BIS Working Papers

No 1192

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Monetary and Economic Department

June 2024

JEL classification: E24, E31.

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This publication is available on the BIS website (www.bis.org).

ISSN 1020-0959 (print)
ISSN 1682-7678 (online)

The wage-price pass-through across sectors:
Evidence from the euro area

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May 29, 2024

Abstract

This paper studies the pass-through from wages to producer prices using sectoral disaggregated data for the euro area. We find a positive and statistically significant wage-price pass-through that reaches 50% after three years, which differs across sectors. The wage-price pass-through in private services is significantly higher than in industry and takes longer before reaching its peak. While a higher labour intensity is a key component of the pass-through, our estimates indicate that differences in sectoral labour shares alone cannot explain the larger wage-price pass-through in private services compared to industry. Instead, the estimates hint at an important role for international competition in the domestic market for the tradeable sector. They also suggest that the sales destination matters: wage growth contributes to domestic inflation for goods but not to export inflation. Finally, we also provide evidence of an increase in the wage-price pass-through after 2020, particularly in private services.

Keywords: *inflation dynamics, wage-price pass-through, sectors, international competition.*

JEL Classification: *E24, E31*

Without implicating, we would like to thank Elena Bobeica, Sarah Holton, Philip Lane, Stefano Neri and Cédric Tille for useful comments and suggestions. The views expressed herein belong to the authors only and do not necessarily reflect those of the ECB, the Eurosystem or the Bank for International Settlements.

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1 Introduction

As inflation made a come back with the post-pandemic re-openings in 2021, wage developments also took centre stage. Surprise inflation first eroded real purchasing power, and then prompted central banks and observers to wonder whether wage increases are on the horizon, and the impact these may have on the outlook and on the persistence of inflation looking ahead. In a sense, this mirrors the discussions in the years preceding the pandemic, when central banks had to deal with sluggish growth in prices against the backdrop of strong labour markets. This illustrates how the link between wages and prices, the so-called wage-price pass-through, is a key ingredient to understand inflation developments.

Our paper is the first to study the pass-through from wages to producer prices in the euro area using sectoral disaggregated data. Using this type of data allows us to unveil different dynamics in the wage pass-through in industry as opposed to services, with implications for aggregate inflation dynamics and the current outlook. We also provide evidence of an increase in the wage-price pass-through after 2020, particularly in private services; this could increase the persistence of inflation and make the "last mile" of the ongoing disinflation more challenging (Schnabel, 2023).

We highlight a sizeable wage-price pass-through in the euro area, which stabilises at around 50% after two to three years. This is sensibly larger than the estimates of Heise et al. (2022) and Amiti et al. (2023) for the United States. Moreover, our results reveal considerable sectoral heterogeneity: the wage-price pass-through is significantly higher in the private service sector than in the industry sector, but takes longer to fully materialise. Similar to Heise et al. (2022), we also investigate the causes of a different wage-price pass-through between industry and services. We find that the wage-price pass-through is larger in the most labour intensive sectors, but that differences in sectoral labour shares alone cannot explain the larger wage-price pass-through in private services compared to industry. Instead, our estimates suggest an important role for international competition for the tradeable sector. As for the United States, we find that a higher import penetration in the domestic market lowers the wage-price pass-through in the industrial sector. On top of the channels investigated by Heise et al. (2022), we also identify a new *international* channel at play: the wage-price pass-through in industry matters for domestic sales but not for exports. Hence, wage growth contributes to domestic inflation for goods but not to export inflation, at least in the short-run.

Our results have important policy implications too. If the wage-price pass-through in the service sector is stronger and takes longer to fully unfold compared to the industry sector, policy makers should keep their eyes on sectoral wage developments for the purpose of forecasting inflation. Moreover, changes in the structural features of the economy that underpin the strength of the pass-through – above all labour intensity and the degree of competition – should also be factored in to understand how the degree of transmission from wages to prices might change.

Related literature. Our paper contributes to the literature examining the relation between labour costs and price inflation. In the euro area, Bobeica et al. (2019) document a strong link between labour costs and prices in the four largest countries using aggregate data. Their results also indicate that the pass-through might vary over time and be state-dependent. In particular, the pass-through is significantly larger in high-inflation regimes than in low-inflation regimes. Evidence for the euro area also shows that the wage-price pass-through is smaller in recessions than in expansions (Hahn, 2020). In the United States, Peneva and Rudd (2017) find little evidence that changes in labor costs have a substantial effect on price inflation in recent years. Similarly, Bobeica et al. (2021) document a weakening of the wage pass-through in the United States, and attributes it to better-anchored inflation expectations.

In contrast to the papers mentioned above, our work instead relies on sectoral rather than aggregate data; as such it relates to the recent paper by Heise et al. (2022) on the estimation of the wage pass-through in the United States. Their results also document a weakening pass-through over time, in particular in the goods sector prior to the Covid-19 crisis. They attribute this decline to rising market concentration and increased import competition. Other studies have documented sectoral heterogeneity in inflation dynamics (e.g. Byrne et al., 2013; Imbs et al., 2011) but, to the best of our knowledge, our paper is the first to analyse the pass-through from wages to prices for the euro area using similar sectoral disaggregated data.

Finally, our paper connects to a recent growing literature aiming at better understand wage and price dynamics after the Covid-19 pandemic (Amiti et al., 2021; Arce et al., 2024; Blanchard and Bernanke, 2023; Crump et al., 2022; di Giovanni et al., 2022). In particular, Amiti et al. (2023) show in a theoretical model that a combined increase in input prices and in wages amplify the total pass-through to prices. Their empirical findings using disaggregated sectoral data support the predictions of the model, and show an increase in the wage pass-through after Covid in the United States notably in the goods sector, which was more affected than services by supply chain disruptions. Chin and Lin (2023) also find a rising pass-through from wages to consumer prices after the pandemic. In the euro area and using sectoral data, Acharya et al. (2023) document an increasing inflationary effect, both to producer prices and consumer prices, of supply-chain constraints in manufacturing industries after Covid. Similar evidence has been found for the United States (LaBelle and Santacreu, 2022).

The remainder of the paper proceeds as follows. The next section describes the data and highlights some salient stylized facts regarding inflation and wage dynamics across sectors. Section 3 presents our baseline estimates of the wage-price pass-through. Section 4 explores the drivers of the heterogeneous wage-price pass-through between industry and private services. Section 5 studies the post-pandemic change in the pass-through. Section 6 documents a range of robustness checks and Section 7 concludes.

2 Data collection and stylized facts

2.1 Data collection

We rely on dissagregated economic data at the sectoral level for the euro area from Eurostat. Sectors are defined according to the NACE Rev. 2 nomenclature, which designates the statistical classification of economic activities in the European Union (Eurostat, 2008).[1] We use sectoral data at the 2-digit level, which provide the most granular breakdown with sufficient variable coverage for our analysis. Our final sample consists of 41 sectors for the euro area (see Table A1 in Annex), covering mining (5 sectors), manufacturing (23), utilities (2), construction (1), retail (3), transport (3), accommodation and food services (2) and information and communication (2).

First, we assemble sectoral data at quarterly frequency from the Eurostat's Short-Term Statistics (STS) database. More specifically, we gather indices on producer prices (PPI)[2], import prices of industrial goods[3], turnover, gross wages and salaries and hours worked. Additionally, we collect information on gross value added and on wages and salaries, both in nominal terms and at annual frequency, from the Eurostat's Structural Business Statistics (SBS) database. We also obtain from the Eurostat's Comext database data on international trade in goods (both exports and

[1]NACE is the French acronym for "Nomenclature statistique des Activités économiques dans la Communauté Européenne".

[2]We take the construction cost index for the construction sector (F) and, since producer prices are not available for the retail sector (G), we take the deflator of the turnover index as our price measure for the sectors G45 to G47.

[3]The import prices of industrial goods follow the Eurostat's statistical classification of products by activity (CPA). Import prices are not available for construction and for private services.

imports) at quarterly frequency. Finally, we get information on labour productivity at sectoral level (1-digit level) and quarterly frequency, defined as gross value added (in real terms) per hour worked, from the Eurostat's National Accounts.[4] Our time coverage spans from 2009Q1 to 2023Q2.

We first calculate a sector-level measure of wage growth per hour worked using indices on gross wages and hours worked.[5] In addition, we calculate a sector-specific input price index, defined as the weighted average of the prices of goods and services that are used as intermediate consumption in the production process. Specifically, the input price index is calculated as follows

$$p_{s,t}^{input} = \sum_{i} \bar{\omega}_{s,i}^{imp} p_{s,i,t}^{imp} + \sum_{j \neq s} \bar{\omega}_{s,j}^{d} p_{s,j,t}^{d} \tag{1}$$

where $p_{s,t}^{input}$ is the index of input prices in sector s at time t and $\bar{\omega}_{s,i}^{imp}$ is the time-invariant sector's share of intermediate consumption of an imported good i whereas $\bar{\omega}_{s,j}^{d}$ is the time-invariant sector's share of intermediate consumption of a domestic good or service j.[6] The time-invariant weights are calculated as the average share of intermediate consumption of a imported input i or a domestic input j over the 2009-2020 period using the input-output table from Eurostat (FIGARO tables).[7] The price of domestic goods and services, $p_{s,j,t}^{d}$, corresponds to the PPI across all sectors j that provide inputs to sector s at time t.[8] Specifically, for industrial sectors it corresponds to the PPI of goods sold domestically, and for the other sectors to log PPI.[9] Since we cannot distinguish between the input price of given sector from its output price, we follow Amiti et al. (2023) and omit the domestic input price of sector j that is the same as sector s.[10]

[4]We calculate labour productivity using Eurostat's National Accounts data for the following separate broad 1-digit level sectors at quarterly frequency: industry excluding manufacturing (B-E excluding C), manufacturing (C), construction (F), retail and wholesale trade, transport, food and accommodation services (G-I) and information and telecommunication (J).

[5]Specifically, we take the difference in log terms between the indices on gross wages and the indices on hours worked.

[6]As information on the prices of imported services is not available in Eurostat, we assume that these prices are the same as the domestic prices of services.

[7]We have, for a given sector s, that $\sum_i \bar{\omega}_{s,i}^{imp} + \sum_{j \neq s} \bar{\omega}_{s,j}^{d} = 1$.

[8]PPI indices are not available for financial and insurance activities (K), real estate activities (L), professional, scientific, technical, administration and support service activities (M-N) as well as for public services (O-Q) and other services (R-U). We therefore assign a weight of zero for those sectors.

[9]Domestically produced goods or services can be sold domestically or exported, and the selling prices can differ depending on the sales destination. However, the PPI series for goods sold domestically are only available for the industry sector in Eurostat.

[10]For instance, the weight associated with the consumption of intermediate food products sold by domestic industries will be zero for the manufacturing sector of food products.

2.2 Stylized facts

Table 1: Summary statistics

	Full sample		Pre-Covid		Post-Covid	
	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
All sectors						
PPI inflation	1.6	7.2	0.6	5.6	5.0	10.1
Wage per hour growth	2.3	3.2	2.1	2.8	2.8	4.1
Input price inflation	2.2	6.5	0.8	3.9	6.8	10.0
Industry						
PPI inflation	1.8	7.6	0.6	6.0	5.4	10.5
Wage per hour growth	2.4	3.3	2.3	3.0	2.8	3.9
Input price inflation	2.5	7.2	0.9	4.4	7.6	10.9
Private services						
PPI inflation	1.1	6.1	0.3	4.9	3.7	8.9
Wage per hour growth	2.0	3.0	1.7	2.2	2.8	4.5
Input price inflation	1.7	5.0	0.6	3.0	5.1	7.7

Note: This table reports the summary statistics of the four-quarter change in producer prices, wages per hour worked and input prices for all sectors, and separately for industry and private services. ”Full sample” corresponds to the 2009Q1-2023Q2 sample, ”Pre-Covid” to the 2009Q1-2019Q4 sample and ”Post-Covid” to 2020Q1-2023Q2. Figures are in percentages.

Table 1 provides summary statistics of the four-quarter change in producer prices, wages per hour worked and input prices. The first vertical panel shows simple statistics (mean and standard deviation) across all sectors over the entire sample (2009Q1-2023Q2), and separately for industry and private services.[11] Over this sample, PPI inflation, wage growth and input price inflation were on average higher and more volatile in industry than in private services.

The second and third vertical panels display the figures for the pre-Covid sample (2009Q1-2019Q4) and for the post-Covid sample (2020Q1-2023Q2), respectively. Between 2009 and 2019, the changes in producer prices and in input prices were on average below 1% across sectors, both in industry and private services. Wage growth was on average higher, between 1.7% in private services and 2.3% in industrial sectors. The post-Covid period was marked by a sharp increase in prices. This is reflected in higher PPI inflation, which reached on average 5.4% in industry and 3.7% in private services, and in higher input price inflation (on average 7.6% in industry and 5.1% in private services). Labour costs and input costs growth also increased significantly after the pandemic for all sectors, from 2.1% to 2.8% and from 0.8% to 6.8%, respectively.

[11] Specifically, industry includes mining, manufacturing and utilities and private services include retail and wholesale trade, transport, accommodation and food services and information and communication.

Figure 1 shows the median growth in wages and prices for all sectors, and separately for industry and private services. PPI inflation and input prices were closely related before the pandemic, but input prices increased relatively more after 2020 due to energy and supply chain disruptions. The increase was less pronounced in private services. By contrast, wages in private services moved more in line with producer prices before 2020 and grew lately at a faster pace than in industry.

Figure 1: Sectoral wage and price dynamics in the euro area

Note: The figure represents the median growth increases in producer prices, input prices and wage per hour worked in euro area sectors. The industry sector comprises mining (B), manufacturing (C), electricity (D) and water (E). Private services include wholesale and retail trade (G), transportation (H), accommodation and food services (I), and information and communication (J) (see Table A1).

3 Estimating the wage pass-through in the euro area

3.1 Baseline results

We first examine the response of producer prices to changes in wages using 2-digit sector-level data for the euro area at quarterly frequency over the 2009Q1-2023Q2 sample. We estimate the following wage-price pass-through equation for different time windows $h = 1, \ldots, 20$

$$\begin{aligned} \Delta_{t-h,t} \ln(p_{s,t}) =& \beta_h \Delta_{t-h,t} \ln(w_{s,t}/h_{s,t}) + \gamma_h \Delta_{t-h,t} \ln(p^{input}_{s,t}) \\ &+ \zeta_h \Delta_{t-h,t} \ln(A_{\bar{s},t}) + \nu_h \Delta_{t-h,t} \ln(y_{s,t}) + \delta_s + \rho_t + \varepsilon_{s,t} \end{aligned} \quad (2)$$

where the dependent variable $\Delta_{t-h,t} \ln(p_{s,t})$ represents the log change in producer price of a given 2-digit sector s between time $t-h$ and t. Our main variable of interest, $\Delta_{t-h,t} \ln(w_{s,t}/h_{s,t})$, corresponds to the change in hourly wages over the same time horizon: its coefficient β_h measures the wage-price pass-through after h quarters. Following Amiti et al. (2023), we also include the log change in input prices, denoted $p^{input}_{s,t}$, whose coefficient γ_h represents the pass-through of input prices to producer prices in sector s after h quarters.

In the regression, we also control for changes in labour productivity, measured by the log change of gross value added per hour worked and denoted $A_{\bar{s},t}$. Sectoral labour productivity at quarterly frequency is only available at the 1-digit level in Eurostat. Hence, for any given 2-digit sector s, we employ the change in labour productivity growth of the corresponding 1-digit sector $\bar{s}$. We also control for developments in economic activity, measured by nominal sales growth $y_{s,t}$.[12]

Finally, we include a set of sector fixed effects, δ_s, to capture time-invariant sector-specific characteristics. Importantly, we also include a set of time fixed effects, ρ_t, to control for aggregate macroeconomic and financial developments. In particular, the time fixed effects allows for a better identification of the wage pass-through as they absorb the potential effects of aggregate inflation developments, as well as changing inflation expectations. The observations are weighted by gross value added in 2012 and we employ Driscoll and Kraay (1998)'s standard errors with bandwidth two quarters to account for cross-sectional and temporal correlation.[13]

Table 2 presents the estimates of our baseline regression, with the columns reporting the results for different time windows. The coefficients associated with our main variable of interest, β_h, hint at a positive and statistically significant effect of wage growth on PPI inflation for most time windows, as also visualised graphically in Figure 2a. The pass-through gradually increases to around 40% over a eight-quarter period. This implies that a 10% cumulated increase in wage growth over two years is associated with a cumulated increase of 4.1% in producer prices. The effect then reaches its peak at 50% after three years and stabilises at this level for longer time windows.[14] These estimates are quantitatively larger than the pass-through estimates for the United States based on similar disaggregated sectoral

[12]Turnover (sales) series are not available for utilities and construction. We use instead production, available in volumes as indices from Eurostat. We calculate the production growth series in nominal terms by using the growth in the price deflator for industry (B-E) and for construction (F) from the Eurostat's National Accounts.

[13]We also winsorize the observations at the 1% and 99% levels.

[14]The estimates for the pre-Covid period (2009Q1-2019Q4) also show a gradual but slower increase in the wage-price pass-through, which stabilises at around 33% over a three-year time window (see Section 6).

Table 2: Estimates of the pass-through from wage growth to PPI inflation

Dependent variable: Log producer price change between t-h and t					
	h=4	*h*=8	*h*=12	*h*=16	*h*=20
$\Delta_{t-h,t}\ln(w/h)$	0.242***	0.406***	0.502***	0.432***	0.501***
	[0.069]	[0.110]	[0.084]	[0.102]	[0.116]
$\Delta_{t-h,t}\ln(p^{input})$	0.687***	0.772***	0.758***	0.778***	0.845***
	[0.042]	[0.048]	[0.047]	[0.058]	[0.071]
$\Delta_{t-h,t}\ln(A)$	-0.395***	-0.467***	-0.355***	-0.328***	-0.358***
	[0.061]	[0.100]	[0.086]	[0.073]	[0.080]
$\Delta_{t-h,t}\ln(y)$	0.211***	0.213***	0.217***	0.214***	0.217***
	[0.024]	[0.023]	[0.018]	[0.018]	[0.020]
Time FE	Y	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y	Y
N	2174	2018	1862	1706	1550
R^2 (within)	0.45	0.51	0.55	0.55	0.54

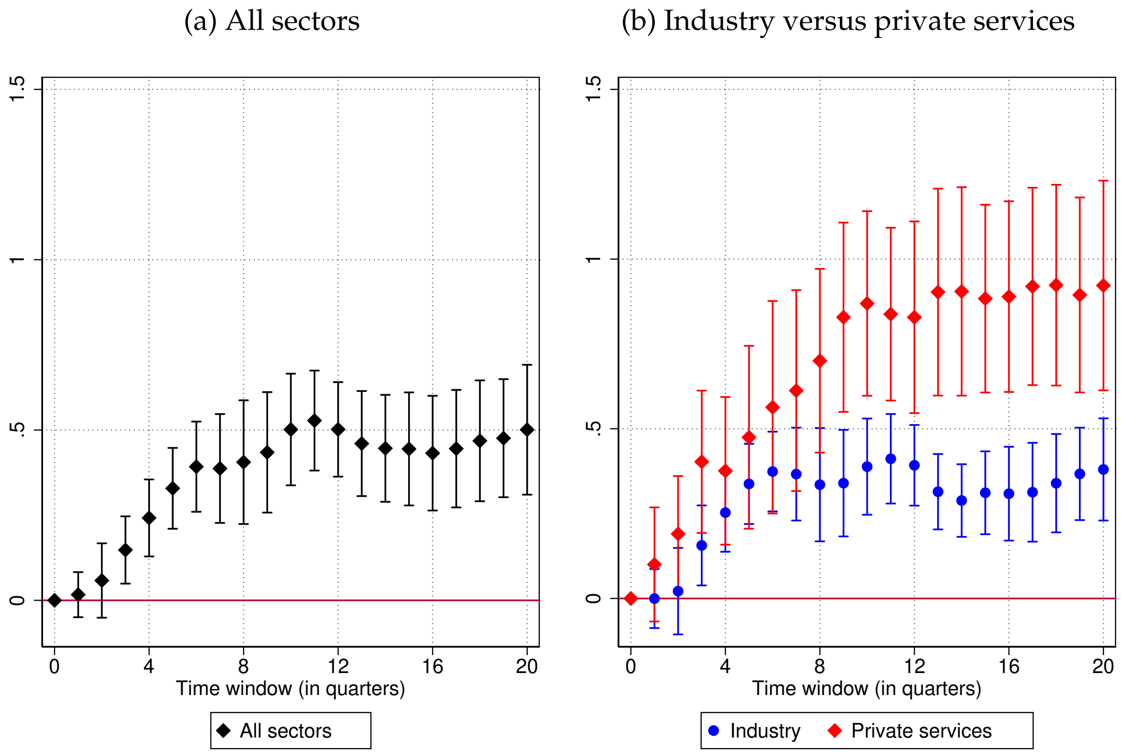
Note: This table reports the estimates of equation 2 over the 2009Q1-2023Q2 period for different window lengths. Driscoll and Kraay standard errors are reported in brackets.
* / ** / *** indicate 10% / 5% / 1% significance level.

data[15] (Amiti et al., 2023; Chin and Lin, 2023; Heise et al., 2022), but are in line with existing empirical evidence for the euro area based on aggregate macroeconomic data (Bobeica et al., 2019).

Looking at the other covariates, we also find a relatively large and significant pass-through from changes in input prices to PPI inflation. Specifically, a 10% increase in input prices is associated with an increase in 6.9% in producer prices after one year. The coefficient increases slightly in the following quarters to stabilize at around 0.77 for higher time windows. As expected, the coefficients associated with labour productivity growth are negative and statistically significant, whereas the coefficients associated with sales are positive and also statistically significant. Specifically, over a four-quarter period, a 10% increase in labour productivity is associated with a 4% decline in prices, and a 10% increase in economic activity translates into a 2% change in prices.

[15] For example, Heise et al. (2022) find a pass-through of 12% after two years over the 2003-2016 period.

Figure 2: Wage-price pass-through for different time windows



Note: The left-hand side panel reports the estimates of β_h from equation 2 for time window $h = 0, \ldots, 20$ quarters whereas the right-hand side panel reports the estimates of β_h from equation 2 separately for industry and private services. Vertical axis refers to the response of a 1% increase in cumulated wage growth on cumulated producer price inflation. Horizontal axis refers to the window length (in quarters). Solid line denotes point estimates and shaded area denotes 90% confidence bands.

3.2 Sectoral heterogeneity in the pass-through

There are a few structural reasons that may make the wage-price pass-through significantly different across sectors; this is especially so when comparing industries and private services. First of all, different sectors have different degrees of labour input; specifically, private services tend to more labour-intensive than industrial sectors. Hence, mechanically, firms in the services sector tend to face higher pressures from rising labour costs. On top of that, the ability of firms to pass on increases in their input costs also depends on the degree of competition in the market in which they operate; this tends to vary across sectors. Competition has a domestic facet, which relates to the market concentration across different sectors. But it has also an international dimension due to competition from foreign firms. External competition is obviously more pronounced in tradable sectors, hence firms in the industrial sector typically face more constraints limiting their market power. The effects of external competition can even be more pronounced for those firms that sell part of their production abroad, in more competitive markets: their capacity to pass on wage increases to their selling prices could be even more compromised.

We investigate this question for the euro area by estimating our baseline equation 2 separately for the industrial and for the private service sectors. Specifically, for industry, our sample includes mining, manufacturing and utilities. For private services, our sample covers retail and wholesale trade, transport, accommodation and food services and information and communication.

Table 3: Pass-through for industry versus private services

Dependent variable: Log producer price change between t-h and t								
	Industry				**Private services**			
	h=4	h=8	h=12	h=20	h=4	h=8	h=12	h=20
$\Delta_{t-h,t}\ln(w/h)$	0.253***	0.335***	0.392***	0.380***	0.376***	0.700***	0.829***	0.922***
	[0.070]	[0.101]	[0.072]	[0.091]	[0.132]	[0.164]	[0.171]	[0.187]
$\Delta_{t-h,t}\ln(p^{input})$	0.957***	1.016***	0.951***	1.051***	-0.134	-0.044	-0.036	0.107
	[0.051]	[0.052]	[0.073]	[0.089]	[0.117]	[0.125]	[0.132]	[0.159]
$\Delta_{t-h,t}\ln(A)$	-0.185	-0.494*	-0.503**	-0.403	0.380	0.390	-0.269	-0.263
	[0.179]	[0.275]	[0.202]	[0.307]	[0.266]	[0.407]	[0.418]	[0.452]
$\Delta_{t-h,t}\ln(y)$	0.192***	0.197***	0.201***	0.195***	0.409***	0.431***	0.435***	0.427***
	[0.018]	[0.018]	[0.021]	[0.018]	[0.064]	[0.073]	[0.059]	[0.073]
Time FE	Y	Y	Y	Y	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y	Y	Y	Y	Y
N	1616	1504	1392	1168	500	460	420	340
R^2 (within)	0.58	0.63	0.67	0.64	0.45	0.46	0.48	0.47

Note: This table reports the estimates of equation 2 over the 2009Q1-2023Q2 period. Industry comprises mining (5 sectors), manufacturing (23) and utilities (2). Private services include retail (3), transport (3), accommodation and food services (2) and information and communication (2). Driscoll and Kraay standard errors are reported in brackets.
* / ** / *** indicate 10% / 5% / 1% significance level.

Results (Table 3) hint at very different dynamics between industry and private services. In the short-run, the wage pass-through builds up gradually in both sectors, as visualised in Figure 2b. Over a one-year horizon, it reaches 25% in industry and 38% in private services, yet these estimates are not statistically different between the two sectors. The dynamics then start to diverge thereafter. After one year and a half, the pass-through of wages to prices in industries stabilises between 35% and 40% and remains at this level over longer time windows. In contrast, it takes one additional year for wage growth in services to fully deploy its effects on prices. The pass-through is indeed estimated to be nearly full (86%) over a horizon of two years and a half. At this horizon, the estimated pass-through in services is twice as large and significantly different in a statistical sense compared to that in the industrial sector. These results are consistent with the evidence for the United States, also suggesting a larger pass-through in the service sector compared with manufacturing (Heise et al., 2022).

The estimates of the other covariates also hint to different dimensions of heterogeneity across sectors. In particular, the pass-through of input prices differs significantly between industry and private services, highlighting the larger role played by intermediate inputs in the cost structure of industrial firms. Specifically, the estimates indicate a full pass-through in industrial sectors at all time horizons, while the pass-through is insignificant and close to zero for private services. In addition, the estimates suggest a different sensitivity of prices to sector-specific slack conditions: the coefficients associated with sales growth are twice as large in private services as in industry. Finally, changes in labour productivity do not affect price dynamics in services, while they do in industry, albeit in the medium-term, over a two to three year horizon. This suggests that productivity gains lead industrial firms to try to become more competitive by lowering their prices, while the same does not occur in services. Again, this may reflect an overall less competitive market in services.

3.3 The role of inflation expectations

The use of sector and time fixed effects as well as the inclusion of a rich set of control variables mitigates some endogeneity concerns. That said, estimates cannot be interpreted as a causal relationship between wage growth and PPI inflation. For instance, while the time fixed effects control for common inflation expectations of firms or households, sector-specific price or wage changes can still be influenced by sector-specific inflation expectations, which could therefore bias our estimates. In this regard, we exploit the European Commission's Business and Consumer Survey that reports information on short-term selling price expectations at the 2-digit sectoral level. However, these data are available only for private services and for manufacturing sectors.[16]

We therefore augment our baseline equation 2 by adding a sector-specific measure on short-term selling price expectations. This measure represents the net percentage of firms (on balance) expecting selling prices to increase in the next 3 months in a given sector s and varies over time (see details in Annex A.3).

[16]We cover more than 80% of the sectors of our original sample as information on expectations for mining and utilities are not available. In addition, we calculate an average for transport services (for which data on selling price expectations are available) and therefore assume that selling price expectations are common to all transport services (H50-H53).

Table 4: Pass-through controlling for selling price expectations

Dependent variable: Log producer price change between t-4 and t	All sectors		Manufacturing		Private services	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta_{t-h,t}\ln(w/h)$	0.30***	0.30***	0.29***	0.29***	0.38***	0.40***
	[0.098]	[0.097]	[0.062]	[0.060]	[0.13]	[0.13]
Selling price exp.		0.0074		0.022		0.21***
		[0.013]		[0.014]		[0.034]
$\Delta_{t-h,t}\ln(p^{input})$	0.54***	0.54***	0.94***	0.93***	-0.13	-0.35***
	[0.042]	[0.039]	[0.047]	[0.046]	[0.12]	[0.11]
$\Delta_{t-h,t}\ln(s)$	0.17***	0.17***	0.15***	0.15***	0.41***	0.39***
	[0.038]	[0.041]	[0.025]	[0.027]	[0.064]	[0.066]
Time FE	Y	Y	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y	Y	Y
N	1884	1884	1326	1326	500	500
R^2 (within)	0.38	0.38	0.63	0.63	0.45	0.54

Note: This table reports the estimates of equation 2 for $h = 4$ over the 2019Q1-2023Q2 period when controlling for selling price expectations. The coefficients associated with productivity growth for private services are not shown for readability. Driscoll and Kraay standard errors are reported in brackets.
* / ** / *** indicate 10% / 5% / 1% significance level.

The first two columns of Table 4 report the estimates for all sectors over a one year time window. Although the sectoral coverage differs, the wage-price pass-through is close to our benchmark results (30% versus 24%, see Table 3) and is not affected by the inclusion of selling price expectations, as shown in Column 2. The estimates reported in Column 3 and 4 show that the results are also consistent for manufacturing sectors (29% versus 25%) with or without selling price expectations; their coefficients are positive but not statistically significant. Turning to private services, the estimates shown in Columns 5 and 6 suggest that the wage pass-through is larger than in industry and is robust to the inclusion of selling price expectations: the associated coefficient is positive and statistically significant at the 1% level. The estimate implies that an increase by 10 percentage point of the net percentage of firms expecting their selling prices to increase in the next 3 months is associated with an increase in producer prices by 2.1% over a four-quarter period. These findings also hold for longer time windows (see Table A4 in Annex).

Overall, these results suggest a significantly lower wage-price pass-through (yet statistically different from zero) in industry than in private services, even when controlling for short-term selling price expectations. This contrasts with the empirical findings for the United States, where the pass-through in the manufacturing sector was been found to be insignificant over all time horizons (Heise et al., 2022). However, the relatively higher pass-through in the service sector is a consistent finding in both economic areas and we explore in the next section the drivers of this heterogeneity.

4 Explaining the drivers of sectoral differences in the pass-through

As anticipated above, differences in the pass-through across sectors are likely underpinned by structural factors: some relate to differences in the production process (most importantly, the share of labour input), while others to the different degree of competition. This section tries to shed light on the relative importance of such factors by examining fourth complementary hypotheses that may rationalise the larger wage-price pass-through in private services than in industry. The first one relates the heterogeneous pass-through to different labour shares. The other ones explore different aspects of the degree of competition. One investigates differences in domestic market concentration. Another one examines the role of international competition in industrial sectors. The last one explores whether the wage-price pass-through for industrial sectors depends on the sales destination.

4.1 Sectoral labour shares

Private services sectors tend to be more labour-intensive than industrial sectors (see evidence for the euro area in Figure A1 in Annex). As a result, the higher pass-through, i.e. a higher change of selling price for a given change in wages, observed in private services could simply reflect sectoral differences in labour costs. To investigate this hypothesis, we modify our baseline equation by conditioning our main variable of interest by a sector-specific measure of wage (labour) share

$$\begin{aligned}\Delta_{t-h,t}\ln(p_{s,t}) =& \beta_h \bar{WS}_s \Delta_{t-h,t}\ln(w_{s,t}/h_{s,t}) + \gamma_h \Delta_{t-h,t}\ln(p_{s,t}^{input}) \\ &+ \zeta_h \Delta_{t-h,t}\ln(A_{\bar{s},t}) + \nu_h \Delta_{t-h,t}\ln(y_{s,t}) + \delta_s + \rho_t + \varepsilon_{s,t}\end{aligned} \tag{3}$$

where $\bar{WS}_s$ is the sector-specific (at 2-digit level) wage share, defined as the ratio between wages and salaries and gross value added, taken on average over time.[17] In this specification, β_h captures the wage pass-through conditional on the

[17] The Eurostat's Structural Business Statistics database only provide information for all 2-digit sectors at annual frequency from 2009 to 2020. For this reason, and as wage shares are relatively stable over time, we calculate an average of the wage share between 2009 and 2020.

wage share. In other words, it indicates the wage pass-through, would the wage share be 100 percent. We estimate equation 3 for all sectors, and separately for industry and private services, over a four-quarter period. Intuitively, an equivalent estimate of β_h between the two sectors would indicate that the different wage pass-through is merely explained by differences in labour shares.

Table 5: Pass-through conditional on the labour share

Dependent variable: Log producer price change between t-4 and t						
	All sectors		**Industry**		**Private services**	
	(w/o)	(w/)	(w/o)	(w/)	(w/o)	(w/)
$\Delta_{t-h,t}\ln(w/h)$	0.24***		0.25***		0.38***	
	[0.069]		[0.070]		[0.13]	
$\Delta_{t-h,t}\ln(w/h)\times \bar{W}S$		0.53***		0.52***		0.86***
		[0.14]		[0.13]		[0.24]
$\Delta_{t-h,t}\ln(p^{input})$	0.69***	0.69***	0.96***	0.96***	-0.13	-0.10
	[0.042]	[0.042]	[0.051]	[0.051]	[0.12]	[0.11]
$\Delta_{t-h,t}\ln(A)$	-0.39***	-0.39***	-0.18	-0.18	0.38	0.36
	[0.061]	[0.062]	[0.18]	[0.18]	[0.27]	[0.27]
$\Delta_{t-h,t}\ln(s)$	0.21***	0.21***	0.19***	0.20***	0.41***	0.41***
	[0.024]	[0.024]	[0.018]	[0.018]	[0.064]	[0.060]
Time FE	Y	Y	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y	Y	Y
N	2174	2174	1616	1616	500	500
R^2 (within)	0.45	0.45	0.58	0.58	0.45	0.46

Note: This table reports the estimates of equation 3 for $h = 4$ over the period 2009Q1-2023Q2. Driscoll and Kraay standard errors are reported in brackets.
* / ** / *** indicate 10% / 5% / 1% significance level.

The coefficients (Table 5) remain positive and statistically significant for all sectors, and for both industry and private services taken separately. The first two columns suggest that the wage-price pass-through is larger in the most labour-intensive sectors. In particular, the pass-through reaches 53% when the wage share is 100 percent. However, it remains lower in industry than in private services for a given labour share. In particular, the pass-through reaches 52% after one year in industrial sectors, whereas almost full wage pass-through (86%) is achieved in private services when the labour share is 100 percent. The results are robust at longer time horizons (see Table A2 in Annex).

These findings are consistent with the results of Heise et al. (2022) and suggest that, while labour-intensive sectors pass on relatively more increases in wage costs, differences in sectoral labour shares alone cannot explain the larger wage pass-through in private services compared to industry. This calls for a closer inspection of the channels related to competition.

4.2 Market concentration

The extent to which firms pass-on wage increases to producer prices might also depend on their market power. Empirical evidence for the United States shows that a high degree of market concentration is associated with a lower wage pass-through (Heise et al., 2022). The main theoretical mechanism behind this effect postulates that large firms have higher markups and can therefore maintain more stable prices by absorbing increases in input costs. While market power and economic dynamism declined substantially in the United States over the last decades, they remained broadly stable in the euro area (Autor et al., 2020; Cavalleri et al., 2019; Loecker et al., 2020; Philippon and Gutierrez, 2018). To check whether differences in market concentration could explain the lower pass-through for industrial sectors in the euro area compared to the United States, we construct a sector-specific measure of market share using information from the Eurostat's Structural Business and Statistics database. More specifically, this measure is calculated as the market share (in terms of turnover) of firms with 250 or more employees. Annex Figure A2 shows that, while market concentration is heterogeneous across sectors, there is no clear evidence that it differs substantially between industry and private services.[18]

Paralleling our analysis in Section 4.1, we augment our baseline model by conditioning our main variable of interest by the sector-specific measure of market share

$$\begin{aligned}\Delta_{t-h,t}\ln(p_{s,t}) =& \beta_h \bar{M}S_s \Delta_{t-h,t}\ln(w_{s,t}/h_{s,t}) + \gamma_h \Delta_{t-h,t}\ln(p_{s,t}^{input}) \\ &+ \zeta_h \Delta_{t-h,t}\ln(A_{\bar{s},t}) + \nu_h \Delta_{t-h,t}\ln(y_{s,t}) + \delta_s + \rho_t + \varepsilon_{s,t}\end{aligned} \tag{4}$$

where $\bar{M}S_s$ is the sector-specific (at 2-digit level) market share in terms of turnover of firms with 250 or more employees, taken on average over time.[19] In this framework, β_h captures the wage pass-through when the market share of large firms is 100 percent.

The first two columns of Table 6 indicate that a higher market concentration is associated with a higher wage-price pass-through. Specifically, the conditional

[18] For instance, market concentration is on average relatively elevated in manufacturing, utilities, as well as in transport and information and communication. By contrast, market concentration is lower in mining, retail and wholesale trade and in accommodation and food services.

[19] As for the wage share, the Eurostat's Structural Business Statistics database only provide information for all 2-digit sectors at annual frequency from 2009 to 2020.

Table 6: Pass-through conditional on market share

Dependent variable: Log producer price change between t-4 and t

	All sectors		**Industry**		**Private services**	
	(w/o)	(w/)	(w/o)	(w/)	(w/o)	(w/)
$\Delta_{t-h,t}\ln(w/h)$	0.24***		0.25***		0.38***	
	[0.069]		[0.070]		[0.13]	
$\Delta_{t-h,t}\ln(w/h)\times\bar{MS}$		0.48***		0.36***		0.95***
		[0.082]		[0.082]		[0.28]
$\Delta_{t-h,t}\ln(p^{input})$	0.69***	0.69***	0.96***	0.96***	-0.13	-0.13
	[0.042]	[0.042]	[0.051]	[0.052]	[0.12]	[0.12]
$\Delta_{t-h,t}\ln(A)$	-0.39***	-0.37***	-0.18	-0.20	0.38	0.38
	[0.061]	[0.062]	[0.18]	[0.18]	[0.27]	[0.28]
$\Delta_{t-h,t}\ln(s)$	0.21***	0.22***	0.19***	0.20***	0.41***	0.40***
	[0.024]	[0.024]	[0.018]	[0.019]	[0.064]	[0.069]
Time FE	Y	Y	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y	Y	Y
N	2174	2174	1616	1616	500	500
R^2 (within)	0.45	0.46	0.58	0.58	0.45	0.45

Note: This table reports the estimates of equation 4 for $h = 4$ for the 2009Q1-2023Q2 period. Driscoll and Kraay standard errors are reported in brackets.
* / ** / *** indicate 10% / 5% / 1% significance level.

wage pass-through is 48% on average across sectors when the market share of large firms is 100%. Consistent with this, the wage pass-through is also higher for a higher market share of large firms in both industry and private services, as shown in the last four columns of Table 6. However, the wage pass-through remains relatively higher in private services than in industry for a given market share of large firms. These results are consistent at longer time horizons (see Table A3 in Annex).

4.3 Import competition

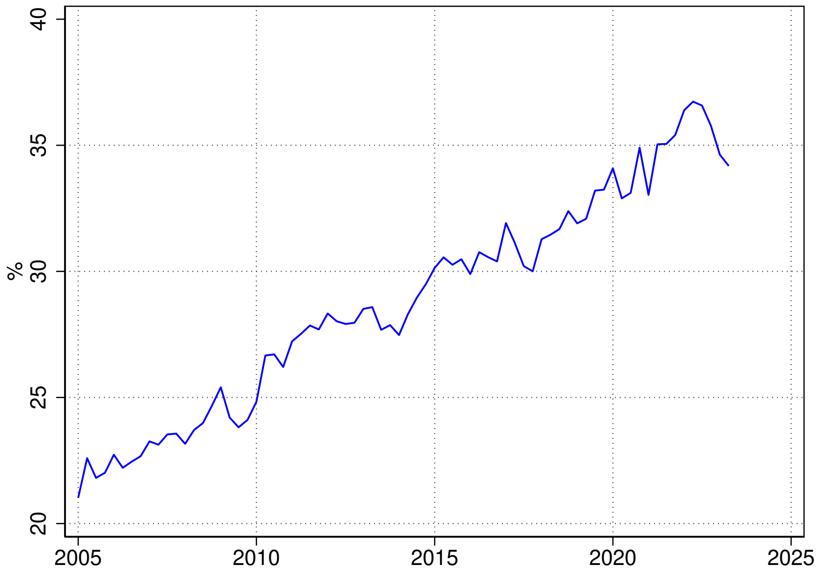
Globalisation has been shown to matter for inflation dynamics and the slope of the Phillips curve (Borio and Filardo, 2007; Forbes, 2019; Guerrieri et al., 2010; Kohlscheen and Moessner, 2022). In the United States, evidence shows for instance that import competition exerts downward price pressures in manufacturing industries, and has contributed to the decline in the wage-price pass-through over time (Amiti et al., 2023; Auer and Fischer, 2010; Heise et al., 2022). On the other hand, private services tend to be more domestically oriented.

To study this third hypothesis, we calculate a sector-specific measure of import for industrial sectors[20], defined as

$$IP_{s,t} = \frac{\text{Imports}_{s,t}}{(\text{Sales}_{s,t} - \text{Exports}_{s,t}) + \text{Imports}_{s,t}}$$

where the imports and exports are retrieved from the Eurostat's Comext database and follow the classification of products by activity (CPA).[21] The sales correspond to the total value of market sales of industrial goods.[22] $IP_{s,t}$ therefore captures the share of domestic consumption, measured by domestic sales plus imports, of industrial goods for a given sector s that is satisfied by imports at time t.

Figure 3: Import penetration in euro area industrial sectors



Note: The figure represents the median import penetration across 2-digit industrial sectors. The import penetration is calculated as the ratio between imports and the sum of domestic sales and imports.

Figure 3 shows the median import penetration for euro area industrial sectors over time. Import penetration has risen substantially over the past two decades and increased from around 20% in 2005 to 35% in 2020. In addition, the degree

[20]The industrial sectors correspond to mining, manufacturing and electricity and gas. For electricity and gas, we use production as turnover series are not available for utilities. Information on trade flows are not available at a dissaggregated sectoral level for water supply and for private services.

[21]This classification is related to the activities as defined by the NACE classification. We seasonally adjust the import and export series using X-13 ARIMA procedure.

[22]We combine annual information from the Structural Business Statistics on turnover values in nominal terms and quarterly information the Short-Term Statistics on turnover growth rates to obtain turnover series in nominal terms at the 2-digit level at quarterly frequency for euro area industries.

to which industrial sectors are exposed to import competition varies considerably across sectors. In the industrial sectors the most exposed, corresponding to the 75th percentile of the sample distribution, the penetration was on average 73% over the 2019Q1-2023Q2 period, whereas it was 16% for the less exposed industrial sectors.

Table 7: Pass-through in industrial sectors conditional on import penetration

Dependent variable: Log producer price change between t-4 and t	(1)	(2)	(3)	(4)	(5)
$\Delta_{t-h,t}\ln(w/h)$	0.27***	0.53***	0.42***		
	[0.071]	[0.11]	[0.087]		
$\Delta_{t-h,t}\ln(w/h)\times IP$		-0.66***			
		[0.22]			
$\Delta_{t-h,t}\ln(w/h)\times$ *High IP*			-0.29**		
			[0.11]		
$\Delta_{t-h,t}\ln(w/h)\times WS$				1.02***	0.85***
				[0.17]	[0.15]
$\Delta_{t-h,t}\ln(w/h)\times IP\times WS$				-1.27***	
				[0.34]	
$\Delta_{t-h,t}\ln(w/h)\times$ *High IP* $\times WS$					-0.60***
					[0.15]
$\Delta_{t-h,t}\ln(p^{input})$	0.94***	0.94***	0.96***	0.95***	0.96***
	[0.048]	[0.048]	[0.052]	[0.048]	[0.052]
$\Delta_{t-h,t}\ln(A)$	-0.19	-0.21	-0.21	-0.19	-0.20
	[0.18]	[0.18]	[0.18]	[0.18]	[0.19]
$\Delta_{t-h,t}\ln(s)$	0.20***	0.20***	0.20***	0.21***	0.20***
	[0.020]	[0.020]	[0.019]	[0.019]	[0.018]
Time FE	Y	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y	Y
N	1508	1508	1508	1508	1508
R^2 (within)	0.59	0.59	0.59	0.59	0.59

Note: This table reports the estimates of equation 5 for $h = 4$ over the 2009Q1-2023Q2 period. *High IP* corresponds to a dummy variable that takes 1 if the import penetration is above the median across industrial sectors in a given quarter. The coefficients associated with *IP* and *High IP* are not shown for readability. Driscoll and Kraay standard errors are reported in brackets.
* / ** / *** indicate 10% / 5% / 1% significance level.

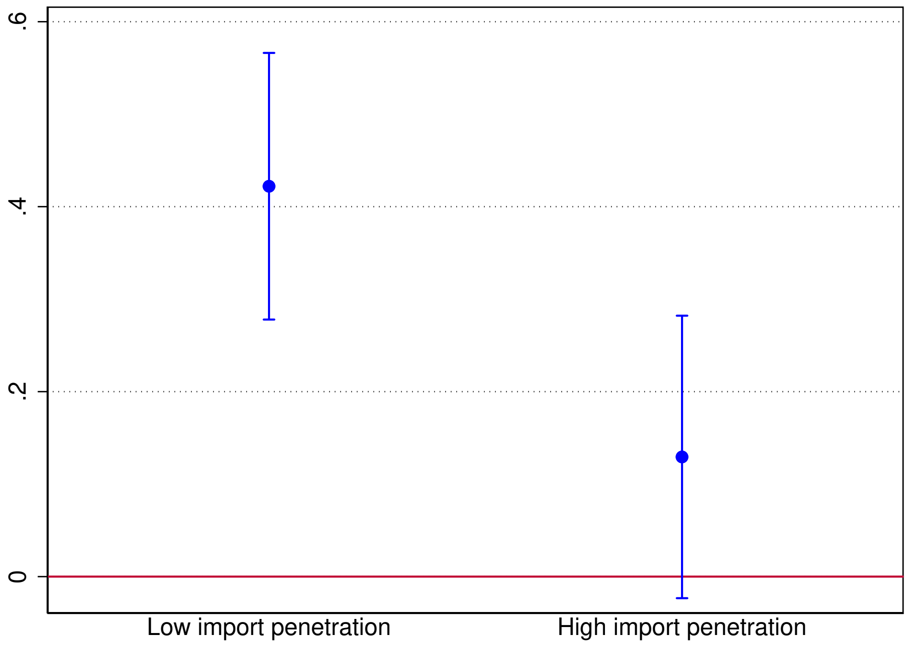
We augment our baseline framework by adding an interaction term between wage growth and import penetration

$$\Delta_{t-h,t}\ln(p_{s,t}) = \beta_{1,h}\Delta_{t-h,t}\ln(w_{s,t}/h_{s,t}) + \beta_{2,h}\Delta_{t-h,t}\ln(w_{s,t}/h_{s,t})\times IP_{s,t-h} + \beta_{3,h}IP_{s,t-h} + \gamma_h\Delta_{t-h,t}\ln(p^{input}_{s,t}) + \zeta_h\Delta_{t-h,t}\ln(A_{\bar{s},t}) + \delta_s + \rho_t + \varepsilon_{s,t} \tag{5}$$

where $IP_{s,t-h}$ represents the import penetration in sector s at time $t-h$. In this framework, the β_1-coefficient corresponds to the wage pass-through when industrial sectors are not exposed to import competition, whereas the sum of β_1 and β_2 captures the pass-through for different degrees of import competition. As an alternative specification, we interact our main variable of interest with a dummy variable, denoted *High IP*, that takes 1 if the sector-specific import penetration is above the median in a given quarter.

The estimates in Column 2 of Table 7 show a positive and statistically significant β_1-coefficient of the wage pass-through over a four-quarter period. However, the coefficient associated with the interaction term between wage growth and import penetration is negative and statistically significant, suggesting that a greater import penetration lowers the wage pass-through in industrial sectors.

Figure 4: Wage pass-through in industries with low and high import penetration



Note: The figure represents the estimated wage-price pass-through over a four-quarter period in industries with low (high) import penetration, corresponding to below (above) median in a given quarter. 90% confidence intervals.

Estimates corresponding to the alternative specification are shown in Column 3 and visualised graphically in Figure 4. In the sectors least exposed to import competition, the wage pass-through is positive and statistically significant, estimated at 43%. By contrast, when the degree of import competition is high, the wage pass-through is amounts to only 16% and is not statistically significant.

Finally, we re-estimate 5 by conditioning the wage pass-through to the sector-specific wage share as in Section 4.1. Results (last two columns of Table 7) still point to a relatively higher wage pass-through when the wage share is elevated, and a stronger pass-through when import penetration is low.

4.4 Export orientation

Yet another aspect of intense international competition is that it could also impair the ability of industrial firms to pass on rising domestic costs to their export prices. As a result, the wage-price pass-through in the tradeable sector could contribute to domestic inflation, but less so to export inflation. To explore this, we look at PPI indices by sales destination for industrial sectors.[23] These indices measure, for a given sector, the average price of all goods sold on the domestic market or sold outside of the domestic market.[24] Output prices for the non-domestic market are further sub-divided into output prices for products dispatched to euro area countries versus to other non-euro area countries.

Table 8: Pass-through in industrial sectors by sales destination

Dependent variable: Log producer price change between t-4 and t

	Sales destination			
	Domestic	International	Other EA	Other non-EA
$\Delta_{t-h,t}\ln(w/h)$	0.26***	0.15	0.13	0.15
	[0.076]	[0.12]	[0.14]	[0.12]
$\Delta_{t-h,t}\ln(p^{input})$	0.99***	1.36***	1.43***	1.33***
	[0.062]	[0.13]	[0.14]	[0.14]
$\Delta_{t-h,t}\ln(A)$	-0.16	-0.78*	-0.65	-1.09**
	[0.19]	[0.43]	[0.44]	[0.48]
$\Delta_{t-h,t}\ln(s)$	0.18***	0.14***	0.14***	0.12***
	[0.017]	[0.033]	[0.035]	[0.034]
Time FE	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y
N	1538	1538	1538	1538
R^2 (within)	0.58	0.47	0.47	0.44

Note: This table reports the estimates of equation 6 over the 2009Q1-2023Q2 period. Driscoll and Kraay standard errors are reported in brackets.
* / ** / *** indicate 10% / 5% / 1% significance level.

We estimate separately our baseline equation by replacing the dependent vari-

[23]Information is available from Eurostat for 27 industrial sectors, as opposed to 30 in our baseline sample.
[24]The prices of goods sold outside of the domestic market are expressed in the national currency.

able with the PPI indices by sales destination.

$$\Delta_{t-h,t}\ln(p^d_{s,t}) = \beta_h\Delta_{t-h,t}\ln(w_{s,t}/h_{s,t}) + \gamma_h\Delta_{t-h,t}\ln(p^{input}_{s,t}) + \zeta_h\Delta_{t-h,t}\ln(A_{\bar{s},t}) + \nu_h\Delta_{t-h,t}\ln(y_{s,t}) + \delta_s + \rho_t + \varepsilon_{s,t} \quad (6)$$

where $p^d_{s,t}$ is for sector s the output price index of goods to destination d at time t, where the destination refers to the domestic market, the international market, other euro area countries or other non-euro area countries. The β-coefficient therefore corresponds to the wage-price pass-through by sales destination.

The estimates of Table 8 display a positive and statistically significant (at the 1% level) pass-through from wages to prices when the goods are sold domestically. Quantitatively, the wage-price pass-through amounts to 26% over a four-quarter period, about the same as in our baseline estimates. By contrast, the pass-through from wages to prices for exported goods is lower (estimated at 15%) and not statistically significant, as shown in the second column of Table 8. The following columns further suggest that the wage-price pass-through remains non-significant, irrespective of whether the goods are exported to other euro area countries or outside the euro area. Therefore, wage growth contributes to domestic inflation but not to export inflation, at least in the short-run . Estimating equation 6 over longer time windows display very similar pass-through coefficients across sales destinations. This suggests that it might take more time for industries to pass on increases in wage costs to prices of export goods (see Table A5 in Annex for a two-year horizon). This may reflect a lower willingness of exporters to adjust margins in the short-run not to lose market power in a more competitive environment.

5 Post-pandemic changes in the pass-through

The pandemic-related containment measures, the supply constraints experienced when economies re-opened, as well as the exceptional stimulus provided by governments and central banks had a large bearing on the level of inflation, as well as on its dynamics, in the following years. It may therefore be the case that they also affected the pass-through at the sectoral level both from wages and input prices.

To investigate changes in the pass-through since the beginning of 2020, we augment our baseline equation 2 by adding a time dummy variable for the post-Covid period

$$
\begin{aligned}
\Delta_{t-h,t}\ln(p_{s,t}) =& \beta_{1,h}\Delta_{t-h,t}\ln(w_{s,t}/h_{s,t}) + \beta_{2,h}\Delta_{t-h,t}\ln(w_{s,t}/h_{s,t}) \times \text{Post Covid}_t \\
&+ \gamma_{1,h}\Delta_{t-h,t}\ln(p^{input}_{s,t}) + \gamma_{2,h}\Delta_{t-h,t}\ln(p^{input}_{s,t}) \times \text{Post Covid}_t \qquad (7)\\
&+ \zeta_h\Delta_{t-h,t}\ln(A_{\bar{s},t}) + \delta_s + \rho_t + \varepsilon_{s,t}
\end{aligned}
$$

where Post Covid_t is a dummy variable that takes 1 after 2020Q1, and 0 otherwise. The coefficients $\beta_{2,h}$ and $\gamma_{2,h}$ hence represent the change in the pass-through, respectively from wages and input prices, to selling prices after Covid. We estimate equation 7 for all sectors and separately for industrial sectors and private services. Given the short time period after Covid, we focus on the short-term wage-price pass-through and estimate the equation over a four-quarter period ($h = 4$).

Table 9: Short-term pass-through before and after Covid

Dependent variable: Log producer price change between t-4 and t						
	All sectors		**Industry**		**Private services**	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta_{t-h,t}\ln(w/h)$	0.061 [0.066]		0.11 [0.097]		0.038 [0.11]	
$\Delta_{t-h,t}\ln(w/h) \times WS$		0.22 [0.13]		0.26* [0.16]		0.20 [0.21]
$\Delta_{t-h,t}\ln(w/h) \times$ Post Covid	0.42*** [0.10]		0.30** [0.14]		0.88*** [0.25]	
$\Delta_{t-h,t}\ln(w/h) \times WS \times$ Post Covid		0.64*** [0.23]		0.46 [0.30]		1.48*** [0.35]
$\Delta_{t-h,t}\ln(p^{input})$	0.53*** [0.063]	0.53*** [0.063]	0.75*** [0.067]	0.75*** [0.067]	0.17 [0.20]	0.15 [0.20]
$\Delta_{t-h,t}\ln(p^{input}) \times$ Post Covid	0.24*** [0.066]	0.25*** [0.068]	0.34*** [0.079]	0.35*** [0.081]	-0.15 [0.24]	-0.15 [0.22]
$\Delta_{t-h,t}\ln(A)$	-0.39*** [0.060]	-0.39*** [0.061]	-0.19 [0.17]	-0.21 [0.17]	0.33 [0.25]	0.34 [0.27]
$\Delta_{t-h,t}\ln(s)$	0.22*** [0.022]	0.22*** [0.022]	0.20*** [0.017]	0.20*** [0.017]	0.42*** [0.053]	0.43*** [0.052]
Time FE	Y	Y	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y	Y	Y
N	2174	2174	1616	1616	500	500
R^2 (within)	0.47	0.47	0.60	0.60	0.48	0.49

Note: This table reports the estimates of equation 7 for $h = 4$. Post Covid is a dummy variable that takes 1 after 2020Q1, and 0 otherwise. Driscoll and Kraay standard errors are reported in brackets. * / ** / *** indicate 10% / 5% / 1% significance level.

The results in Table 9 suggest that the short-term pass-through of wages to producer prices has increased after Covid. The coefficient associated with the interaction term between wage growth and the post-Covid dummy variable is positive and statistically significant (Column 1). Quantitatively, the pass-through from wages to prices is estimated to have reached 48% over a one-year period after Covid, while it was not statistically significant different from 0 before 2020. The estimates also show a change in the pass-through of input prices, which increased from 53% to 77%.

Columns 3 and 5 of Table 9 reveal that the change in the pass-through of wages and input prices was heterogeneous across sectors. In the industrial sectors (Column 3), the pass-through from wages to prices is estimated at 11% before 2020, although not statistically significant. It picked up after Covid, reaching 41% after one year. Looking at input prices, the pass-through also increased significantly, from 75% before Covid to full pass-through after Covid.

In private services (Column 5), the wage-price pass-through increased relatively more than in industry. Before Covid, the short-term pass-through was also not statistically significant and close to 0. After Covid, it became statistically significant and reached 91%. By contrast, the results do not indicate a change in the pass-through from input costs to producer prices after Covid.

As in Section 4.1, we condition our main of variable on the wage share to investigate whether the change in the wage-price pass-through after Covid merely reflects different sectoral labour shares. The estimates in Column 2 also highlight a higher wage pass-through in the labour-intensive sectors, both before and after Covid. In addition, in the short run, the conditional wage-price pass-through was estimated to be quantitatively similar before Covid between industry and private services (although not statistically significant in the latter), as shown in Columns 4 and 6 of Table 9. However, the results indicate a larger and statistically significant post-Covid change in the conditional wage pass-through for private services compared to industry, suggesting that, for a given wage share, private services fully passed on wage increases.[25]

Following Section 4.3, we explore heterogeneity in the post-Covid change in the pass-through within the industrial sector, between industries more or less exposed to import competition.[26] The estimates in Columns 2 and 3 of Table A6 in Annex indicate that the increase in the pass-through from wages to prices was uneven

[25] However, a one-sided t-test shows that the conditional wage pass-through was not greater than one after Covid in private services.

[26] As in Section 4.3, the industrial sectors correspond in this analysis to the mining, manufacturing and electricity and gas sectors as information on import penetration for water supply is not available.

across industries. The wage-price pass-through increased after Covid in all industrial sectors, but more so in the industries with low import penetration. The results hold when using the dummy variable *High IP* that takes 1 if the sector-specific import penetration is higher than the median at given point in time (Column 3). Quantitatively, the post-Covid wage-price pass-through was 16% in the industries most exposed to international competition and 60% in the industries least exposed.

Finally, we study whether the change in the wage-price pass-through for industrial sectors varied across destinations. The coefficients reported in Table A7 in Annex indicate a statistically significant increase in the pass-through to prices of goods sold domestically. After 2020, the short-term pass-through to domestic PPI inflation is estimated at 45%, as shown in the first column of the Table. Conversely, the estimates reported in the following columns indicate that the increase in the pass-through of wages to prices of export goods was lower on size and not statistically significant.

Overall, these results provide evidence of an increasing wage-price pass-through in the euro area after Covid. The estimates found for the post-Covid period are sensibly higher, both for industry and private services, than those found for the United States (Amiti et al., 2023; Chin and Lin, 2023). In addition, the pick-up in the pass-through from input prices also points to the increasing importance of supply shocks during the post-pandemic period, in particular related energy and supply-chain disruptions, in explaining price dynamics, particularly in the industrial sector (Acharya et al., 2023; Ascari et al., 2024; Binici et al., 2024; di Giovanni et al., 2023). Finally, our results support the view of a time-varying wage-price pass-through, which becomes larger in high inflation regimes (Bobeica et al., 2019; Borio et al., 2023).

6 Robustness checks

In this section, we perform a number of robustness checks of our baseline estimation. First, we estimate our baseline equation controlling for changes in the HICP index (in log terms) over corresponding time windows (and hence dropping time fixed effects). The estimates (Annex Table B1) lie in the same range of our baseline estimates (see Table 2). In particular, the wage-price pass-through increases gradually over time and reaches 47% over a two-year period. The coefficients associated with the other variables are also quantitatively similar.

Second, our sample of industrial sectors is considerably heterogeneous. In particular, it features manufacturing firms engaged in the production of tradeable goods, as well as companies in the mining and utilities sector engaged in activities related to the extraction of minerals or the production of energy. As an additional robustness check, we estimate our baseline equation for industry by separating manufacturing and mining and utilities. Results (Table B2) are similar to our baseline for industry over a four-quarter horizon (see Table 3): the pass-through stabilises at around 20% in the medium- to long-run. This is weaker than the estimates for the industry as a whole, but is consistent with the fact that the pass-through is estimated to be lower in the industrial sectors exposed to international competition. On the other hand, the pass-through from wages to prices in the mining and utilities sector is not statistically significant and is close to 0 over a four-quarter horizon, but rises to 43% after three years.

Third, the reduced ability of industrial firms to pass on increases in domestic costs to their domestic prices could lead them to reorient their activities towards the domestic market, which in turn could affect the exposure of the sector to international competition. To avoid such endogeneity concerns, we re-estimate equation 5 by fixing the measure of import penetration in 2005, i.e. four years before the beginning of our sample. The estimates presented in Table B3 in Annex continue to show a lower pass-through in industrial sectors when import penetration is high, both over a one-year and two-year time window.

Fourth, the analysis on the export orientation (see Section 4.4) could suffer from a omitted variable bias as some industrial sectors export structurally more than others. This could influence the average wage-price pass-through by sales destination at the sectoral level. We therefore re-estimate equation 6 by controlling for a sector-specific measure of export intensity, defined as the ratio of exports to total sales. The estimates continue to show a statistically significant wage-price pass-through for goods sold domestically, as opposed to exported goods (see Table B4 in Annex).

Finally, since our post-Covid variable is time-varying, we re-estimate the equation 7 controlling for the log-change in the HICP index (and therefore omitting time fixed effects). Results (Table B5) show a positive and statistically significant wage-price pass-through for the pre-Covid period and continue to point a larger pass-through after the pandemic. When breaking the sample between industry and services, the results still hint at an increase in the wage-price pass-through in both sectors, albeit to a less extent in private services when using time fixed effects.We also estimate our baseline equation for the 2009-2019 period. Even though inflation was low and stable during this period, the results (Annex Table B6) still point to a gradual increase in the wage pass-through, albeit at lower levels for all sectors, consistent with the observation that the pass-through increased after 2020. For the industrial sectors, the pass-through from wages to prices is smaller at shorter time horizons, but gets significant and closer to our baseline estimates over a three-year time window. The estimates also suggest an increase in the wage-price pass-through coefficient from input prices after 2020. On the other hand, the wage-price pass-through is estimated to be sensibly lower in private services at all horizons when excluding the post-Covid period, but remains quantitatively higher than for the industrial sectors. These results reinforce the view of a state-dependent wage-price pass-through that depends on the level of inflation, but does not disappear when inflation is low and stable.

7 Conclusion

We investigated sectoral heterogeneity in the pass-through of wages to producer prices using euro area data. Our results point to a substantially higher pass-through in the services sector. This partly reflects a higher labour intensity, but also a more limited degree of competition. In this respect, we also found that industrial sectors that are less exposed to the competition of foreign firms, both in the domestic market and internationally, have a higher degree of pass-through.

Our results underscore the importance of considering sectoral heterogeneity when formulating a monetary policy response to wage pressures. More specifically, wages catching up to recover the purchasing power lost because of surprise inflation are likely to lead to comparatively larger price pressures in services. Looking ahead, this will make services inflation stickier.

One important caveat when assessing the broader implications for inflation of our results relates to our price measure. To be able to match different sectors of economic activity, we relied on producer price indices. The pass-through of producer to consumer prices, in turn, will also depend on structural features of the retail sector, and most importantly on the evolution of profit margins. This is a relevant topic for future research.

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A Appendix

A.1 Additional tables

Table A1: Sectoral coverage

Broad section	Section (1-digit level)	Division (2-digit level)
Industry	Mining and quarrying (B)	Mining of coal and lignite (B05) Extraction of crude petroleum and natural gas (B06) Mining of metal ores (B07) Other mining and quarrying (B08) Mining support service activities (B09)
	Manufacturing (C)	Food products (C10) Beverages (C11) Tobacco products (C12) Textiles (C13) Wearing apparel (C14) Leather and related products (C15) Wood and of products of wood and cork (C16) Paper and paper products (C17) Printing and reproduction of recorded media (C18) Coke and refined petroleum products (C19) Chemicals and chemical products (C20) Basic pharmaceutical products and pharmaceutical preparations (C21) Rubber and plastic products (C22) Other non-metallic mineral products (C23) Basic metals (C24) Fabricated metal products, except machinery and equipment (C25) Computer, electronic and optical products (C26) Electrical equipment (C27) Machinery and equipment n.e.c. (C28) Motor vehicles, trailers and semi-trailers (C29) Other transport equipment (C30) Furniture (C31) Other manufacturing (C32) Repair and installation of machinery and equipment (C33)
	Electricity, gas, steam and air conditioning supply (D)	Electricity, gas, steam and air conditioning supply (D35)
	Water supply; sewerage, waste management and remediation activities (E)	Water collection, treatment and supply (E36)
Construction	Construction (F)	-
Private services	Wholesale and retail trade; repair of motor vehicules and motorcycles (G)	Wholesale and retail trade and repair of motor vehicles and motorcycles (G45) Wholesale trade, except of motor vehicles and motorcycles (G46) Retail trade, except of motor vehicles and motorcycles (G47)
	Transportation and storage (H)	Water transport (H50) Air transport (H51) Postal and courier activities (H53)
	Accommodation and food service activities (I)	Accommodation (I55) Food and beverage service activities (I56)
	Information and communication (J)	Computer programming, consultancy and related activities (J62) Information service activities (J63)

Note: This table describes the sectors available in our final sample. The sections, corresponding to the first level sectors, are identified by an alphabetical code (under brackets). The divisions, corresponding the second level sectors, are identified by a two-digit numerical code (under brackets).

Table A2: Pass-through conditional on wage share (2009Q1-2023Q2)

Dependent variable: Log producer price change between t-8 and t						
	All sectors		**Industry**		**Private services**	
	(w/o)	(w/)	(w/o)	(w/)	(w/o)	(w/)
$\Delta_{t-h,t} \ln(w/h)$	0.41***		0.34***		0.70***	
	[0.11]		[0.10]		[0.16]	
$\Delta_{t-h,t} \ln(w/h) \times \bar{W}S$		0.65***		0.44**		1.37***
		[0.22]		[0.21]		[0.32]
$\Delta_{t-h,t} \ln(p^{input})$	0.77***	0.78***	1.02***	1.03***	-0.044	-0.033
	[0.048]	[0.049]	[0.052]	[0.055]	[0.12]	[0.12]
$\Delta_{t-h,t} \ln(A)$	-0.47***	-0.47***	-0.49*	-0.49*	0.39	0.38
	[0.100]	[0.10]	[0.28]	[0.28]	[0.41]	[0.42]
$\Delta_{t-h,t} \ln(s)$	0.21***	0.22***	0.20***	0.20***	0.43***	0.44***
	[0.023]	[0.024]	[0.018]	[0.019]	[0.073]	[0.070]
Time FE	Y	Y	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y	Y	Y
N	2018	2018	1504	1504	460	460
R^2 (within)	0.51	0.50	0.63	0.63	0.46	0.47

Note: This table reports the estimates of equation 3 for $h = 8$. Driscoll and Kraay standard errors are reported in brackets. * / ** / *** indicate 10% / 5% / 1% significance level.

Table A3: Pass-through conditional on market share (2009Q1-2023Q2)

Dependent variable: Log producer price change between t-4 and t						
	All sectors		**Industry**		**Private services**	
	(w/o)	(w/)	(w/o)	(w/)	(w/o)	(w/)
$\Delta_{t-h,t}\ln(w/h)$	0.41***		0.34***		0.70***	
	[0.11]		[0.10]		[0.16]	
$\Delta_{t-h,t}\ln(w/h)\times \bar{MS}$		0.51***		0.33**		1.55***
		[0.18]		[0.15]		[0.43]
$\Delta_{t-h,t}\ln(p^{input})$	0.77***	0.77***	1.02***	1.02***	-0.044	-0.065
	[0.048]	[0.049]	[0.052]	[0.055]	[0.12]	[0.14]
$\Delta_{t-h,t}\ln(A)$	-0.47***	-0.45***	-0.49*	-0.50*	0.39	0.37
	[0.100]	[0.094]	[0.28]	[0.28]	[0.41]	[0.45]
$\Delta_{t-h,t}\ln(s)$	0.21***	0.22***	0.20***	0.20***	0.43***	0.42***
	[0.023]	[0.026]	[0.018]	[0.020]	[0.073]	[0.087]
Time FE	Y	Y	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y	Y	Y
N	2018	2018	1504	1504	460	460
R^2 (within)	0.51	0.50	0.63	0.63	0.46	0.44

Note: This table reports the estimates of equation 4 for $h = 8$. Driscoll and Kraay standard errors are reported in brackets. * / ** / *** indicate 10% / 5% / 1% significance level.

Table A4: Pass-through controlling for expectations ($h = 8$)

Dependent variable: Log producer price change between t-8 and t						
	All sectors		**Manufacturing**		**Private services**	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta_{t-h,t}\ln(w/h)$	0.35**	0.34**	0.20*	0.20	0.70***	0.78***
	[0.14]	[0.14]	[0.12]	[0.12]	[0.16]	[0.16]
Selling price exp.		-0.027		-0.048**		0.27***
		[0.016]		[0.022]		[0.052]
$\Delta_{t-h,t}\ln(p^{input})$	0.64***	0.63***	1.00***	1.00***	-0.044	-0.26**
	[0.041]	[0.039]	[0.039]	[0.031]	[0.12]	[0.12]
$\Delta_{t-h,t}\ln(s)$	0.21***	0.21***	0.15***	0.16***	0.43***	0.40***
	[0.037]	[0.038]	[0.022]	[0.021]	[0.073]	[0.069]
Time FE	Y	Y	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y	Y	Y
N	1748	1748	1234	1234	460	460
R^2 (within)	0.47	0.47	0.69	0.70	0.46	0.53

Note: This table reports the estimates of equation 2 for $h = 8$ when controlling for expectations. The coefficients associated with productivity growth for private services are not shown for readability. Driscoll and Kraay standard errors are reported in brackets.
* / ** / *** indicate 10% / 5% / 1% significance level.

Table A5: Pass-through in industrial sectors by sales destination ($h = 8$)

Dependent variable: Log producer price change between t-8 and t				
	Sales destination			
	Domestic	International	Other EA	Other non-EA
$\Delta_{t-h,t}\ln(w/h)$	0.33***	0.34***	0.37***	0.33***
	[0.11]	[0.12]	[0.13]	[0.12]
$\Delta_{t-h,t}\ln(p^{input})$	1.03***	1.24***	1.27***	1.30***
	[0.058]	[0.086]	[0.082]	[0.100]
$\Delta_{t-h,t}\ln(A)$	-0.46	-1.20***	-1.04**	-1.92***
	[0.28]	[0.42]	[0.40]	[0.50]
$\Delta_{t-h,t}\ln(s)$	0.19***	0.15***	0.16***	0.14***
	[0.018]	[0.028]	[0.029]	[0.024]
Time FE	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y
N	1430	1430	1430	1430
R^2 (within)	0.63	0.55	0.56	0.55

Note: This table reports the estimates of equation 6 for $h = 8$ over the 2009Q1-2023Q2 period. Driscoll and Kraay standard errors are reported in brackets.
* / ** / *** indicate 10% / 5% / 1% significance level.

Table A6: Short-term pass-through before and after Covid in industrial sectors depending on import penetration

Dependent variable: Log producer price change between t-4 and t			
	(1)	(2)	(3)
$\Delta_{t-h,t} \ln(w/h)$	0.12	0.14	0.14
	[0.10]	[0.11]	[0.098]
$\Delta_{t-h,t} \ln(w/h) \times$ Post Covid	0.32**	0.67***	0.46***
	[0.14]	[0.12]	[0.12]
$\Delta_{t-h,t} \ln(w/h) \times IP$		-0.048	
		[0.30]	
$\Delta_{t-h,t} \ln(w/h) \times$ Post Covid $\times IP$		-0.92***	
		[0.24]	
$\Delta_{t-h,t} \ln(w/h) \times$ *High IP*			-0.038
			[0.15]
$\Delta_{t-h,t} \ln(w/h) \times$ Post Covid $\times$ *High IP*			-0.40***
			[0.11]
$\Delta_{t-h,t} \ln(p^{input})$	0.75***	0.75***	0.75***
	[0.065]	[0.068]	[0.068]
$\Delta_{t-h,t} \ln(p^{input}) \times$ Post Covid	0.33***	0.31***	0.34***
	[0.075]	[0.075]	[0.078]
$\Delta_{t-h,t} \ln(A)$	-0.20	-0.19	-0.20
	[0.17]	[0.17]	[0.17]
$\Delta_{t-h,t} \ln(s)$	0.20***	0.21***	0.21***
	[0.019]	[0.020]	[0.019]
Time FE	Y	Y	Y
Sector FE	Y	Y	Y
N	1508	1508	1508
R^2 (within)	0.60	0.61	0.61

Note: This table reports the estimates for $h = 4$. Post Covid is a dummy variable that takes 1 after 2020Q1, and 0 otherwise. *IP* corresponds to the import penetration at time $t-4$ and *High IP* corresponds to a dummy variable that takes 1 if the import penetration is above the median across industrial sectors in a given sector. The coefficients associated with *IP* and *High IP* are not shown for readability. Driscoll and Kraay standard errors are reported in brackets.
* / ** / *** indicate 10% / 5% / 1% significance level.

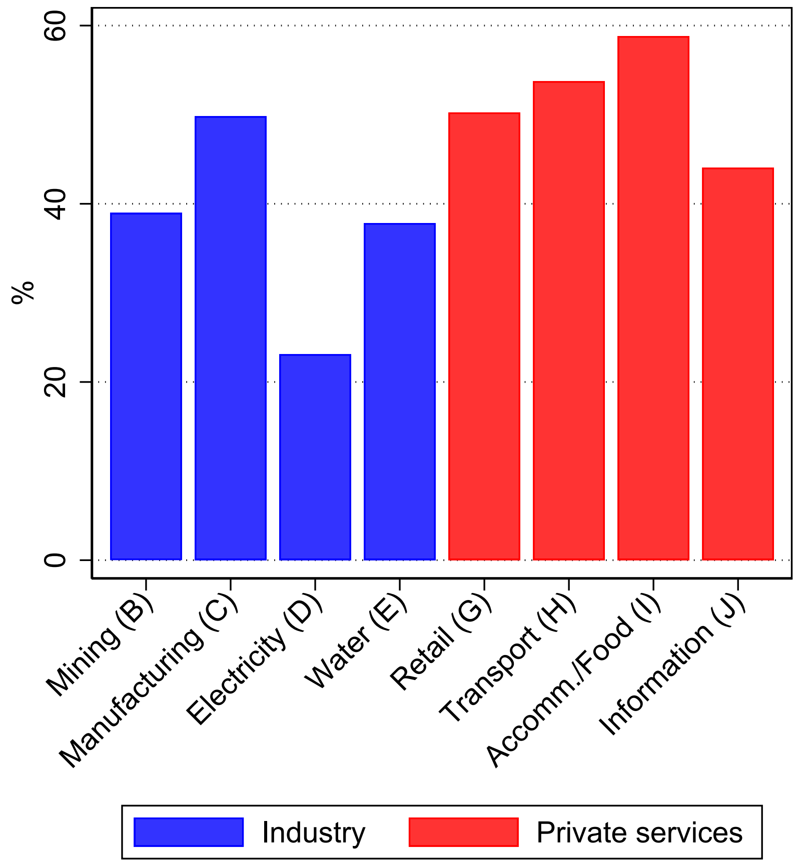
Table A7: Short-term pass-through before and after Covid in industrial sectors by sales destination

Dependent variable: Log producer price change between t-4 and t				
	Sales destination			
	Domestic	International	Other EA	Other non-EA
$\Delta_{t-h,t}\ln(w/h)$	0.080	0.053	0.0056	0.10
	[0.096]	[0.13]	[0.15]	[0.13]
$\Delta_{t-h,t}\ln(w/h) \times$ Post Covid	0.37^{**}	0.16	0.21	0.035
	[0.14]	[0.24]	[0.30]	[0.23]
$\Delta_{t-h,t}\ln(p^{input})$	0.72^{***}	1.08^{***}	1.13^{***}	1.10^{***}
	[0.068]	[0.18]	[0.18]	[0.20]
$\Delta_{t-h,t}\ln(p^{input}) \times$ Post Covid	0.45^{***}	0.49^{**}	0.52^{**}	0.41^{*}
	[0.082]	[0.21]	[0.22]	[0.23]
$\Delta_{t-h,t}\ln(A)$	-0.17	-0.79^{*}	-0.67	-1.11^{**}
	[0.18]	[0.43]	[0.43]	[0.48]
$\Delta_{t-h,t}\ln(s)$	0.19^{***}	0.14^{***}	0.14^{***}	0.12^{***}
	[0.015]	[0.035]	[0.037]	[0.037]
Time FE	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y
N	1538	1538	1538	1538
R^2 (within)	0.61	0.48	0.48	0.44

Note: This table reports the estimates for $h = 4$. Post Covid is a dummy variable that takes 1 after 2020Q1, and 0 otherwise. Driscoll and Kraay standard errors are reported in brackets.
* / ** / *** indicate 10% / 5% / 1% significance level.

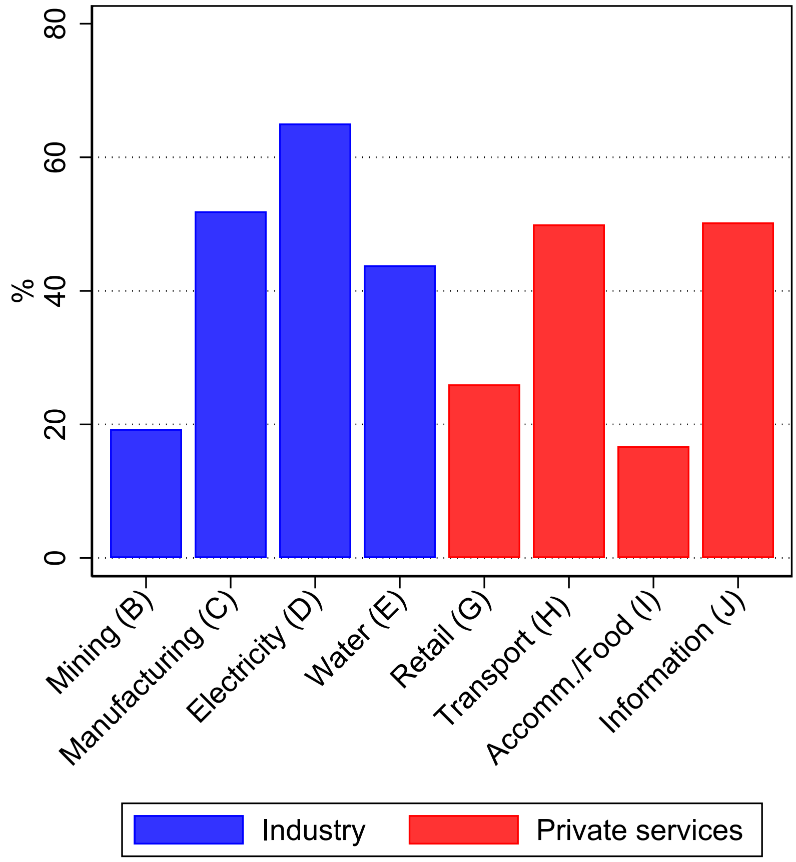
A.2 Additional figures

Figure A1: Wage share by one-digit sector



Note: The figure shows the average wage share for one-digit sectors. The wage share is defined as the ratio between wages and salaries and gross value added, calculated on average over the 2009-2020 period across 2-digit sectors.

Figure A2: Market share of firms with 250+ employees



Note: The figure shows the average market share for one-digit sectors. The market share is defined as the ratio between the turnover of firms with 250+ employees and total turnover, calculated on average over the 2009-2020 period across 2-digit sectors.

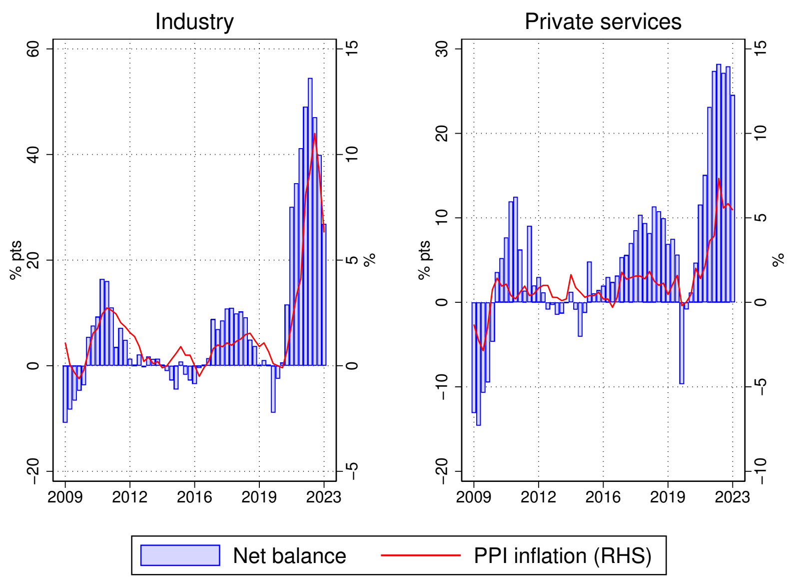
A.3 European Commission's Business and Consumer Survey

The European Commission's Business and Consumer survey is a regular harmonised survey for different sectors of the European economies. The survey provides information at the sectoral level (2-digit level) for industry, services, retail trade and construction. More specifically, it asks the following question

> **How do you expect your selling prices to change over the next 3 months?**
>
> They will
>
> (+) increase
>
> (=) remain unchanged
>
> (-) decrease

and reports the net balance of firms expecting their selling prices to increase in the following three months, calculated as the difference between the percentage of respondents having chosen the option "increase" and the percentage of respondents having chosen the option "decrease".

Figure A3: Selling price expectations and PPI inflation



Note: The figure represents the median net balance of firms expecting their selling prices to increase in the following three months as well as the median PPI inflation across industrial and service sectors, respectively.

B Robustness checks

Table B1: Pass-through without time fixed effects

Dependent variable: Log producer price change between t-h and t					
	h=4	h=8	h=12	h=16	h=20
$\Delta_{t-h,t}\ln(w/h)$	0.355***	0.472***	0.471***	0.451***	0.556***
	[0.071]	[0.107]	[0.068]	[0.081]	[0.113]
$\Delta_{t-h,t}\ln(p^{input})$	0.540***	0.682***	0.669***	0.636***	0.684***
	[0.037]	[0.044]	[0.038]	[0.041]	[0.051]
$\Delta_{t-h,t}\ln(A)$	-0.328***	-0.388***	-0.286***	-0.221***	-0.254***
	[0.042]	[0.073]	[0.068]	[0.062]	[0.046]
$\Delta_{t-h,t}\ln(y)$	0.190***	0.189***	0.205***	0.197***	0.190***
	[0.022]	[0.022]	[0.018]	[0.015]	[0.014]
$\Delta_{t-h,t}\ln(\text{HICP})$	-0.043	-0.356**	-0.271**	-0.144	-0.298*
	[0.125]	[0.151]	[0.113]	[0.140]	[0.177]
Time FE	N	N	N	N	N
Sector FE	Y	Y	Y	Y	Y
N	2174	2018	1862	1706	1550
R^2 (within)	0.68	0.74	0.77	0.76	0.75

Note: This table reports the estimates of equation 2 without time fixed effects but controlling for log changes in the HICP index. Driscoll and Kraay standard errors are reported in brackets.
* / ** / *** indicate 10% / 5% / 1% significance level.

Table B2: Pass-through in manufacturing versus mining and utilities

Dependent variable: Log producer price change between t-4 and t

	Manufacturing			**Mining and utilities**		
	h=4	h=8	h=12	h=4	h=8	h=12
$\Delta_{t-h,t}\Big(\ln(w)-\ln(h)\Big)$	0.291***	0.205*	0.184**	-0.011	0.231	0.431**
	[0.060]	[0.119]	[0.086]	[0.159]	[0.241]	[0.186]
$\Delta_{t-h,t}\ln(p^{input})$	0.934***	1.001***	0.999***	0.652*	0.627	0.830**
	[0.046]	[0.039]	[0.053]	[0.356]	[0.388]	[0.366]
$\Delta_{t-h,t}\ln(y)$	0.154***	0.149***	0.145***	0.377***	0.320***	0.342***
	[0.025]	[0.021]	[0.019]	[0.063]	[0.071]	[0.074]
Time FE	Y	Y	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y	Y	Y
N	1384	1288	1192	232	216	200
R^2	0.63	0.69	0.70	0.38	0.31	0.39

Note: This table reports the estimates of equation 2 separately for manufacturing and for mining and utilities. Labour productivity estimates are absorbed by the time fixed effects. Driscoll and Kraay standard errors are reported in brackets.
* / ** / *** indicate 10% / 5% / 1% significance level.

Table B3: Pass-through with import penetration fixed in 2005

Dependent variable: Log producer price change between t-h and t				
	One-year period (*h*=*4*)		Two-year period (*h*=*8*)	
	(1)	(2)	(3)	(4)
$\Delta_{t-h,t}\ln(w/h)$	0.52***	0.44***	0.61***	0.53***
	[0.10]	[0.082]	[0.18]	[0.13]
$\Delta_{t-h,t}\ln(w/h) \times IP_{2005}$	-0.79***		-0.80*	
	[0.29]		[0.43]	
$\Delta_{t-h,t}\ln(w/h) \times \textit{High IP}_{2005}$		-0.36***		-0.37***
		[0.10]		[0.14]
$\Delta_{t-h,t}\ln(p^{input})$	0.95***	0.96***	1.00***	1.01***
	[0.050]	[0.051]	[0.050]	[0.052]
$\Delta_{t-h,t}\ln(A)$	-0.22	-0.21	-0.52*	-0.51*
	[0.18]	[0.18]	[0.28]	[0.28]
$\Delta_{t-h,t}\ln(s)$	0.20***	0.20***	0.21***	0.21***
	[0.018]	[0.018]	[0.018]	[0.018]
Time FE	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y
N	1508	1508	1404	1404
R^2 (within)	0.59	0.59	0.64	0.64

Note: This table reports the estimates of equation 5 with import penetration fixed in 2005. Driscoll and Kraay standard errors are reported in brackets.
* / ** / *** indicate 10% / 5% / 1% significance level.

Table B4: Pass-through in industrial sectors by sales destination controlling for export intensity ($h = 4$)

Dependent variable: Log producer price change between t-4 and t				
	Sales destination			
	Domestic	International	Other EA	Other non-EA
$\Delta_{t-h,t}\ln(w/h)$	0.27***	0.15	0.13	0.15
	[0.079]	[0.12]	[0.14]	[0.12]
$\Delta_{t-h,t}\ln(p^{input})$	0.98***	1.36***	1.43***	1.33***
	[0.060]	[0.13]	[0.14]	[0.14]
$\Delta_{t-h,t}\ln(A)$	-0.16	-0.78*	-0.65	-1.09**
	[0.19]	[0.43]	[0.44]	[0.48]
$\Delta_{t-h,t}\ln(s)$	0.18***	0.13***	0.14***	0.12***
	[0.017]	[0.033]	[0.035]	[0.034]
Export Intensity	-0.042	-0.062**	-0.058*	-0.064*
	[0.031]	[0.028]	[0.033]	[0.032]
Time FE	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y
N	1488	1488	1488	1488
R^2 (within)	0.58	0.47	0.47	0.44

Note: This table reports the estimates of equation 6 for $h = 4$ over the 2009Q1-2023Q2 period. Driscoll and Kraay standard errors are reported in brackets.
* / ** / *** indicate 10% / 5% / 1% significance level.

Table B5: Post-Covid change in the pass-through without time fixed effects ($h = 4$)

Dependent variable: Log producer price change between t-4 and t

	All sectors		**Industry**		**Private services**	
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta_{t-h,t} \ln(w/h)$	0.20^{***}		0.23^{***}		0.15	
	[0.062]		[0.086]		[0.094]	
$\Delta_{t-h,t} \ln(w/h) \times WS$		0.46^{***}		0.48^{***}		0.39^{**}
		[0.14]		[0.17]		[0.18]
$\Delta_{t-h,t} \ln(w/h) \times$ Post Covid	0.33^{***}		0.33^{***}		0.30^{***}	
	[0.061]		[0.12]		[0.072]	
$\Delta_{t-h,t} \ln(w/h) \times WS \times$ Post Covid		0.55^{***}		0.56^{**}		0.55^{***}
		[0.11]		[0.26]		[0.14]
$\Delta_{t-h,t} \ln(p^{input})$	0.50^{***}	0.50^{***}	0.55^{***}	0.55^{***}	0.11	0.10
	[0.038]	[0.039]	[0.050]	[0.051]	[0.096]	[0.10]
$\Delta_{t-h,t} \ln(p^{input}) \times$ Post Covid	0.049	0.057	0.070	0.077^{*}	0.047	0.060
	[0.035]	[0.035]	[0.042]	[0.043]	[0.076]	[0.078]
$\Delta_{t-h,t} \ln(A)$	-0.33^{***}	-0.33^{***}	-0.42^{***}	-0.42^{***}	0.16^{**}	0.16^{**}
	[0.043]	[0.044]	[0.057]	[0.058]	[0.064]	[0.066]
$\Delta_{t-h,t} \ln(s)$	0.20^{***}	0.20^{***}	0.19^{***}	0.19^{***}	0.39^{***}	0.39^{***}
	[0.019]	[0.019]	[0.020]	[0.020]	[0.043]	[0.041]
$\Delta_{t-h,t} \ln(\text{HICP})$	-0.17^{*}	-0.16	-0.39^{**}	-0.37^{*}	0.43^{***}	0.41^{***}
	[0.094]	[0.097]	[0.19]	[0.20]	[0.14]	[0.13]
Time FE	N	N	N	N	N	N
Sector FE	Y	Y	Y	Y	Y	Y
N	2174	2174	1616	1616	500	500
R^2 (within)	0.69	0.69	0.70	0.70	0.77	0.78

Note: This table reports the estimates of equation 7 for $h = 4$ over the 2009Q1-2023Q2 period without time fixed effects and controlling for the log change in the HICP index. Driscoll and Kraay standard errors are reported in brackets.
* / ** / *** indicate 10% / 5% / 1% significance level.

Table B6: Pass-through for industry versus private services for the pre-Covid period

Dependent variable: Log producer price change between t-h and t									
	All sectors			**Industry**			**Private services**		
	h=4	h=8	h=12	h=4	h=8	h=12	h=4	h=8	h=12
$\Delta_{t-h,t}\ln(w/h)$	0.048	0.138	0.327***	0.117	0.133	0.231***	0.050	0.234	0.382**
	[0.062]	[0.095]	[0.082]	[0.094]	[0.089]	[0.078]	[0.093]	[0.146]	[0.144]
$\Delta_{t-h,t}\ln(p^{input})$	0.528***	0.617***	0.621***	0.774***	0.804***	0.755***	0.273*	0.067	-0.114
	[0.061]	[0.054]	[0.047]	[0.071]	[0.045]	[0.044]	[0.148]	[0.153]	[0.185]
$\Delta_{t-h,t}\ln(A)$	-0.317***	-0.190*	-0.107	0.067	0.097	0.195	-0.054	-0.165	-0.522***
	[0.062]	[0.104]	[0.147]	[0.150]	[0.148]	[0.151]	[0.154]	[0.140]	[0.160]
$\Delta_{t-h,t}\ln(y)$	0.219***	0.228***	0.257***	0.220***	0.240***	0.266***	0.447***	0.450***	0.537***
	[0.029]	[0.034]	[0.020]	[0.035]	[0.029]	[0.020]	[0.049]	[0.038]	[0.037]
Time FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Sector FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	1652	1496	1340	1224	1112	1000	384	344	304
R^2 (within)	0.36	0.50	0.60	0.49	0.65	0.72	0.47	0.45	0.60

Note: This table reports the estimates of equation 2 using observations for the pre-Covid period (2009Q1-2019Q4). Driscoll and Kraay standard errors are reported in brackets.
* / ** / *** indicate 10% / 5% / 1% significance level.

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