variation in firm wage growth arising from various factors at a granular level. The specification in equation (4) includes firm (γ_f) and country-sector-year ($\gamma_{c,s,t}$) fixed effects. Although it is still hard to claim causality, the inclusion of these fixed effects mitigates concerns about omitted variables to a large extent. Firm fixed effects soak up the effect of all firm-level time invariant characteristics on wage growth. Country-sector-year fixed effects absorb the impact of all factors, which are common for all firms in a country in a given sector in a year, on firm wage growth. Such factors can include demand or supply shocks, or sector-level trends, that affect firm wage growth irrespective of our main channel. To give a sense of the granularity of this approach, one can consider the manufacturing industry (with the NACE code C). Within manufacturing industry, there are 2-

digit sectors with the NACE codes ranging from 10 to 33, and food production is one of those 2-digit sectors (with the NACE code 10). Under food production, there are 3-digit sectors (with the NACE codes from 101 to 109), one of those being dairy products (with the NACE code 105) which classifies cheese producers as a 4-digit sector (with the NACE code 1051). Thus, the specification in equation (4) controls for the effects of all factors which affect the firms within the 4-digit sectors (e.g., the cheese producers) industry in a given country in a year similarly. Finally, standard errors are clustered at country-sector-year level.

To address further concerns on omitted variables, we extend the specification to control for various firm-level time varying features, which can affect wage growth, as follows:

$$\begin{aligned}\Delta\log(W)_{f,c,s,t} &= \beta_1 \Delta\log(Y)_{f,c,s,t} + \beta_2 \Delta\log(Y)_{f,c,s,t} \times S_{f,c,s,t-1} + \beta_3 S_{f,c,s,t-1} \\ &+ \beta_4 X_{f,c,s,t-1} + \gamma_f + \gamma_{c,s,t} + \epsilon_{f,c,s,t} \qquad (5)\end{aligned}$$

where $X_{f,c,s,t-1}$ stands for firm-level control variables, including the lagged values of total assets, leverage, or wage growth.

In the next step, we first aim to rule out several alternative explanations to our main finding by accounting for the roles of various firm-specific time-variant factors in the pass-through of value added to wages. We then test whether the role of firm labor market power survives in this pass-through, when we take into account the roles of slow-moving variables, i.e., broader trends, in the link between wage and output dynamics. The specification is as follows:

$$\begin{aligned}\Delta\log(W)_{f,c,s,t} &= \beta_1 \Delta\log(Y)_{f,c,s,t} + \beta_2 \Delta\log(Y)_{f,c,s,t} \times S_{f,c,s,t-1} + \beta_3 S_{f,c,s,t-1} \\ &+ \beta_4 \Delta\log(Y)_{f,c,s,t} \times Z_{f,c,s,t-1} + \beta_5 Z_{f,c,s,t-1} + \beta_6 Z_{f,c,s,t-1} \times S_{f,c,s,t-1} \\ &+ \gamma_f + \gamma_{c,s,t} + \epsilon_{f,c,s,t} \qquad (6)\end{aligned}$$

where $Z_{f,c,s,t-1}$ stands for TFP, intangibility ratio, exports, or age, at the firm-level. We next employ regressions where Z represents a common year trend, or the sets of country-, and industry-specific year trends, thereby accounting for the roles of all secular (common or country-, and industry-specific) trends in the pass-through of value added to wage growth.[11] To the extent that the labor market power channel is not undermined by such factors, we expect our coefficient of interest β_2 to remain negative and statistically significant after accounting for these alternative channels.

Finally, we explore whether the role of firm labor market power varies during the economic cycle. The specification is as follows:

$$\begin{aligned}\Delta\log(W)_{f,c,s,t} &= \beta_1 \Delta\log(Y)_{f,c,s,t} + \beta_2 \Delta\log(Y)_{f,c,s,t} \times S_{f,c,s,t-1} + \beta_3 S_{f,c,s,t-1} \\ &+ \beta_4 \Delta\log(Y)_{f,c,s,t} \times \Delta \mathrm{Q}_{c,t} + \ + \beta_5 \Delta\log(Y)_{f,c,s,t} \times S_{f,c,s,t-1} \times \Delta \mathrm{Q}_{c,t}\end{aligned}$$

[11] In that set of regressions with trends, variable Z cannot be included to due multicollinearity arising from the inclusion of country-sector-year fixed effects.

$$+ \beta_6 S_{f,c,s,t-1} \times \Delta \mathrm{Q}_{c,t} + \gamma_f + \gamma_{c,s,t} + \epsilon_{f,c,s,t} \quad (7)$$

where $\Delta \mathrm{Q}_{c,t}$ is the change in unemployment rate, labor market slack, or real GDP. In specification (7), to the extent that firms are able to exert their market power to suppress wages in the periods during which labor market or the economy performs poorly, we expect β_5 to be negative for the labor market variables, but positive for economic growth.[12]

5. Results

5.1. Main Results

Table 2 illustrates the main results based on specification (4). In column 1, we explore the pass-through of the changes in firm value added to wages. The coefficient estimate of the changes in firm value added suggests that a 10 percentage points increase in value added growth is associated with a 3.3 percentage points higher growth in firm wage-bill. In the next column, we account for the role of firm's labor market power (proxied by payroll share in the 4-digit NACE sector) in this relationship. The coefficient estimate of the interaction between firm's value added growth and payroll share in its sector is negative as expected, and statistically significant at the 1 percent level. This implies that the relationship between the changes in value added and wages is weaker for the firms that have relatively higher payroll share in their sector, confirming the main prediction of the model as presented in equation (2).

Table 2: Main results

Variable	(1)	(2)
$\Delta \log(Y)$	0.325***	0.325***
	(0.003)	(0.003)
$\Delta \log(Y) \times S$		-0.008***
		(0.000)
S		-1.786***
		(0.021)
Firm F.E.	Yes	Yes
C-S-Y F.E.	Yes	Yes
R-squared	0.473	0.474
Observations	15,358,722	15,358,722

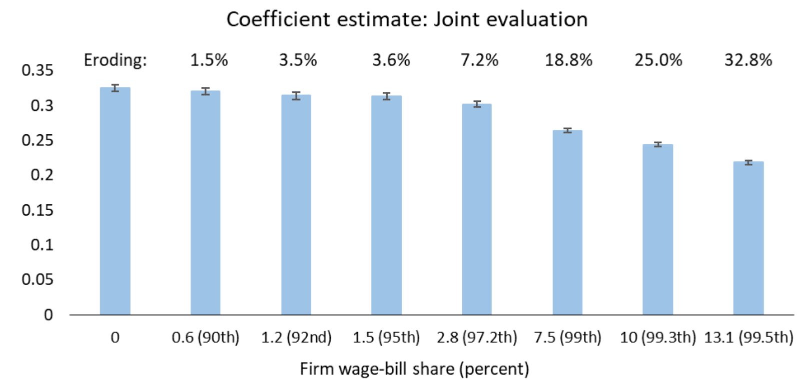
Notes: Results are based on equation 4. Dependent variable is firm wage growth. Y is firm value added, S is firm payroll share in its sector. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

[12] In this set of regressions, variable ΔQ cannot be included to due multicollinearity arising from the inclusion of country-sector-year fixed effects.

We next focus on the economic importance of the results based on the distribution of payroll share across the sample (as shown in Table 1). For this purpose, Figure 1 reports the jointly estimated coefficient for this relationship (i.e., $\beta_1 + \beta_2 S$) at different percentiles of the distribution of firm payroll share (as calculated within 4-digit NACE sectors) across the sample. The first bar shows the coefficient estimate for a hypothetical firm with a payroll share around zero, together with the 90 percent confidence interval. As mentioned earlier, the majority of the sample consists of SMEs, which are not expected to have large labor market power. Thus, it is sensible to focus on the higher end of the payroll share distribution in the sample in order to capture this relationship for firms which account for large shares of the overall payroll in their sectors, and hence likely to exert labor market power to suppress wages. For instance, the coefficient estimates in column 2 in Table 2 suggests that, at the 99th percentile of the payroll share distribution (with a firm with wage bill share of 7.5 percent in its sector), a 10 percentage points increase in value added growth is associated with a 2.7 percentage points higher growth in firm wage-bill. This means that the link between the value added and wage dynamics becomes 19 percent lower (as reported by the corresponding bar in Figure 1), compared to an atomic firm (as shown by the first bar in Figure 1). Focusing on the 99.5th percentile of the payroll share distribution in the sample (as shown by the last bar in Figure 1), almost one third of this pass-through erodes in a firm with 13 percent payroll share in its sector, compared to an atomic firm in the same sector. These results point to the importance of firms with sizeable market share in determining the wage-output disconnect.

We also report the size of the estimated role of labor market share in this pass-through for firms with lower payroll shares as well to provide a more complete representation of our finding. The second bar in Figure 1 illustrates the estimated relationship between the value added and wage growth for a firm at the 90th percentile of the payroll share distribution in the sample (corresponding to a firm accounting for 0.6 percent of the industry's total wage-bill). First, the jointly estimate coefficient estimate (i.e., $\beta_1 + \beta_2 S$) for this firm is not statistically significantly different from that of an atomic firm in the first column (with a payroll share around zero). This is sensible, since a firm with only 0.6 percent payroll share in its sector may not be expected to benefit from any labor market power to suppress wages. At the 92nd percentile of it (corresponding to a firm with payroll share of 1.2 percent), the relationship between the changes in value added and wages starts to become statistically significantly different from that of the hypothetical atomic firm with a zero-payroll share (comparing the first and third bars). As we move to the higher end of the distribution, the role of firm labor market power in the wage-output disconnect becomes economically more meaningful.

Figure 1: An illustration of the result across the sample



Notes: Results are based on the second column in Table 2. Chart illustrates the estimated coefficient estimate $\beta_1 + \beta_2 S$ in equation (4) based on the different values of firm payroll share S, with the corresponding percentiles of payroll share in the overall sample are in parentheses. It also shows the 90 percent confidence intervals (vertical lines in each bar). The numbers on the row with "Eroding" (above each bar) report the percentage difference between the first bar and the corresponding bar.

Finally, although it is not the focus in this study, we find that the coefficient estimate of the payroll share is negative. It suggests that firms that have initially a larger wage-bill compared to their peers in the same sector tend to exhibit a lower wage growth which points to convergence of wages across firms within 4-digit sectors over time.

5.2. Robustness Checks

In this section, we employ a large set of robustness checks starting from a dummy variable approach. Although we show that firm labor market power tends to weaken the pass-through of value added to wages by adopting the exact values of firm payroll share in the main analysis above, the economic importance of the role of payroll share in the relationship between value added and wage growth is found to be particularly meaningful at the higher end of the distribution of firm payroll share in the sample (as shown in Figure 1). In this regard, it can be sensible to explore the role of firm labor market power in the case of firms that are particularly have greater payroll share, relative to their peers. We identify firms with particularly large payroll share in their sector by adopting dummy variable approach, and run the analysis as an alternative to the baseline. Table 3 shows the results.

We first compare the association between value added and wage growth across the firms with smaller and larger payroll share in each country-sector-year cell. For this purpose, we use various top percentiles of payroll share distribution to identify the firms with particularly high wage-bill in their country-sector-year cell. In particular, instead of using the exact values of payroll share, we adopt a dummy which takes 1 if firm's payroll share is above the 90^{th} (column 1), 95^{th} (column 2), 99^{th} (column 3), or 99.5^{th} (column 4) percentile in its country-4-digit-sector cell in a given year. Hence, we compare the pass-through from value added to wages across firms with relatively higher payroll share with their peers in the same sector. In these tests, while the coefficient estimate of the first term (i.e., value added growth) remains very similar, the coefficient estimate of the interaction term (between value added growth and the dummy for firm payroll share) becomes markedly larger as we move from the 1st to the 4th column. For instance, about 6 percent of the link between value added and wage growth is eroded for the firms above the 90th percentile of the payroll share distribution in a sector, relative to their peers. This erosion reaches about 19 percent when we focus on the 99.5th percentile of firm payroll share distribution as the cutoff point in column 4.

We follow a similar exercise, but rather than focusing on country-sector-year cells, we identify firms with large wage bill share focusing on the payroll share distribution on the overall sample (similar to the exercise in Figure 1). In particular, after calculating firm payroll shares in each country-4-digit-sector-year cell, a dummy variable for high payroll share is assigned 1, if firm's payroll share is above the 90th (column 5), 95th (column 6), 99th (column 7), or 99.5th (column 8) percentile of the overall sample. The findings are consistent with the previous result from Figure 1, pointing that the weakening in the pass-through of firm value added growth to wage growth becomes much higher for the firms that have larger payroll share in their sectors, relative to the rest of the firms in that sector.

Table 3: Dummy variable approach

	Country-sector-year				Overall sample			
Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
$\Delta \log (Y)$	0.324***	0.325***	0.325***	0.325***	0.327***	0.326***	0.325***	0.325***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)
$\Delta \log(Y) \times S$	-0.020***	-0.029***	-0.051***	-0.060***	-0.063***	-0.077***	-0.102***	-0.112***
	(0.002)	(0.002)	(0.005)	(0.007)	(0.003)	(0.003)	(0.005)	(0.006)
S	-9.687***	-8.150***	-6.279***	-5.993***	-10.756***	-9.602***	-8.097***	-7.341***
	(0.115)	(0.112)	(0.147)	(0.215)	(0.084)	(0.094)	(0.151)	(0.193)
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
C-S-Y F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.476	0.474	0.473	0.473	0.475	0.474	0.473	0.473
Observations	15,358,722	15,358,722	15,358,722	15,358,722	15,358,722	15,358,722	15,358,722	15,358,722

Notes: Results are based on equation 4. Dependent variable is firm wage growth. Y is firm value added, S is firm payroll share. Payroll share is a dummy which takes 1 if firm's payroll share if above the 90th (column 1), 95th (column 2), 99th (column 3), 99.5th (column 4) percentile in its country-4-digit-sector cell in a given year. Payroll share is a dummy which takes 1 if firm's payroll share if above the 90th (column 5), 95th (column 6), 99th (column 7), 99.5th (column 8) percentile of the overall sample. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Next, we test the results by controlling for the role of several firm-level time variant variables in wage growth as robustness. This is important, since although firm fixed effects in specification (4) absorb the effects of all time-invariant firm-level characteristics on wage growth, there can still be time-varying factors affecting wage growth. Thus, we use specification (5), and include the lagged values of firm's total assets and leverage in columns 1 and 2, respectively, in Table 4. Finally, control for a possible process of mean reversion in firm wage growth (similar to Sever 2023) and include lagged value of wage growth (column 3).

The main finding on the role of firm payroll share in the relationship between value added and wage growth remains robust. However, firms that are initially larger measured as assets, or have higher leverage, seem to have lower wage growth. Finally, the negative coefficient of the lagged value of wage growth in the last column suggests that wage growth tends to exhibit mean reversion.

Table 4: Control variables

Variable	(1)	(2)	(3)
$\Delta \log(Y)$	0.322***	0.329***	0.271***
	(0.003)	(0.003)	(0.003)
$\Delta \log(Y) \times S$	-0.008***	-0.008***	-0.005***
	(0.000)	(0.000)	(0.000)
S	-1.663***	-1.860***	-1.858***
	(0.020)	(0.022)	(0.024)
X	-2.289***	-3.451***	-0.076***
	(0.063)	(0.121)	(0.001)
Firm F.E.	Yes	Yes	Yes
Country-sector-year F.E.	Yes	Yes	Yes
R-squared	0.475	0.477	0.455
Observations	15,358,722	15,278,394	12,219,395

Notes: Results are based on equation 5. Dependent variable is firm wage growth. Y is firm value added, S is firm payroll share in its sector. X is the lagged values of total assets (in log, column 1), leverage (column 2), and wage growth (column 3). *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

We then focus on the robustness of the results to different explanatory variables, as well as to various subsamples. Table 5 illustrates the findings. To start with, we replace firm value added growth with sales and revenue growth, in columns 1 and 2 respectively. Next, we proxy for firm labor market power by using the employment share of firms, rather than the payroll share (column 3). The results remain similar.

In column 4 in Table 5, we aim to address a possible concern on whether firm labor market power as proxied for payroll share can indeed be capturing product market power. To mitigate this concern, we test our results by using a measure of firm labor market power net of product market share. We proxy firm product market power with the share of firm's share in its sector's total sales. We then regress firm payroll share on sales share by including the sets of fixed effects in the main estimation, and use the residual from this regression as a proxy for firm labor market power above beyond its product market power. The result remains similar.

We also test the results in various subsamples. First, there can be a concern about reporting, or possibly large fluctuations, of the wage bill of smaller firms. To alleviate such concerns, we employ the regression by using data only from the firms that report at least 10 employees each year during the sample period (column 5 in Table 5). Another concern can be about the firms with less years of observations in the sample. To mitigate that, column 6 employs the analysis using data only from firms with at least a decade of observations during the sample period. We then aim to address a possible concern can be that payroll shares in some 4-digit sectors with a lower number of firms may be driving the results. Column 7 runs the test using data only form the 4-digit NACE sectors which have at least 100 firms each year during the sample period. Column 8 uses data from the five countries with the largest number of firm-year observations (i.e., France, Italy, Portugal, Spain and Sweden).[13] The significant role of firm payroll share remains robust in these tests.

Finally, instead of annual changes, we first do the analysis using 3-year windows to calculate the changes (over the period of *t* and *t-3*), and by adopting firm payroll share from *t-3*. This allows us to smooth out annual variations, and explore the previous relationship in the medium-term. Column 9 shows that the role of firm labor market power in the pass-through of value added growth to wage growth stays similar. The last column shows that our previous relationship holds, even when tested using 5-year windows. However, in the estimations using longer time windows, the coefficient estimate of the change in firm value added increases to almost 0.5, from about 0.3 in the baseline regressions (which uses annual changes), seeming to converge the longer term relationship between wage and value added in data (the mean value of the share of firm wages to value added -at levels- is above 0.7 in the sample[14]).

Table 5: Other robustness checks

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$\Delta\log(Y)$	0.405***	0.435***	0.325***	0.329***	0.356***	0.286***	0.336***	0.329***	0.446***	0.479***
	(0.004)	(0.004)	(0.003)	(0.003)	(0.002)	(0.003)	(0.005)	(0.004)	(0.004)	(0.004)
$\Delta\log(Y)\times S$	-0.003***	-0.003***	-0.006***	-0.008***	-0.014***	-0.007***	-0.092***	-0.010***	-0.011***	-0.011***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.006)	(0.001)	(0.000)	(0.001)
S	-1.359	-1.292***	-0.995***	-2.563***	-1.806***	-1.650***	-21.599***	-2.357***	-3.564***	-4.010***
	(0.015)	(0.013)	(0.018)	(0.031)	(0.023)	(0.024)	(0.374)	(0.040)	(0.050)	(0.066)
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
C-S-Y F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.442	0.448	0.474	0.478	0.599	0.426	0.480	0.474	0.663	0.759
Observations	19,716,956	20,826,873	15,358,722	14,846,792	3,718,563	7,194,885	10,879,656	13,747,171	10,676,486	7,756,065

Notes: Results are based on equation 4. Dependent variable is firm wage growth. Y is firm value added, S is firm payroll share in its 4-digit NACE sector, unless otherwise noted. Columns 1 and 2 replace value added growth with sales and revenue growth, respectively. Column 3 replaces payroll share with employment share in 4-digit NACE sectors. Column 4 uses firm payroll share net of sales shares in the corresponding sector. Column 5 runs the test using data only from firms that report at least 10 employees each year during the sample period. Column 6 employs the analysis using data only from firms with at least 10 years of observations. Column 7 runs the test using data only form the 4-digit NACE sectors which have at least 100 firms each year during the sample period. Column 8 uses data from the five countries with the largest number of firm-year observations (France, Italy, Portugal, Spain and Sweden). Column 9 (10) employs the analysis based on 3-year (5-year) windows. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

[13] The results are also similar when we drop these five countries, and run the analysis in the rest of sample.

[14] With the 25th and 75th percentiles of the distribution being 0.6 and 0.9, respectively, and standard deviation being 0.4.

We now test the role of firm labor market power on the value added and wage growth relationship across various industry groups. This set of tests allows us to (i) confirm that the results are not driven by a subset of industries, (ii) examine whether there exists heterogeneity in the findings across different industries. Table 6 displays the results, and also reports the erosion in the pass-through of value added to wages at the 99th percentile of firm payroll share distribution in each subsample (by comparing the pass-through for firms with payroll share around zero and at the 99th percentile of the payroll share distribution in the corresponding subsample).

We first divide sample into two broad categories, namely, service (column 1) and non-service (column 2) industries, and test the relationship in each subsample. To start with, the baseline relationship survives in both set of industries, suggesting that the firms exhibit labor market power in both sectors. However, the magnitude of the role of labor market power appears to be larger in non-service industries, partly driven by different distributions of payroll share in those subsamples. The 99th percentile of firm payroll share distribution corresponds to about 4.5 percent (12.3 percent) in service (non-service) industries. At this percentile, about 8 percent (40 percent) of the initial pass-through is eroded, as reported in the first two columns in Table 6.

Next, we divide the sample into tradable and non-tradable industries.[15] The baseline relationship remains similar in both tradable and non-tradable industries, but the magnitude of the role of labor market power becomes larger in tradable industries, mostly driven by different distributions of payroll share. The 99th percentile of firm payroll share distribution corresponds to about 17.5 percent (4.4 percent) in tradable (non-tradable) industries. At this percentile, about 47 percent (12 percent) of the initial pass-through is eroded, as reported in the third and fourth columns in Table 6.

We also run the test in three one-digit industries with the largest number of observations in the sample, namely manufacturing (column 5), wholesale and retail trade (column 6), and construction (column 7). The role of firm labor market power remains significant across industries, but the estimated magnitude appears to be the largest in the subsample consisting of manufacturing industries, and lowest for construction industry.

[15] The classification is adopted from Besley et al. (2021), where tradable industries are manufacturing and mining. We note that the results in this set of tests remain very similar, if we categorize information and communication sector as tradable in robustness.

Table 6: Different industry groups

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\Delta \log(Y)$	0.297***	0.377***	0.334***	0.324***	0.336***	0.284***	0.414***
	(0.003)	(0.006)	(0.002)	(0.004)	(0.002)	(0.011)	(0.011)
$\Delta \log(Y) \times S$	-0.005***	-0.012***	-0.009***	-0.007***	-0.009***	-0.007***	-0.008***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.002)
S	-2.427***	-1.340***	-1.264***	-2.322***	-1.273***	-2.716***	-2.569***
	(0.018)	(0.023)	(0.022)	(0.037)	(0.022)	(0.068)	(0.139)
Eroding	*8 percent*	*40 percent*	*47 percent*	*12 percent*	*46 percent*	*11 percent*	*4 percent*
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
C-S-Y F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.452	0.519	0.511	0.468	0.513	0.457	0.532
Observations	9,692,701	5,666,021	3,185,676	12,173,046	3,129,724	4,524,552	2,323,219

Notes: Results are based on equation 4. Dependent variable is firm wage growth. Y is firm value added, S is firm payroll share in its sector. Columns 1 and 2 run the test using data from service (with 1-digit NACE codes of G, H, I, J, L, M, N) and non-service industries, respectively. Columns 3 and 4 employ the test using data from tradable (with 1-digit NACE codes of B, C) and non-tradable industries, respectively. Columns 5-7 test the results in manufacturing, wholesale and retail trade, and construction industries, respectively. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

We then examine the role of firm labor market power in the pass-through of value added to wages in different time periods to examine a possible time variation in this relationship. For this purpose, we run the analysis in 10-year rolling windows. Table 7 shows that the baseline result holds across different time spans, and the role of firm labor market power becomes somewhat more pronounced in over time, e.g., by comparing the first and last columns (which broadly correspond to the pre- and post-Global Financial Crisis of 2008).[16] Below, we dig deeper into the role of time trend in this relationship as well.

Table 7: 10-year rolling windows

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\Delta \log(Y)$	0.320***	0.311***	0.306***	-0.302***	0.300***	0.301***	0.304***	0.307***	0.310***
	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
$\Delta \log(Y) \times S$	-0.007***	-0.007***	-0.007***	-0.007***	-0.008***	-0.008***	-0.009***	-0.010***	-0.011***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
S	-1.876***	-2.027***	-2.077***	-2.147***	-2.364***	-2.601***	-2.843***	-2.975***	-3.069***
	(0.032)	(0.034)	(0.035)	(0.037)	(0.040)	(0.044)	(0.045)	(0.048)	(0.049)
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
C-S-Y F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.533	0.524	0.507	0.488	0.478	0.474	0.457	0.459	0.461
Observations	6,911,149	7,352,353	7,768,810	8,184,781	8,594,256	9,029,964	9,445,752	9,719,198	9,971,953

Notes: Results are based on equation 4. Dependent variable is firm wage growth. Y is firm value added, S is firm payroll share in its sector. Columns 1-9 run the test in 10-year rolling windows ending in 2010, 2011, 2012, …, and 2018, respectively. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

[16] The economic importance of the estimate role of firm labor market power in the pass-through of value added to wages seems to increase over time. For instance, the result in the first column (for the earliest period) suggests that 18 percent of the link between the changes in value added and wages is eroded at the 99th percentile of the payroll share distribution of this sample, compared to a firm with a payroll share of 0. The result in the last column (the most recent period) suggests that a similarly estimated erosion becomes 25 percent for the firm at the 99th percentile of the corresponding sample.

In the next set of tests, we employ the analysis at different levels of granularity regarding industry classification. This helps us address a possible concern, i.e., whether the focus of the baseline analysis may be too narrow by using 4-digit sector classification. That is, by definition, firms have greater payroll shares in narrower industry cells, which may over-emphasize firm's labor market power. To make sure that the granularity of the baseline analysis regarding industry classification does not drive the results, we focus on broader industries. Table 8 shows the results. In column 1, *S* denotes firm payroll share in 2-digit NACE industries, instead of 4-digit sectors and in column 2, we use an even broader definition of industries, i.e., 1-digit NACE industries to calculate firm-level shares. The results suggest that the role of labor market power in value added and wage growth remains robust to using different industry definitions in calculating firm labor market shares. Note that the increase in the coefficient of interaction term is mostly mechanical, such that the market share *S* decreases as move to a broader industry definition.

Table 8: Payroll share in broader industry categories

Variable	(1)	(2)
$\Delta \log(Y)$	0.325***	0.325***
	(0.003)	(0.003)
$\Delta \log(Y) \times S$	-0.026***	-0.094***
	(0.002)	(0.034)
S	-4.659***	-13.341***
	(0.246)	(3.105)
Firm F.E.	Yes	Yes
C-S-Y F.E.	Yes	Yes
R-squared	0.474	0.473
Observations	15,358,722	15,358,722

Notes: Results are based on equation 4. Dependent variable is firm wage growth. Y is firm value added, S is firm payroll share in its 2-digit (column 1) or 1-digit (column 2) industry. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

We also run a large set of tests to check the robustness of the results to various combinations of fixed effects, and to different levels of clustering of standard errors. In unreported results, we test this relationship using data only from the Eurozone countries, or only from the rest of the sample, and find that the results are very similar in both subsamples. Moreover, we confirm that the findings stay similar, when we (i) drop firm fixed effects, country-sector-year fixed effects, or both; (ii) replace country-sector-year fixed effects with country-sector, sector-year and country-year fixed effects; and (iii) use country-2-digit-industry-year fixed effects, instead of country-4-digit-sector-year fixed effects. The results stay virtually the same, if standard errors are (i) not clustered (but robust to heteroskedasticity); (ii) one-way clustered at country-sector, sector-year, or country-year levels; (ii) two-way clustered at any combinations of those three levels;

(iii) three-way clustered at country-sector, sector-year and country-year levels; or (iv) clustered at country-2-digit-industry-year level.

5.3. Alternative Explanations

In this section, we aim to rule out alternative explanations to the firm labor market power channel. First, we focus on the productivity channel. Although there may be many other potential reasons through which firms obtain larger labor market power, our theoretical model implies that more productive firms have higher labor market share, and thus a higher labor market power. Therefore, it may raise a concern, i.e., whether labor market power in the estimation is indeed just a proxy for productivity, and thus, our results may be driven by firm productivity, rather than labor market power (e.g., Autor et al. 2020). To formally test this argument, we add the interaction between firm TFP and the value added growth based on specification (6). This test also addresses a potential omitted variable bias by controlling firm TFP in the estimation, since firm TFP can be a determinant of wage growth as well. Column 1 in Table 9 shows the result. Our main result remains similar, thereby empirically eliminating the firm productivity channel as an alternative explanation to our main finding. Although it is not our focus in this study, we note that that more productive firms tend to have higher wage growth, and somewhat stronger pass-through of value added to wages (while the coefficient estimate of the interaction term between the changes in firm value added and productivity being statistically significant only at the 10 percent level).

Second, we examine whether the use of more productive, or innovative, forms of capital can undermine our main finding, and be an explanation to the weakening in value added wage pass-through, as discussed in the decline of the labor share literature (e.g., Grossman and Oberfield 2022). To proxy for the innovative activities of firms, we use intangible capital ratio (similar to Ahn et al. 2020). Column 2 suggests that the coefficient of interaction between firm payroll share and value added remains negative and statistically significant, even after controlling for the interaction between intangibility and value added, ruling out this as an alternative explanation to our main finding. We also note that wage growth is higher, and the link between value added and wage growth becomes stronger, for firms with higher intangibility ratio.

Furthermore, we test whether the previous results can be explained by the heterogeneity in pass-through based on firm age, rather than labor market power. Haltiwanger et al. (2016) and Decker et al. (2016) show that the high-growth young firms have been the source of both job creation and output growth. It is thus sensible to examine whether our results were driven by older firms with higher labor market shares. In Column 3, we include the interaction between a dummy variable indicating young firms and the change in firm value added. The results show that the role of labor market power remain significant after controlling for the firm age, addressing this concern. The results also show that both wage growth and the pass-through of value added growth to wage growth are higher in younger firms, in line with Haltiwanger et al. (2016).[17]

Next, we test whether our findings remain significant under the globalization explanation of the declining labor share. Elsby et al. (2013) proposes offshoring of labor-intensive components as an explanation to the decline of labor share in the U.S. which would imply a weaker pass-through from value added growth to wage growth. If firms' offshoring activities and labor market shares are correlated, our results would be driven by the role of offshoring. To address this concern, we use firm export revenues (used as share of total revenues) which is the closest variable available in ORBIS to proxy for firms' engagement in offshoring.[18] Column 4 shows that our result is robust to including the interaction between firm export revenue and value added growth. The results also show that the pass-through from value added to wage growth is weaker in firms with higher export revenue shares.

Additionally, we examine whether the previous results may be driven by unobserved and slow-moving global, and country- or industry-level factors. In this regard, country-sector-year fixed effects in specification (4) are able to absorb the underlying variation in firm wage growth arising from all unobserved factors at a very granular level. However, it is also important to check whether some broader trends may impact the pass-through of value added to wage growth, and whether they can undermine the role of firm labor market power in this relationship. This is important, as noted above, since the literature discuss that several broad trends, such as globalization, changes in minimum wages, or the fall in the relative price of capital goods, can shape the labor share. To account for all slow-moving global trends, we include the interaction between firm value added growth and a common year trend, as in specification (6). Given that our sample consists of advanced economies only in Europe, a common year trend likely accounts for factors, such as exposure to the rise of China, offshoring, technological change, or changing demographics. Column 5 shows that the main result of the paper stays similar. Moreover, the negative coefficient estimate of the new interaction term implies that this pass-through has been declining, on average, which points to a declining trend in labor share, over the years, in line with the literature.

We then go one step further, and include the set of interactions between firm value added growth and country-specific year trends. Our goal is to address the concerns about whether the trends discussed in the previous paragraph (e.g., exposure of countries to globalization, or demographic changes) may vary across countries. In this regard, we investigate whether our previous finding remains similar, when we explicitly control for trends that are specific to each country. Column 6 shows that the role of firm labor market share remains significant. We display the coefficient estimates of the interactions between the

[17] We define dummy variable equals to 1 if firm is older than 5 years following McGowan et al. (2017). However, our results are robust to using larger age thresholds, e.g., 15 years.

[18] Note that this variable is only available for about 10 percent of the main sample.

changes in value added and country-specific year trends in the Appendix (the left-hand side chart in Figure A.1), which shows that the pass-through has become weaker over time in the majority of the countries.

Finally, we include the set of interactions between industry-specific year trends (for 1-digit NACE industries) and firm value added growth in the estimation to account for the role of industry-specific global trends in the association between value added and wage dynamics explicitly. This is sensible, since for instance, manufacturing industry may be exposed to a different underlying trend (e.g., regarding globalization or automation, as discussed above) in the pass though of value added to wages, compared to other industries. Thus, in this test, we account for such underlying trends at a granular level for each industry. Column 7 in Table 9 shows that our main result remains robust. We illustrate the coefficient estimates of the interactions between the changes in value added and industry-specific year trends in the Appendix (the left-hand side chart in Figure A.2), which shows that the pass-through has become weaker over time over time in most of industries.

Table 9: Alternative explanations

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\Delta \log(Y)$	0.363***	0.309***	0.272***	0.378***	0.371***	0.373***	0.370***
	(0.004)	(0.003)	(0.003)	(0.003)	(0.008)	(0.007)	(0.007)
$\Delta \log(Y) \times S$	-0.011***	-0.008***	-0.005***	-0.024***	-0.009***	-0.008***	-0.009***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
S	-1.278***	-1.732***	-1.655***	-2.864***	-1.645***	-1.645***	-1.572***
	(0.028)	(0.021)	(0.020)	(0.107)	(0.023)	(0.023)	(0.023)
$\Delta \log(Y) \times Z$	0.005*	0.125***	0.180***	-0.001***	-0.004***	*see*	*see*
	(0.003)	(0.004)	(0.002)	(0.000)	(0.001)	*Appendix*	*Appendix*
Z	29.990***	0.695***	2.727***	-0.063***			
	(0.302)	(0.086)	(0.067)	(0.009)			
$Z \times S$	-0.554***	-0.555***	-0.389***	0.014***	-0.016***	*see*	*see*
	(0.028)	(0.043)	(0.021)	(0.002)	(0.001)	*Appendix*	*Appendix*
Firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
C-S-Y F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.529	0.477	0.485	0.548	0.475	0.481	0.481
Observations	11,548,229	14,852,651	15,356,068	1,582,562	15,358,722	15,358,722	15,358,722

Notes: Results are based on equation 6. Dependent variable is firm wage growth. Y is firm value added, S is firm payroll share in its sector. Z is firm's TFP (intangibility ratio) in column 1 (column 2). In column 3, Z is a dummy variable which takes 1 if a firm is 5 years old or younger. In column 4, Z is firm export revenue as percent of total revenues. In columns 5 and 6, Z is common year trend, and the set of country-specific year trends, respectively. In column 7, Z is the set of industry-specific year trends (for 1-digit NACE industries). *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5.4. Decomposing wage growth

Having established the role of firm labor market power in the pass-through of value added to wages, we now dig deeper to pinpoint the sources of this channel by decomposing firm wage growth into employment growth and average wage per employee growth. Note that our main dependent variable, the change in total wage-bill of a firm (W_{fcst}), can be rewritten as the sum of the changes in employment and average wage per employee as follows:

$$W_{fcst} = w_{fcst} l_{fcst}$$

$$\ln W_{fcst} = \ln w_{fcst} + \ln l_{fcst}$$

$$\Delta \ln W_{fcst} = \Delta \ln w_{fcst} + \Delta \ln l_{fcst}$$

where w_{fcst} and l_{fcst} denote the average wage per employee and the number of employees of firm *f*, respectively. We obtain the former by dividing firm's overall wage-bill with the total number of employees, and replace the dependent variable with the change in average wage per employee or in the number of employees. This exercise is aimed at providing insights into the role of firm labor market power in the pass-through of value added to these two components separately, with potential implications for policy making. Table 10 shows the results.

The result in column 1 shows that role of firm labor market power in determining the pass-through of value added to average wage dynamics (instead of the overall wage-bill). The coefficient estimates suggest that about 21 percent of the pass-through of value added to average wage per employee is eroded for the firm located at the 99th percentile of the payroll share distribution in the sample, compared to an atomic firm (with a payroll share of around 0). This result is intuitive, suggesting that firms use labor market power to suppress the average wage paid to employees.

In column 2 in Table 10, we observe that, somewhat interestingly, firm labor market appears to weaken the association between value added and employment dynamics as well. One possible explanation for this finding may be that firms with higher labor market power can also exert their power on the workers in the form of unpaid overtime to extend their profit by suppressing employment (i.e., new hires), which can have implications for labor regulations, as well as the enforcement of existing regulations. In this regard, survey data show that unpaid overtime is not trivial in various European countries (e.g., see Eurofond 2022). However, we also note that the estimated role of labor market power in the pass-through of value added to employment is economically smaller, relative to its role in the case of average wage per employee. The erosion in the pass-through as calculated similar to above turns to be about 16 percent in this case, compared to a 21 percent erosion in the case of average wages as shown in column 1 in Table 10.

Table 10: Employment and average wage growth

Variable	(1)	(2)
$\Delta \log(Y)$	0.178***	0.135***
	(0.002)	(0.002)
$\Delta \log(Y) \times S$	-0.005***	-0.003***
	(0.000)	(0.000)
S	-1.060***	-0.674***
	(0.017)	(0.013)
Eroding	*21 percent*	*16 percent*
Firm F.E.	Yes	Yes
C-S-Y F.E.	Yes	Yes
R-squared	0.252	0.211
Observations	15,358,722	15,358,722

Notes: Results are based on equation 4. Dependent variable is the change in average wage per employees (column 1) or employment growth (column 2). Y is firm value added, S is firm payroll share in its sector. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5.5. The Role of Economic Cycles

In the final step, we examine how the role of firm labor market power in the pass-through of value added to wages varies with the economic cycle. The wage Phillips curve suggests a negative correlation between the labor market slack and wage growth. A greater number of unemployed workers relative to available vacancies typically signifies a weakening in worker bargaining power. Furthermore, fear and threat argument from Blanchard (1991) suggests that unemployment affects bargaining dynamics between firms and workers, potentially weakening the bargaining power of labor in wage determination. We reconcile these arguments with the model's implications from equation (3). Recall that wage markdowns intensify (indicating a higher discrepancy between wages and marginal product of labor) as labor mobility decreases, or when it becomes costlier for workers to move between firms and sectors ($\theta \rightarrow 0$ and/or $\epsilon \rightarrow 0$). To the extent that workers, on average, become less likely to find a new job when unemployment rate increases or GDP growth decreases, the model intuitively implies that markdowns would be lower (greater disconnect between wages and output) during unfavorable economic conditions. Therefore, we anticipate that firm labor market power will be more pronounced during downturns in the labor market. We use specification (7) to test this argument, and present the findings in Table 11.

In column 1, the negative and statistically significant coefficient estimate of the triple interaction (between value added growth, payroll share and the change in unemployment rate) suggests that the weakening in the pass-through from value added growth to wages growth in firms with higher payroll share becomes higher in the years of increased unemployment rates. The coefficient estimates of 0.008 (the interaction between value added growth and payroll share) and 0.062 (the triple interaction) imply that if unemployment rate increases, for instance, by 3 percentage points (making the variable 0.03 in our estimation), the role of labor market power becomes 25 percent higher, compared to a year with no increase in unemployment (by comparing 0.008 and 0.008 plus 0.062 x 0.003), in line with our argument above.

Consistently, column 2 shows that this pattern remains similar when we adopt labor market slack which presents a broader view of labor market, compared to unemployment rate. The coefficient estimates similarly suggest that a 3 percentage points increase in labor market slack increases the role of firm payroll share by 40 percent.

In the third column, a similar relationship arises when we focus on GDP growth to present the cycle of the economy. We find that the role of firm labor market power increases in the years with lower economic growth. The coefficient estimates imply that a 3 percentage points lower economic growth inflates the role of firm labor market power in eroding the pass-through of firm value added to wages by about 12 percent.

Table 11: The role of economic cycles

Variable	(1)	(2)	(3)
$\Delta \log(Y)$	0.325***	0.309***	0.325***
	(0.003)	(0.005)	(0.004)
$\Delta \log(Y) \times S$	-0.008***	-0.011***	-0.009***
	(0.000)	(0.001)	(0.000)
S	-1.810***	-3.413***	-1.860***
	(0.021)	(0.060)	(0.022)
$\Delta \log(Y) \times S \times \Delta Q$	-0.062***	-0.151***	0.036***
	(0.022)	(0.029)	(0.011)
$\Delta \log(Y) \times \Delta Q$	0.179	0.473**	-0.013
	(0.169)	(0.183)	(0.126)
$S \times \Delta Q$	-5.101***	-3.120***	2.859***
	(0.370)	(0.449)	(0.192)
Firm F.E.	Yes	Yes	Yes
C-S-Y F.E.	Yes	Yes	Yes
R-squared	0.474	0.467	0.474
Observations	15,358,722	8,699,617	15,358,722

Notes: Results are based on equation 7. Dependent variable is firm wage growth. Y is firm value added, S is firm payroll share in its sector. Q is unemployment rate (column 1), labor market slack rate (column 2), or real GDP (column 3). *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

6. Conclusions and Implications

The disconnect between wages and output has potential consequences on consumption, wealth and inequality. Thus, understanding the nature of this phenomenon is important to help design appropriate policies. In this regard, our paper proposes firm labor market power as a factor affecting this disconnect. It sheds light on this matter by laying out a theoretical model, and testing its implication empirically based on firm-level data from 14 advanced European economies since the 2000s. Our results suggest that against the same amount of value added growth, wage growth is lower in firms with higher labor market power. The estimated role of firm labor market power in this disconnect becomes large in the firms with substantially high payroll share in their sectors. The significant role of labor market power in weakening the pass-through from value added to wages remains similar across different subsamples. Moreover, this pattern is robust, when different firm-level explanations and the roles of slow-moving trends are accounted for. Furthermore, this channel is escalated during downturns (i.e., when unemployment rate or labor market slack increases, or economic growth is lower), possibly due to a weakening in worker bargaining power during turbulent times.

Our results point to the necessity of implementing policies to improve competitiveness in labor markets, which can in turn strengthen the pass-through of output to wages. In this regard, pro-competition reforms, enforcements of prohibitions against non-compete agreements, merger controls, and labor market regulations to prevent labor markets from being controlled by fewer firms can be considered, alongside regulatory intervention when needed. Cross-border coordination and cooperation of national competition authorities remain important as well, given the interconnectedness of global markets. Also, policies aimed at reskilling and upskilling the labor force would enhance labor mobility across firms and sectors, potentially addressing rising firm labor market power by a few firms. The role of such policies becomes even more crucial during downturns. We believe that the findings of this paper are even more relevant in the post-Covid-19 period, given that the pandemic had adverse effects on SMEs (e.g., Juergensen et al. 2020).

We note several avenues for future research. First, the role of specific policies to buttress the link between wages and output is important to explore to inform policies going forward. Moreover, we show that the pass-through of value added to average wages also are weakened in firms with greater labor market power. This result, however, will have distinct implications for inequality, and also for policy design, if firms with high market share suppress wages, particularly for low-earners, or less skilled workers. Thus, to better assess the macroeconomic consequences of firm labor market share (e.g., on wage inequality which can fuel overall income inequality), it is promising for future research to go beyond the average wage dynamics, and explore how much of the wage-output pass-through is eroded for different segments of the labor market, at least, in countries for which there is worker-level data. Last but not least, it will also be interesting to explore whether the role of the firm labor market power in the disconnect between wage and output dynamics remains similar in emerging market and developing economies.

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Appendix

A. Tables and Figures

Table A.1. Industries

NACE Code	NACE 2-digit range	Industry
B	5-9	Mining and quarrying
C	10-33	Manufacturing
D	35	Electricity, gas, steam and air conditioning supply
E	36-39	Water supply; sewerage; waste management and remediation activities
F	41-43	Construction
G	45-47	Wholesale and retail trade; repair of motor vehicles and motorcycles
H	49-53	Transporting and storage
I	55-56	Accommodation and food service activities
J	58-63	Information and communication
L	68	Real estate activities
M	69-75	Professional, scientific and technical activities
N	77-82	Administrative and support service activities

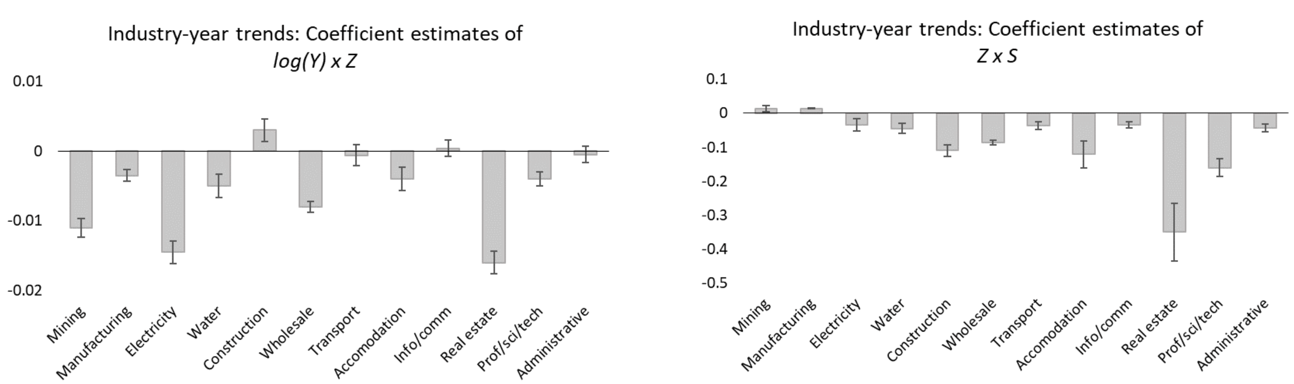
Table A.2. Summary statistics

Variable	Mean	Median	Std. dev.
Value added growth (%)	3.91	2.58	43.24
Sales growth (%)	2.85	1.00	34.18
Revenue growth (%)	2.91	1.18	32.67
Wage growth (%)	5.34	2.96	31.48
Payroll share (%)	0.42	0.03	2.41
Employment growth (%)	1.22	0.00	26.73
Employment share (%)	0.39	0.03	2.19
Wage per employee growth (%)	4.12	2.18	32.22
Export revenue share (%)	0.00	6.70	24.21
Assets (log)	13.52	13.38	1.76
Leverage (ratio)	1.09	0.98	0.97
Age (log)	2.42	2.57	0.85
TFP (log)	0.73	0.49	0.66
Intangibility ratio	0.13	0.00	0.25

Figure A.1: Country-specific year trends (Table 9, column 6)

Notes: Results are from column 6 in Table 9. Chart illustrates the coefficient estimates of the interactions with country-specific year trends for each country in the estimation. It also shows the 90 percent confidence intervals.

Figure A.2: Industry-specific year trends (Table 9, column 7)

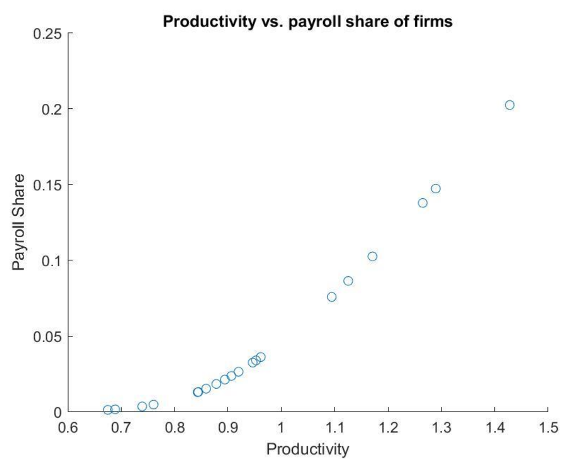


Notes: Results are from column 7 in Table 9. Chart illustrates the coefficient estimates of the interactions with industry-specific year trends for each industry in the estimation. It also shows the 90 percent confidence intervals.

B. Numerical Illustration of the Model

To illustrate the labor market power implication of productivity levels, we provide a simple example showing the variation in labor market power across firms with different productivity levels. We assume that there exist two sectors, each including 20 firms with different productivity levels. Similar to Atkeson and Burstein (2008), we assume that each firm draws its idiosyncratic productivity z_{fs} form a log-normal distribution, $\log z \sim N(0, \kappa)$. For simplicity, we assume that productivity is constant over time. The model's parameters are chosen as follows: Elasticity of substitution across sectors (ϵ) and firms (θ) are 0.5 and 10, respectively, following Berger et al. (2022); and the productivity distribution parameter (κ) is 0.385, following Atkeson and Burstein (2008). Solving a static problem for wages and labor supply as function of productivity levels of firms, we illustrate the model's implication in Figure A.3, showing that more productive firms have higher payroll-shares in their industries.

Figure A.3: Productivity and labor market share in the model



Note: Distribution of productivity and payroll-share (in their respective industries) of the 40 firms are plotted following the solution of the model using parameters chosen as described above.

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