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Evidence from Uruguay

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Abstract[1]

This paper examines the relationship between wages and market power at the firm level. We derive firm-specific measures of labor market power and present a natural decomposition of wage changes into shifts in labor market power and labor productivity. Our findings indicate that 50-60 percent of the variation in nominal wages is attributable to price changes, while the remaining portion—reflecting changes in real wages—is explained mainly by changes in market power and to a lesser extent by changes in labor productivity. Moreover, we show that firms with greater market power tend to pay higher wages, suggesting rent-sharing between employers and employees, at the cost of higher prices for consumers.

JEL classifications: L1
Keywords: Wages, Price markups, Labor market power

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1. Introduction

Recent economic literature has highlighted a generalized increase in market power across advanced economies, with implications for wage determination and labor share dynamics. This rise in market power has been linked to reductions in the labor share (De Loecker et al., 2020) and manifests in both product and labor markets. When labor markets deviate from perfect competition, wages reflect not only the marginal productivity of labor but also the bargaining power between employers and employees. Nonetheless, the relative contributions of productivity changes and shifts in bargaining power to wage variation remain unclear, lacking a unified theoretical prediction.

Our paper aims to fill this gap by empirically decomposing wage variation into components driven by changes in worker productivity and shifts in bargaining power. The context of Uruguay from 2007 to 2019 offers a unique setting for this analysis, marked by high inflation, substantial variation in real wages, and government intervention through tripartite Wage Councils. These councils—comprising employers, employees, and government representatives—set differentiated minimum wages by job category across sectors. Casacuberta and Gandelman (2023) show that this institutional framework contributed to a decline in firms' labor market power, contrasting with trends observed in the United States (Stansbury and Summers, 2020; Yeh et al., 2022) and Germany (Mertens, 2022).

The relationship between wages and firm characteristics has spurred extensive research that extends beyond the classical competitive market framework. Early theoretical contributions, such as MacDonald and Solow (1981), emphasize the role of bargaining power and labor market institutions in wage determination. Building on this foundation, recent studies have incorporated firm heterogeneity, market power, and institutional factors into models of wage inequality (Deb, Eeckhout, and Patel, 2024). Empirical findings support these theoretical advancements. For instance, Berlingieri et al. (2018) document a positive but sector-specific relationship between wages and productivity, while Azar, Marinescu, and Steinbaum (2019) show that higher labor market concentration depresses wages.

Moreover, the interaction between product market power and wages has attracted growing attention. Blanchard and Giavazzi (2003) explore how deregulation affects wage growth, while Stansbury and Summers (2020) argue that weakened labor institutions constrain wage responses to productivity gains. In a similar vein, Leduc and Zheng (2024) examine how automation reduces workers' bargaining power, dampening wage adjustments and exacerbating unemployment fluctuations.

Specific methodological advances have further enriched this literature. The approach developed by De Loecker and Warzynski (2012), building on the seminal work of Hall (1986), provides a framework for estimating firm-level indicators of market power. Extending this framework to labor markets enables the estimation of firm-level indicators as the wedge between wages and the marginal revenue product of labor. This wedge reflects deviations from perfect competition and serves as a measure of bargaining power in the labor market. Building on these methods, Mertens (2023) analyzes how worker and firm-side market power shape wage differentials, while Dobbelaere et al. (2024) explore the role of collective bargaining in wage markups and markdowns in Germany. Lamadon, Mogstad, and Setzler (2022) offer complementary evidence from the United States, estimating significant rents shared between firms and workers.

Our contribution lies in employing a production-based approach to estimate firm-level price markups and labor market power indicators. This framework allows us to disentangle the effects of bargaining power and productivity on wage variation. Specifically, we address two key questions. First, to what extent do wage changes reflect shifts in the wedge between marginal revenue product and wages? Extending the framework of Conlon et al. (2023), we adapt their analysis of product markups to labor markets, decomposing wage variation into productivity and labor market power effects.

Second, we investigate the relationship between product market power and wages. Theoretical ambiguity surrounds this relationship: firms with high market shares may leverage greater labor market power to suppress wages, or rent-sharing mechanisms may enable unionized workers to secure higher wages, which could translate into higher prices. Additionally, sector-level policies may simultaneously increase markups and wages through protectionist measures that facilitate rent-sharing. Thus, we ask: do firms with higher price markups pay higher or lower wages?

The paper proceeds as follows. Section 2 outlines the methodology. Section 3 describes the data. Section 4 presents the results, and Section 5 concludes.

2. Methodology

2.1 Product Markup and Wage Markdown Estimation

Our approach is based on Hall (1986) and De Loecker and Warzynski (2012) method to obtain expressions for market power in the goods market and in the labor markets. Market power in the goods market is proxied by the ratio between firms' prices and marginal costs. Labor market power is the ratio between labor marginal revenue productivity (MRPL) and wages.

For firm *i* at period *t* we assume a production technology given by

$$Q_{it} = Q_{it}(L_{it}, M_{it}, K_{it}, \omega_{it}) \tag{1}$$

where L_{it} and M_{it} are labor and materials respectively, K_{it} is capital, ω_{it} is a scalar productivity term and Q_{it} is gross output. For cost minimization, the following Lagrangian can be written:

$$\mathcal{L} = w_{it}(L_{it})L_{it} + pm_{it}M_{it} + r_{it}K_{it} + \lambda_{it}(Q_{it} - Q_{it}(\cdot)) \tag{2}$$

where w_{it}, pm_{it} and r_{it} are prices for labor, materials and capital, respectively.

We assume material inputs prices are exogenous to firms. The first order condition for material inputs is:

$$\frac{\partial \mathcal{L}}{\partial M_{it}} = pm_{it} - \lambda_{it}\frac{\partial Q_{it}}{\partial M_{it}} = 0 \tag{3}$$

where λ_{it} represents marginal cost at a given level of output. Rearranging, we obtain a relation between output elasticity of materials (θ_{it}^{M}) and product markup over marginal cost μ_{it}:

$$\theta_{it}^{M} = \frac{\partial Q_{it}/\partial M_{it}}{Q_{it}/M_{it}} = \frac{P_{it}}{\lambda_{it}}\frac{pm_{it}M_{it}}{P_{it}Q_{it}} = \mu_{it}\frac{pm_{it}M_{it}}{P_{it}Q_{it}}. \tag{4}$$

where P_{it} is firm's output price. In other words, the expression for the product markup can be written as:

$$\mu_{it} = \theta_{it}^{M}[\alpha_{it}^{M}]^{-1} \tag{5}$$

where α_{it}^{M} is the materials share of revenue.

From the same firm problem an expression for a wedge between the MRPL and the wage can be derived. It is customary in the literature to consider a model in which firms have monopsony power in the labor market and the wedges are above 1. However, it is also observed that this wedge can be below 1, which would not be consistent with that view. As Mertens (2023) points out, alternative models can give different interpretations. In the first of them labor is assumed to be flexible, and firm monopsony power is assumed in the labor market, *i.e.*, $w_{it}(L_{it})$ is a positively sloped function. Then the first order condition with respect to labor would be:

$$\frac{\partial \mathcal{L}}{\partial L_{it}} = \frac{\partial w_{it}}{\partial L_{it}} L_{it} + w_{it} - \lambda_{it} \frac{\partial Q_{it}}{\partial L_{it}} = 0 \tag{6}$$

hence, we obtain:

$$\theta_{it}^{L} = \frac{\partial Q_{it}/\partial L_{it}}{Q_{it}/L_{it}} = \left[\frac{\partial w_{it}}{\partial L_{it}} \frac{L_{it}}{w_{it}} + 1\right] \frac{P_{it}}{\lambda_{it}} \frac{w_{it} L_{it}}{P_{it} Q_{it}} = [\varepsilon_{Sit}^{-1} + 1] \mu_{it} \alpha_{it}^{L} \tag{7}$$

where ε_{S}^{-1} is the inverse elasticity of labor supply, and α_{it}^{L} is the labor share of revenue.

Profit maximization in a monopolistic labor market implies that $[\varepsilon_{Sit}^{-1} + 1]$ equals the wage markdown (υ_{it}), which in turn can be defined as the ratio between marginal revenue of labor $MRPL_{it}$ and the wage w_{it}. From equation (6), the cost of an additional labor unit is shown to be equal to marginal cost λ_{it} (that must be equal to marginal revenue) times the marginal product of labor $\partial Q_{it}/\partial L_{it}$.

Then, we obtain the estimated wage markdown as:

$$\upsilon_{it} = [\mu_{it}]^{-1} \theta_{it}^{L} [\alpha_{it}^{L}]^{-1} \tag{8}$$

Alternatively, in a bargaining model, workers can be assumed to maximize a utility function given by:

$$U(w_{it}, L_{it}) = w_{it} L_{it} + (\bar{L}_{it} - L_{it}) \bar{w}_{it} \tag{9}$$

where $\bar{w}_{it}$is the reservation wage and $\bar{L}_{it}$ is the employment level in competition. If negotiation takes place over wages and employment the solution is obtained from the following Nash maximand:

$$\max_{w_{it}, L_{it}, K_{it}, M_{it}} [\phi_{it} log\, ((w_{it} - \bar{w}_{it}) L_{it}) + (1 - \phi_{it})\, log(R_{it} - w_{it} L_{it} - pm_{it} M_{it} - rK_{it})] \tag{10}$$

where R_{it} is firm revenue, and $\phi_{it} \in [0,1]$ is worker bargaining power. Maximizing with respect to L_{it} gives the first order condition:

$$\frac{\phi_{it}}{L_{it}} - \frac{(1-\phi_{it})}{\pi_{it}} \left(\frac{\partial R_{it}}{\partial L_{it}} - w_{it}\right) = 0 \tag{11}$$

which in turn gives:

$$w_{it} \left(\frac{\phi_{it}}{1-\phi_{it}} \frac{\pi_{it}}{w_{it} L_{it}}\right) = w_{it} \upsilon_{it} = MRPL_{it} \tag{12}$$

where π_{it} denotes firm profits. The reasoning is analogous to that for the first order condition for materials: revenue from an additional unit of labor must equal the cost of that unit. From here the expression for the labor market power indicator is also the wedge between MRPL and wages as in equation (8). In this case, however, the wage is above the marginal revenue product of labor and the indicator is expected the be below 1.

To estimate price markups and the wedge in labor markets according to equation (5) and (8) we need estimates of $\alpha_{it}^{L}, \alpha_{it}^{M}, \theta_{it}^{L}$ and θ_{it}^{M}. The first two are directly observed in the data as the labor and materials shares of revenue. For the θs we explore various alternatives and discuss the robustness of our results.

2.2 Output Elasticities

Firm-level output elasticities require consistent estimates of the production function parameters. A common approach is to use control function-based estimators to correct for endogeneity biases, which arise from firms' choices of factor use. Rather than adopting the frequently used Cobb-Douglas specification, we opt for a more flexible translog specification that allows elasticities to vary by firm and period. The translog production function is defined as:

$$y_{it} = \beta_l l_{it} + \beta_m m_{it} + \beta_k k_{it} + \beta_{ll} l_{it}^2 + \beta_{mm} m_{it}^2 + \beta_{kk} k_{it}^2 + \beta_{lk} l_{it} k_{it} + \beta_{lm} l_{it} m_{it} + \beta_{km} k_{it} m_{it} + \omega_{it} + \varepsilon_{it} \quad (13)$$

where y_{it} is gross output, l_{it}, m_{it} and k_{it} are labor, materials and capital inputs respectively (all in logs), while ω_{it} is unobserved Hicks-neutral productivity, assumed to follow a first-order Markov process, and ε_{it} idiosyncratic shock independent of current and past input choices.

We apply control function-based methods for estimation, drawing on the approaches of De Loecker and Warczynski (2012) and Wooldridge (2009). Both methods address the endogeneity issue stemming from the fact that, while output and inputs are observable by the econometrician, productivity (ω_{it}) is observed only by the firm.

De Loecker and Warczynski (2012) build on the timing assumptions of Ackerberg, Caves, and Frazer (2006) to account for the endogeneity of input choices. They posit that materials, m_{it}, can be assumed to be a function of unobserved productivity, such that:

$$m_{it} = g(l_{it}, m_{it}, \omega_{it}) \quad (14)$$

Under appropriate assumptions, this function can be inverted to express firm's productivity as a function of observables:

$$\omega_{it} = g^{-1}(k_{it}, m_{it}, l_{it}) \tag{15}$$

Substituting this into the production function results in:

$$y_{it} = \beta_l l_{it} + \beta_m m_{it} + \beta_k k_{it} + \beta_{ll} l_{it}^2 + \beta_{mm} m_{it}^2 + \beta_{kk} k_{it}^2 + \beta_{lk} l_{it} k_{it} + \beta_{lm} l_{it} m_{it} + \beta_{km} k_{it} m_{it} + g^{-1}(k_{it}, m_{it}, l_{it}) + \varepsilon_{it} = \widetilde{\Phi}(k_{it}, m_{it}, l_{it}) + \varepsilon_{it} \tag{16}$$

In a first stage, only the composite term $\widetilde{\Phi}(\cdot)$ and the error term ε_{it} can be estimated. The production function parameters are not identified. To recover them, the productivity evolution is modeled as:

$$\omega_{it} = h(\omega_{it-1}) + \xi_{it} \tag{17}$$

for given values of the β parameters the innovation in productivity ξ_{it} can be computed, and exploiting the moment conditions

$$E\left(\xi_{it}(\beta)\begin{pmatrix} l_{it-1} \\ m_{it-1} \\ k_{it} \\ l_{it-1}^2 \\ m_{it-1}^2 \\ k_{it}^2 \\ m_{it-1}k_{it} \\ l_{it-1}k_{it} \\ m_{it-1}l_{it-1} \end{pmatrix}\right) = 0 \tag{18}$$

the β parameters can be estimated in a second stage using GMM.

Wooldridge (2009) proposes an alternative, single-stage method based on the following assumptions:

$$E(\varepsilon_{it}|\, l_{it}, k_{it}, m_{it}, l_{it-1}, k_{it-1}, m_{it-1}, \dots, l_{i1}, k_{i1}, m_{i1}) = 0; \quad t = 1,..,T \tag{19}$$
$$E(\omega_{it}|\, k_{it}, l_{it-1}, k_{it-1}, m_{it-1}, \dots, l_{i1}, k_{i1}, m_{i1}) = E(\omega_{it}|\, \omega_{it-1})$$

along with k_{it} being uncorrelated with the productivity innovation $\psi_{it} = \omega_{it} - E(\omega_{it}|\, \omega_{it-1})$. The key moment condition is:

$$E(\omega_{it}|\, \omega_{it-1}, \dots, \omega_{i1}) = E(\omega_{it}|\, \omega_{it-1}) = f[g(k_{it-1}, m_{it-1})]. \tag{20}$$

The two equations that identify the production function parameters are:

$$y_{it} = h(l_{it}, m_{it}, k_{it}) + g(k_{it}, m_{it}) + \varepsilon_{it}$$
$$y_{it} = h(l_{it}, m_{it}, k_{it}) + f[g(k_{it-1}, m_{it-1})] + \zeta_{it} \tag{21}$$

where $\zeta_{it} = \varepsilon_{it} + \psi_{it}$. Following Petrin et al. (2004), functions $g(k_{it}, m_{it})$ and $f[g(k_{it-1}, m_{it-1})]$ can be approximated by third degree polynomials in k_{it}, m_{it}, including all terms of the form $k_{it}^p m_{it}^q$, where $p \geq 0$, $q \geq 0$ and $p + q \leq 3$.

Instruments for the first equation are contemporaneous capital k_{it}, labor l_{it}, material inputs m_{it} and the polynomial terms approximating $g(k_{it}, m_{it})$ but excluding k_{it}. For the second equation contemporaneous capital k_{it}, lags of labor and materials inputs l_{it-1} and m_{it-1}, lags of the polynomial and functions of them can be used as instruments. Both equations are estimated simultaneously using GMM.

Finally, for either the De Loecker and Warczynski (2012) or Wooldridge (2009) alternative we recover labor and materials elasticities of output for firm *i* in period *t* by computing

$$\theta_{it}^L = \hat{\beta}_l + 2\hat{\beta}_{ll} l_{it} + \hat{\beta}_{lm} m_{it} + \hat{\beta}_{lk} k_{it}$$
$$\theta_{it}^M = \hat{\beta}_m + 2\hat{\beta}_{mm} m_{it} + \hat{\beta}_{lm} l_{it} + \hat{\beta}_{km} k_{it} \tag{22}$$

Though production function coefficients are taken to be common within each sector, as elasticities for each factor depend not only on estimated coefficients but also on factor levels, they differ by firm and time.

2.3 Wage Decomposition

We propose a decomposition for wage increases analog to the one devised by Conlon et al (2023) for prices. In their paper, they start from the point by Syverson (2019) that larger price markups would arithmetically translate into higher firm prices unless changes in marginal costs offset them. Defining markups as the ratio of price to marginal cost, variation in prices must equal the variation in markups plus the variation in marginal costs. Nevertheless, Conlon et al. (2023) do not find empirical support for a strong correlation between markups and price changes. As the authors recognize, this could be due to weaknesses in the way price markups are measured or issues with the sample they use or the availability of price indices.

In the case of Conlon et al. (2023), price variation was computed at a sector level, while markups were obtained at the firm level. In our paper, we compare changes in firm-level average wage per worker to changes in firm-level changes in labor market power and firm-level labor productivity.

Formally, the labor market power indicator is

$$\upsilon_{it} = \frac{P_{it} MPL_{it}}{w_{it}} \tag{23}$$

Therefore, it must be that:

$$\Delta w_{it} \approx \Delta P_{it} - \Delta \upsilon_{it} + \Delta MPL_{it} \tag{24}$$

We can use our setup to get empirical measures of the different components of equation (24). The labor market power indicator ($\hat{\upsilon}$) is:

$$\hat{\upsilon}_{it} = \frac{\theta_{it}^{L}}{\theta_{it}^{M}} \frac{\alpha_{it}^{M}}{\alpha_{it}^{L}} \tag{25}$$

where elasticities are obtained from estimated production function coefficients, hence our labor market power indicator is subject to measurement error.

Taking our estimated elasticity of product to labor (7), a measure of the revenue marginal productivity of labor is:

$$MRPL_{it} = P_{it} \frac{\partial Q_{it}}{\partial L_{it}} = \theta_{it}^{L} \frac{P_{it} Q_{it}}{L_{it}} \tag{26}$$

i.e., multiplying our estimated elasticity by nominal output per worker. Again, our elasticities come from the estimated production coefficients, and the same caveat applies.

We do not observe firm prices P_{it}, and we cannot separate productivity in physical terms MPL_{it} to compute the first and third terms of the right hand-side of (24). Instead, we approximate firm price variation with sector price variation ΔP_{jt}, and instead of physical labor productivity we approximate it with the change in deflated marginal revenue product of labor ($\Delta \overline{MRPL}_{it}$):

$$\Delta \overline{MRPL}_{it} = \Delta MRPL_{it} - \Delta P_{jt} = \Delta MPL_{it} + \Delta P_{it} - \Delta P_{jt}$$

Then, we write the decomposition of wage changes as follows:

$$\Delta w_{it} \approx \Delta P_{jt} - \Delta \nu_{it} + \Delta \overline{MRPL}_{it} + \Delta \psi_{ijt} \tag{28}$$

where the term $\Delta \psi_{ijt}$ is measurement error.

3. Data

We use Uruguayan data for 2007-2019. During this period Uruguay underwent a rapid recovery from the deep 2002 economic and financial crisis. A left-leaning government took office in 2005, and Wage Councils with tripartite negotiations between employers, labor unions and government were established. Inflation during the period was consistently above the targeted rate by the Central bank and expectations adjusted accordingly.

The project is based on the National Annual Economic Activity Survey (Encuesta Anual de Actividad Económica, EAAE) from the Uruguayan National Statistics Institute (INE). The EAAE survey aims to represent firms in the local economy, though some sectors such as agriculture, banking, construction, household work and extraterritorial organizations are not included (see below for sectors included).

Within each four-digit ISIC sector, all firms above given employment or sales thresholds (compulsory range) are included in the sample, while a probabilistic sample is drawn from the set of firms below. The INE periodically revises sample coverage and includes new firms using listings from the social security institute and tax authority. The resulting unbalanced panel includes consistent annual data on sales, production, labor (number of workers), capital and intermediate inputs (such as electricity, fuel, water and materials).

We clean the database from observations with missing values in the required variables, observations with negative estimated elasticities, or where the GMM estimation failed to converge. Our preferred estimation alternative is Wooldridge (2009), which shows convergences in almost all cases; in Table 1 we show the raw number of observations by year and in Table A1 the disaggregation by sector of activity. We have 31,579 observations corresponding to 4,089 different firms.[2] On average each firm is observed eight years.

[2] The estimation based on DLW alternative ends up with a workable dataset of 30,929 observations.

Table 1. Observations by Year

2007	976
2008	1,288
2009	1,240
2010	1,521
2011	2,902
2012	3,341
2013	3,035
2014	3,067
2015	3,031
2016	2,943
2017	2,785
2018	2,818
2019	2,632
Total	31,579

There are 321 firms present in the sample every year, which we term "continuers." Note that no-continuation does not necessarily mean exiting the market. The 321 continuing firms are those that survived the whole period and were always included by the INE in their sampling. There are also 568 firms present in the sample after 2011; thus, in the subsample 2011-2019 we have 889 firms with data every year. In order to verify that our results are not driven by composition effects due to resampling and that they hold in general and not only for a specific set of firms, we present our results both for all firms and the set of continuers.

4. Results

In what follows, we present our estimates based on the Wooldridge (2009) alternative for the estimation of the production function. In the appendix we report results using De Loecker and Warczynski (2012). Table A2 in the Appendix provides descriptive statistics on firm-level elasticities of output to production factors.

4.1 Market Power Evolution

Figure 1 shows that product markups were roughly constant in the 2007-2019 period, while wage markdowns have a significant decrease. The average price markup is 1.1, while the average labor market power indicator is 1.2. According to both the unweighted estimates and the revenue weighted averages the decrease in the labor market product indicator is about 17 percent. This is a different trend than what was reported for the United States and Germany (Stansbury and Summers, 2020; Yeh et al., 2022; Mertens, 2022) but consistent with work for Uruguay (Casacuberta and Gandelman, 2023).

Figure A1 reports the same evolution in medians, showing product markups constant and a decrease in the labor market power indicator that ends up below 1. Figure A2 reports the averages for the set of continuers, and Figure A3 reports the result by size of firms.

Figure 1.

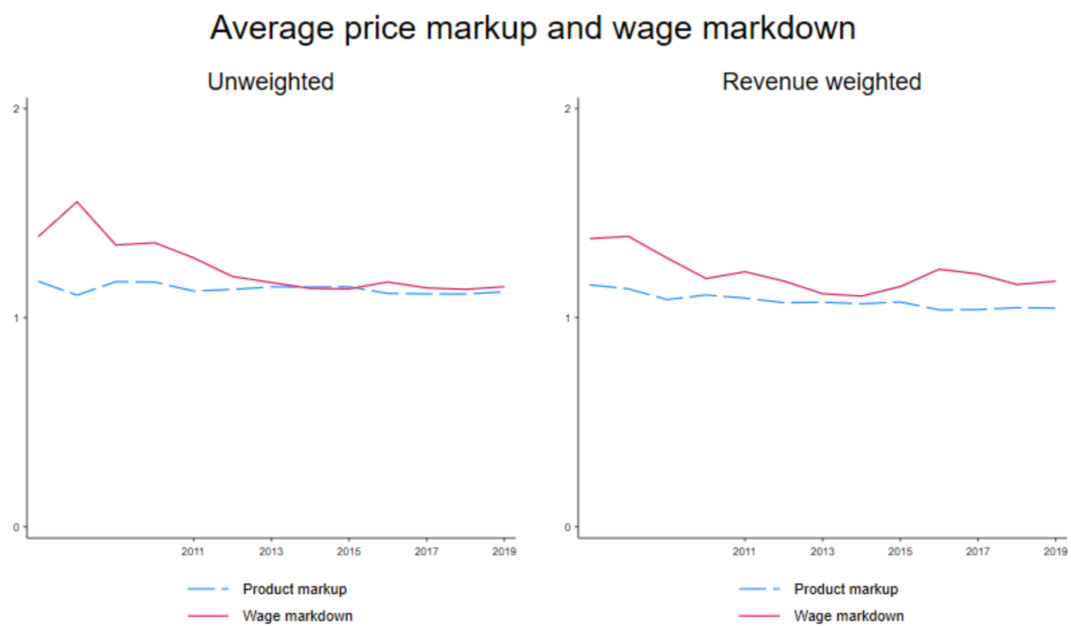
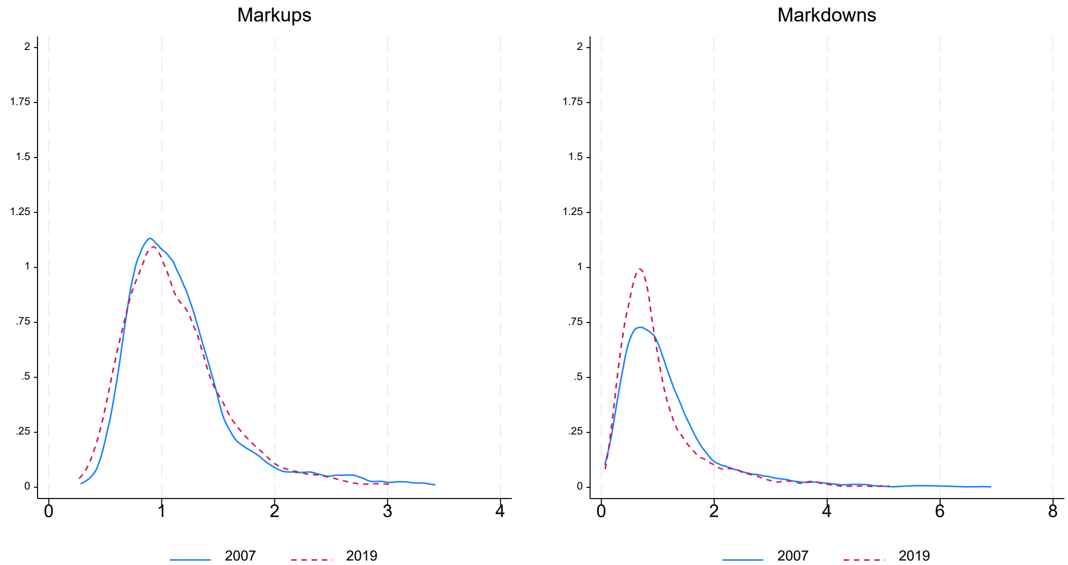


Figure 2 reports the kernel densities for 2007 and 2019 for all firms (Figure A4 in the Appendix is restricted to continuers). The distribution of price markups remains almost without changes. On the other hand, there is a clear leftward shift of the labor market power indicator distribution, which suggests that there is a common phenomenon for most firms.

Figure 2.
Kernel densities



4.2 Wage Change Decomposition

Before presenting the decomposition, we report in Figure 3 a scatter plot of changes in wages vs. changes in labor market power indicator and changes in wages vs. changes in labor productivity. As we indicated in the description of the data, our sample has changes in its coverage that are not trivial. In Figure 3 we reproduce the scatter plots but taking as a starting point the 2007-2008 average in one case and the 2012-2013 average in the second case. The final point of comparison is the 2018-2019 average. We additionally report in Figures A6 and A7 the same scatter plots based on the DLW production function estimation alternative. In all cases, a negative alignment can be verified between changes in wages and changes in the labor market power indicator as well as a positive alignment between changes in wages and changes in labor productivity.

Figure 3.

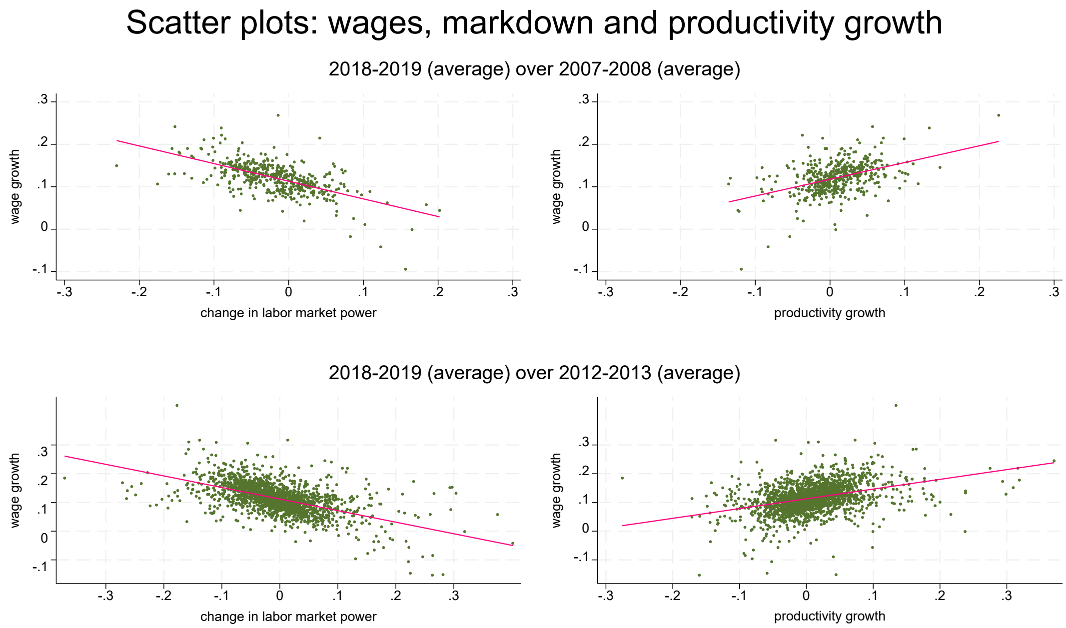


Table 2 presents the decomposition using Wooldridge (2009) elasticity estimates. For comparability, as firms remain in the sample different numbers of periods, we normalize rates of growth in annual terms according to the duration of the firm's spells in the sample.

In nominal terms, changes in prices account for most of the variations in wages. Overall, we find that price variation corresponds to 54 percent of the variation in wages. We also find that for small firms, changes in prices account for 53 percent of changes in wages, while these figures rise to 55 percent for medium firms and 59 percent for large firms.

Besides nominal terms, the decomposition implies that changes in real wages $(\Delta w - \Delta P)$ are the result of changes in the labor market power indicator and changes in labor productivity. On average, we find that 37 percent of the increase in real wages can be accounted for by changes in the labor market power indicator and 28 percent are accounted for by increases in labor marginal productivity, while 35% cannot be related to these two determinants. Looking at the median, the change in the labor market power indicator explains a higher share, 52 percent, while productivity change explains 20 percent, and 28 percent remains unaccounted for. We do find that this result is about the same for the three brackets of firms considered, small, medium and large.

We present several robustness tables. In Table 3 we reproduce de decomposition for different sets of firms and time considerations. Firstly, we restrict to the set of 391 continuing firms. Second, we expand the set of firms, incorporating firms for which we we cannot compute our statistics for each year but can do so for 2007-2008 and 2018-2019. Finally, we consider as the starting point the 2012-2013 average. The results are similar with changes in the labor market power indicator explaining substantially more than changes in labor productivity and with a sizeable part of changes in real wages that cannot be attributed to these factors.

Tables A3 and Table A4 in the Appendix present the same results for DLW.

Table 2. Decomposition Results: Main Specification
(using Wooldridge, 2009 for the production function estimation)

	Wage growth	Prices growth	Change in labor market power	Change in labor productivity	Unaccounted wage change
mean	13.9%	7.5%	-2.4%	1.8%	2.3%
median	13.6%	7.6%	-3.1%	1.2%	1.7%
N	3720	3720	3720	3720	3720
By firm size					
Small	13.9%	7.4%	-2.6%	1.8%	2.2%
Medium	14.0%	7.7%	-2.3%	1.8%	2.2%
Large	13.8%	8.2%	-1.1%	1.9%	2.7%

Table 3. Robustness Decomposition Results
(using Wooldridge, 2009 for the production function estimation)

Continuers					
	Wage growth	Prices growth	Change in labor market power	Change in labor productivity	Unaccounted wage change
mean	12.1%	7.6%	-1.2%	0.8%	2.5%
median	12.0%	7.0%	-1.1%	0.5%	2.2%
N	391	391	391	391	391
Average 2018-2019 over Average 2007-2008					
	Wage growth	Prices growth	Change in labor market power	Change in labor productivity	Unaccounted wage change
mean	12.4%	7.4%	-2.3%	0.7%	2.0%
median	12.3%	6.3%	-1.6%	0.3%	1.8%
N	462	462	462	462	462
Average 2018-2019 over Average 2012-2013					
	Wage growth	Prices growth	Change in labor market power	Change in labor productivity	Unaccounted wage change
mean	12.0%	8.2%	-1.1%	0.7%	2.0%
median	11.9%	8.1%	-1.4%	0.5%	1.9%
N	2030	2030	2030	2030	2030

4.3 Do High Price-Markup Firms Pay Higher/Lower Wages?

The final step of our study is to relate wages to price markups. In Figure 4 we present a scatter plot in which a clear positive trend can be seen. This suggests that firms with greater market power pay higher wages.

Figure 4.

To formally test whether higher markup firms pay higher wages, we estimate the following specification:

$$\log (w_{it}) = \alpha_i + \alpha_{st} + \beta log(\mu_{it}) + \gamma X_{it} + \varepsilon_{it}$$

where w_{it} is the average wage paid by firm i at time t, α_i are firm fixed effects, α_{st} are sector-year fixed effects and X_{it} are firm level additional variables to control for characteristics that could affect labor demand (e.g., labor productivity, firm size, the capital to labor ratio). The parameter of interest is β.

Table 4 shows an association between high product market firm markups and higher wages. The estimated elasticity of wages with respect to markups is 0.334. The regression is exploratory, and no causal effect can be deduced, but the evidence presented suggests that a 10 percent increase in price markups would correspond to a 3.3 percent increase in wages. The results are even stronger for the set of continuers, with an elasticity of 0.455.

In the third column we interact the markups regressor with dummies for firm size. We find no differences in the wage-markup elasticity between small and medium firms, but we do find that the elasticity increases for larger firms.

Finally, we run separate regressions for manufacturing, trade and services and find in all cases statistically significant wage to price-markups elasticities that are larger in services than in manufacturing and trade.

In Appendix Figure A6 and Table A4 we reproduce the results for DLW, where we also find statistically significant results.

Table 4. Do Higher Markups Firms Pay Higher Wages?

	All	continuers	Interaction with size	Manufacturing	Trade	Services
Lnmkup	0.334***	0.485***	0.327***	0.304***	0.220***	0.438***
	(0.006)	(0.016)	(0.008)	(0.015)	(0.008)	(0.010)
Meddium	0.059***	-0.013	0.061***	0.066***	0.072***	0.068***
	(0.005)	(0.023)	(0.005)	(0.013)	(0.007)	(0.009)
Large	0.085***	0.004	0.084***	0.135***	0.093***	0.100***
	(0.008)	(0.026)	(0.008)	(0.018)	(0.011)	(0.013)
Meddim* lnmkup			-0.015			
			(0.010)			
Large*lnmkup			0.047***			
			(0.013)			
Ln (capital to labor)	0.121***	0.182***	0.121***	0.129***	0.088***	0.126***
	(0.003)	(0.007)	(0.003)	(0.007)	(0.004)	(0.004)
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	31,579	4,847	31,579	7,276	11,740	12,563
R-squared	0.418	0.529	0.419	0.496	0.568	0.303
Number of id	4,089	398	4,089	898	1,491	1,700

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5. Conclusions

In this study, we estimated market power in the final product market (product markups) and in the labor market (wedge between marginal revenue of labor and wages) using a control function-based estimation method. Our findings align with previous research conducted in Uruguay but differ from those reported for the United States and Germany. Notably, we observed that firm product markups remained relatively constant from 2007 to 2019, while firm wage markdowns exhibited a downward trend.

Given the context of substantial inflation and rising real wages, our results prompt an exploration of the extent to which wage changes can be attributed to shifts in market power versus changes in labor productivity. As expected, we find that a significant portion of the changes in nominal wages correlates with changes in firms' prices. More interesting, in our main estimates we find that that 37 percent of changes in real wages can be explained by a decrease in labor market power (with firms losing market power relative to workers), while 28 percent can be attributed to changes in labor productivity. Additionally, 35 percent of the changes remain unaccounted for in our analysis.

Furthermore, we examined the relationship between wages and market power in the final goods produced by firms. Our results reveal a positive elasticity of wages to markups, estimated to be in the range of 0.2 to 0.4. Although this estimate does not imply a causal relationship, it is consistent with rent-sharing models that suggest an alignment of incentives between employees and employers to extract greater surpluses from consumers.

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Appendix

Table A1. Observations by Sector of Activity

	N	Firms
C. Manufacturing	7,276	898
G. Wholesale and retail trade; repair of motor vehicles and motorcycles	11,740	1,491
H. Transportation and storage	2,924	392
I. Accommodation and food service activities	1,388	187
J. Information and communication	843	122
L. Real estate activities	248	35
M. Professional, scientific and technical activities	908	125
N. Administrative and support service activities	1,450	197
P. Education	1,336	195
Q. Human health and social work activities	2,112	255
R. Arts, entertainment, and recreation	623	84
S. Other service activities	731	108
Total	31,579	4,089

Table A2. Production Function Coefficients by Sector of Activity (based on Wooldridge, 2009) (Av=average, Med=median, sd=standard deviation, RTS=returns to scale, N=observations)

	θ_L			θ_K			θ_M			RTS		
ISIC code	Av	Med	Sd	Av	Med	Sd	Av	Med	Sd	Av	Med	Sd
10	0.17	0.18	0.07	0.13	0.13	0.04	0.73	0.71	0.13	1.03	1.03	0.02
11	0.31	0.32	0.08	0.05	0.05	0.04	0.69	0.69	0.08	0.93	0.93	0.04
13	0.31	0.31	0.14	0.17	0.17	0.10	0.60	0.60	0.10	1.07	1.09	0.12
14	0.25	0.22	0.13	0.14	0.12	0.07	0.69	0.71	0.10	1.05	1.06	0.10
15	0.28	0.23	0.20	0.24	0.21	0.11	0.56	0.48	0.31	0.86	0.86	0.15
16	0.33	0.33	0.11	0.09	0.08	0.03	0.71	0.71	0.13	1.12	1.12	0.05
17	0.21	0.18	0.15	0.16	0.12	0.13	0.52	0.49	0.19	0.90	0.86	0.33
18	0.36	0.35	0.19	0.20	0.22	0.06	0.47	0.44	0.16	0.99	0.99	0.09
20	0.22	0.22	0.04	0.12	0.12	0.03	0.76	0.74	0.17	1.09	1.07	0.14
22	0.24	0.23	0.12	0.11	0.07	0.09	0.77	0.74	0.21	1.15	1.11	0.23
23	0.29	0.28	0.14	0.14	0.15	0.03	0.59	0.60	0.10	1.02	1.03	0.16
24	0.39	0.43	0.21	0.13	0.13	0.08	0.64	0.59	0.30	1.06	1.04	0.07
33	0.73	0.79	0.21	0.09	0.09	0.03	0.40	0.37	0.12	1.23	1.24	0.13
45	0.43	0.43	0.23	0.25	0.23	0.13	0.49	0.47	0.19	1.13	1.12	0.19
46	0.18	0.19	0.07	0.23	0.23	0.05	0.38	0.37	0.11	0.78	0.77	0.07
47	0.48	0.48	0.15	0.08	0.08	0.03	0.40	0.40	0.12	0.95	0.96	0.05
49-53	0.32	0.31	0.11	0.08	0.08	0.03	0.55	0.54	0.11	0.93	0.94	0.11
55	0.37	0.37	0.10	0.13	0.14	0.04	0.50	0.49	0.10	1.00	1.00	0.03
56	0.09	0.10	0.04	0.09	0.07	0.06	0.87	0.88	0.08	1.03	1.04	0.07
59	0.22	0.22	0.02	0.10	0.07	0.06	0.74	0.73	0.08	1.07	1.03	0.12
60	0.41	0.42	0.21	0.22	0.21	0.12	0.42	0.37	0.17	0.95	0.96	0.14
62	0.45	0.43	0.15	0.07	0.06	0.05	0.50	0.50	0.17	0.98	0.98	0.05
68	0.51	0.59	0.23	0.35	0.27	0.25	0.49	0.50	0.20	1.21	1.23	0.08
69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
71	0.36	0.35	0.14	0.12	0.10	0.12	0.58	0.57	0.13	1.01	1.03	0.15
72	0.42	0.46	0.20	0.43	0.37	0.33	0.34	0.35	0.13	1.15	1.13	0.17
73	0.24	0.22	0.12	0.08	0.08	0.04	0.68	0.66	0.08	1.00	0.98	0.18
74	0.55	0.53	0.21	0.33	0.35	0.10	0.52	0.50	0.30	1.31	1.32	0.17
77	0.26	0.23	0.19	0.38	0.40	0.18	0.46	0.46	0.09	1.04	1.01	0.18
79	0.38	0.43	0.17	0.06	0.06	0.03	0.62	0.51	0.22	1.05	1.06	0.07
81	0.47	0.49	0.19	0.09	0.07	0.07	0.35	0.31	0.18	0.92	0.91	0.09
85	0.62	0.62	0.17	0.01	0.03	0.07	0.29	0.28	0.12	0.92	0.99	0.21
86-88	0.4	0.4	0.16	0.07	0.07	0.03	0.42	0.41	0.18	0.89	0.87	0.11
90-93	0.39	0.4	0.16	0.06	0.06	0.02	0.45	0.44	0.1	0.9	0.92	0.13
94-96	0.36	0.38	0.09	0.12	0.13	0.06	0.3	0.31	0.07	0.78	0.82	0.13

Figure A1.

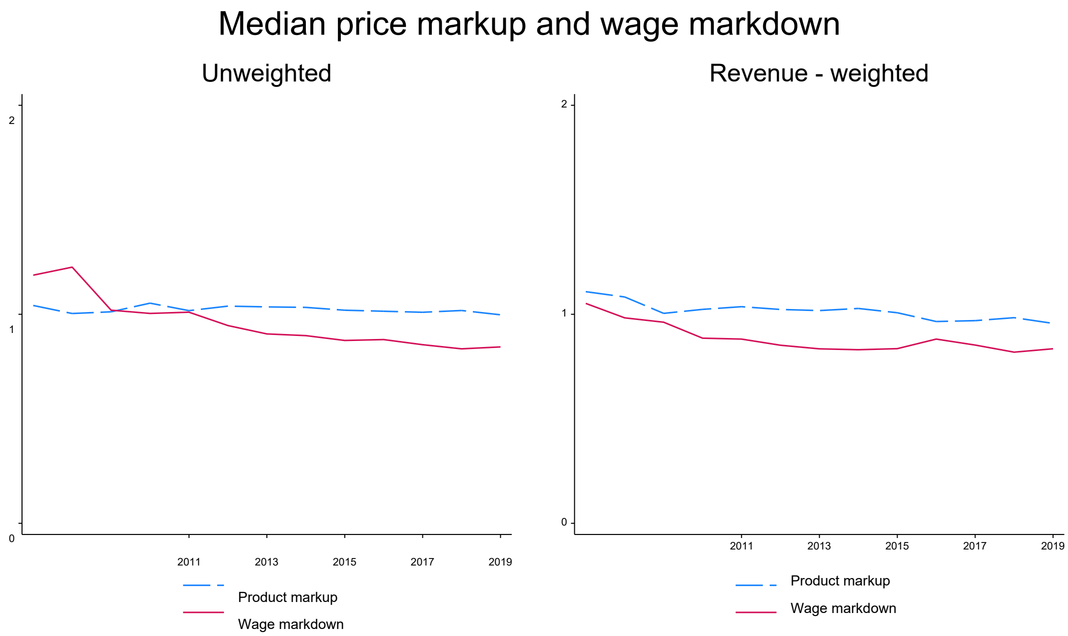

Figure A2.

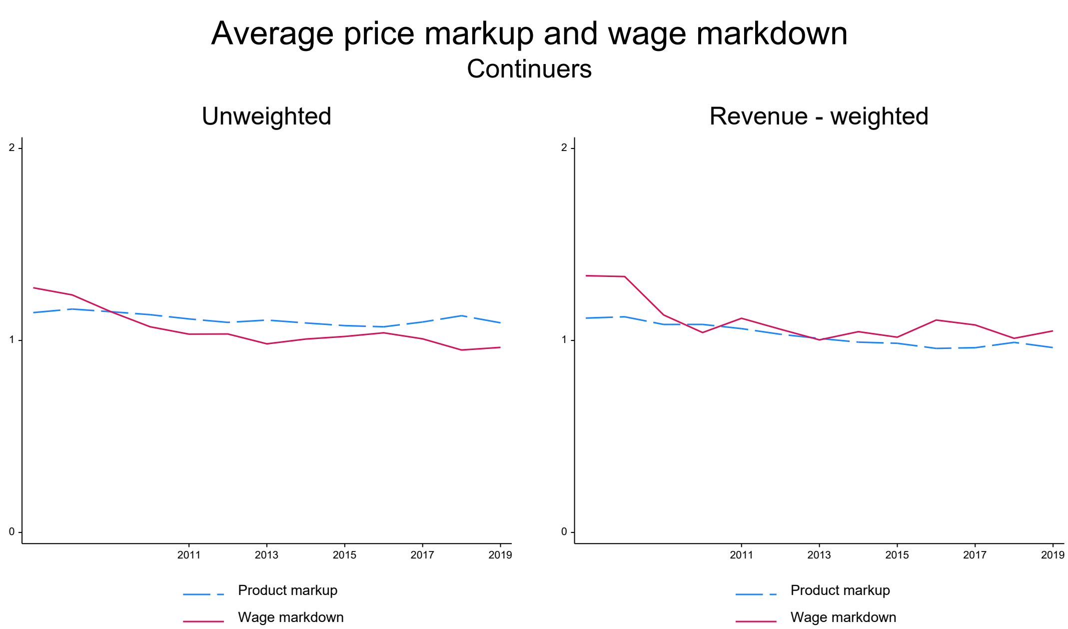

Figure A3.

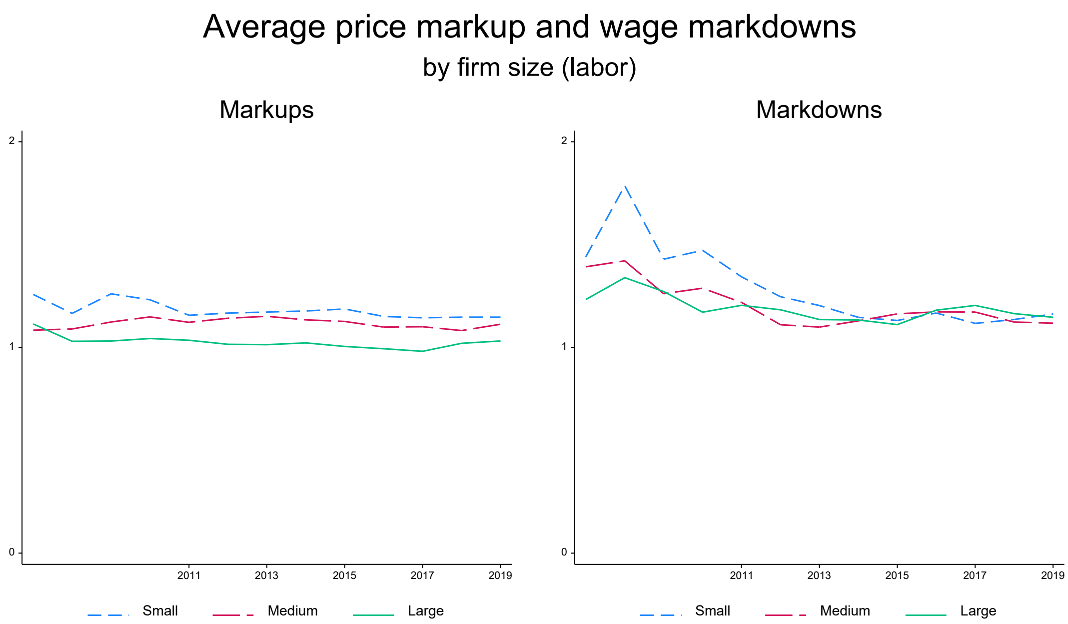

Figure A4.

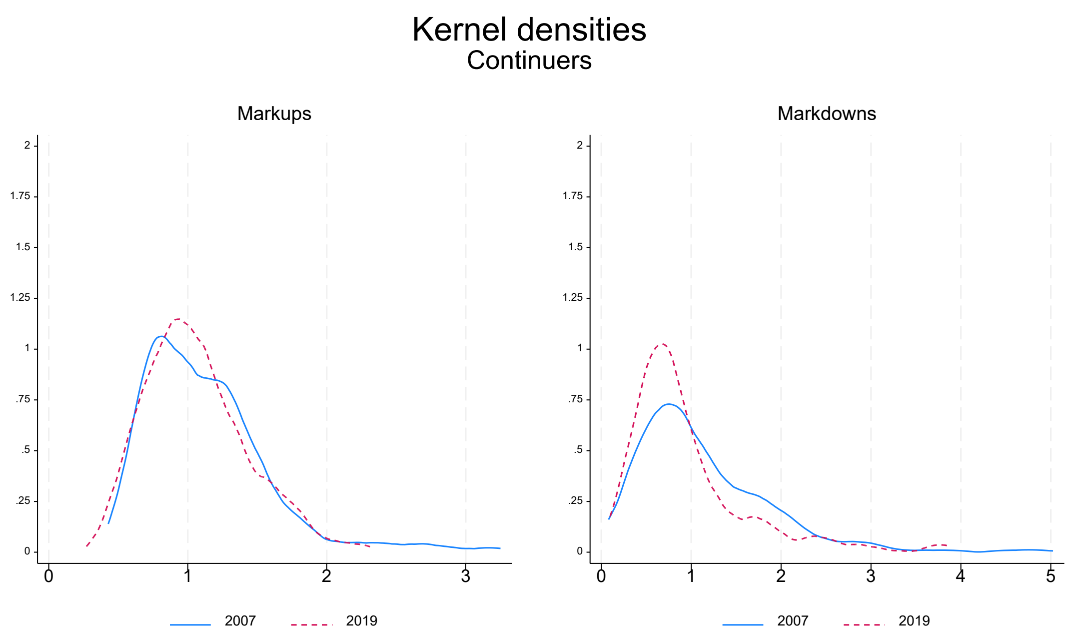

Figure A5.
(using DLW for the production function estimation)

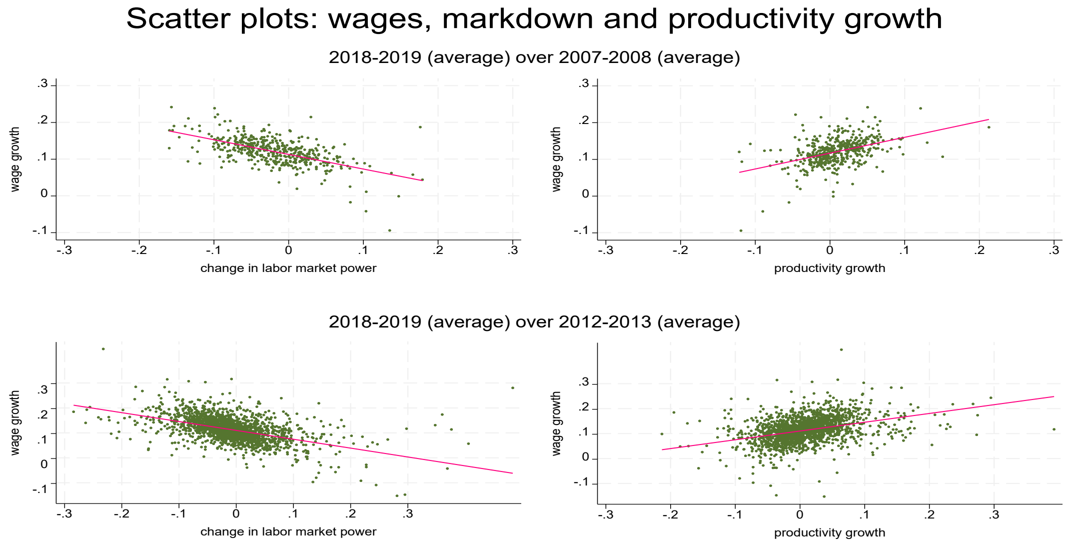

Table A3. Decomposition Results: Robustness
(using DLW for the production function estimation)

	Wage growth	Prices growth	Change in labor market power	Change in labor productivity	Unaccounted wage change
mean	14.0%	7.6%	-2.4%	1.6%	2.3%
median	13.5%	7.6%	-3.3%	1.3%	1.7%
N	3654	3654	3654	3654	3654
By firm size					
Small	13.9%	7.4%	-3.0%	1.5%	2.0%
Medium	14.1%	7.7%	-1.8%	1.9%	2.7%
Large	13.8%	8.2%	-0.5%	1.7%	3.3%

Table A4. Decomposition Results: Robustness
(using DLW for the production function estimation)

	Wage growth	Prices growth	Change in labor market power	Change in labor productivity	Unaccounted wage change
Continuers 2019-2007					
mean	12.1%	7.7%	-1.1%	0.7%	2.7%
median	12.0%	7.0%	-1.0%	0.2%	2.6%
N	384	384	384	384	384
Average 2018-2019 over Average 2007-2008					
	Wage growth	Prices growth	Change in labor market power	Change in labor productivity	Unaccounted wage change
mean	12.3%	7.4%	-2.7%	0.1%	2.1%
median	12.3%	6.3%	-3.2%	0.3%	2.0%
N	447	447	447	447	447
Average 2018-2019 over Average 2012-2013					
	Wage growth	Prices growth	Change in labor market power	Change in labor productivity	Unaccounted wage change
mean	12.1%	8.2%	-1.2%	0.7%	2.0%
median	11.9%	8.1%	-1.3%	0.3%	1.9%
N	1990	1990	1990	1990	1990

Figure A6.

Table A4. Do Higher Markups Firms Pay Higher?
(robustness results using DLW for the production function estimation)

	All	Continuers	Interaction	Manufacturing	Trade	Services
lnmkup	0.191***	0.249***	0.198***	0.200***	0.123***	0.260***
	(0.003)	(0.009)	(0.005)	(0.009)	(0.004)	(0.006)
Medium	0.048***	-0.032	0.053***	0.067***	0.067***	0.042***
	(0.005)	(0.023)	(0.006)	(0.013)	(0.007)	(0.009)
Large	0.073***	-0.012	0.074***	0.144***	0.079***	0.068***
	(0.008)	(0.027)	(0.008)	(0.017)	(0.011)	(0.013)
Medium#co.lnmkup			-0.015**			
			(0.006)			
Large *lnmkup			-0.004			
			(0.007)			
Ln (capital to labor)	0.126***	0.182***	0.126***	0.135***	0.101***	0.118***
	(0.003)	(0.007)	(0.003)	(0.007)	(0.004)	(0.004)
Fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	30,929	4,728	30,929	6,976	11,757	12,196
R-squared	0.428	0.516	0.428	0.525	0.563	0.316
Number of id	3,993	392	3,993	867	1,495	1,631

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1