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THE PASS−THROUGH OF COST SHOCKS TO FIRMS' PRICES AND PROFITS

by Fabio Parlapiano*

Abstract

The post-pandemic surge in the prices of intermediate goods and energy has intensified scrutiny of firms' pricing policies and their role in fuelling inflation by passing cost shocks through to consumer prices. This paper combines firm-level balance sheet and price data to decompose the nominal growth rate of value added and operating profits into price and quantity effects. Between 2016 and 2023 the pass-through of intermediate input price changes to firms' output prices was less than one-to-one, with pricing policies contributing negatively to value added dynamics. Instead, quantity effects emerged as the main driver of growth in value added, particularly during the post−pandemic recovery. Econometric analysis indicates that, in response to intermediate input price shocks, very large firms exhibit strong pass-through capacity, which is associated with concurrent economic gains. However, this was not the average case, as firms' price setting behaviour generally offered limited protection against unexpected input costs.

JEL Classification: G00, G30, L1.

Keywords: firms' price setting behaviour, cost shocks, pass-through, economic margins.

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* Directorate General for Economics, Statistics and Research, Banca d'Italia, Via Nazionale 91 – 00184 – Roma.

1. Introduction and main findings[2]

The resurgence of inflation during 2021–2022, triggered by a confluence of cost−push shocks, including the energy crisis, global supply chain disruptions, and the release of pent−up post−pandemic demand, has reignited interest in firms' pricing behaviour. As the primary interface between production and consumption, firms' prices play a pivotal role in the transmission of inflationary pressures to the broader economy. Understanding how firms adjust their prices in response to input cost shocks is therefore essential for assessing the persistence and distributional effects of inflation.

Firms' price-setting, when implemented as mark−ups over marginal costs, not only influence the inflationary dynamics but also serve as a mechanism through which firms manage operational risk. The ability to pass on rising input costs to customers can act as a form of hedging, especially for firms facing financial constraints or limited access to external financing. However, the extent and effectiveness of such pass−through mechanisms remain empirically contested and may vary significantly across firms and sectors.

This paper contributes to this debate by investigating the relationship between firms' pricing policies and their economic margins −specifically, value added and operating profits− by disentangling the respective contributions of price and quantity changes to their evolution. The analysis leverages detailed firm−level survey data on output and intermediate input price changes for a representative sample of Italian non−financial firms. The annual variation in value added is decomposed into three additive terms: (i) pricing policy, (ii) intermediate input productivity, and (iii) the interaction between the two. Unlike aggregate metrics derived from national accounts, this firm−level approach captures heterogeneity in firms' exposure to input price shocks, their reliance on intermediate inputs, and their capacity to pass cost increases along the supply chain to final consumers.

To complement the decomposition analysis, we conduct an econometric analysis to estimate firms' pricing and economic margins responses in the face of cost shocks, measured as idiosyncratic unexpected changes in intermediate input prices. This dual approach enables us to characterize firms' economic resilience by assessing both their ability to transfer cost shocks to output prices and the implications of their pricing behaviour for profitability.

Our findings indicate that the pass−through of intermediate input price increases to output prices was incomplete, leading to a negative contribution of price-setting behaviour to value added. In contrast, quantity dynamics ―particularly changes in output and input volumes― emerged as the primary driver of value added growth, especially in the post−pandemic period. While larger firms demonstrated a greater capacity to pass on cost shocks and were more likely to benefit in terms of profitability, this pattern was not representative of the average firm.

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[2] Fabio Parlapiano, Bank of Italy, Economic and Statistics Department, Via Nazionale 91, 00184, Rome, Fabio.Parlapiano@bancaditalia.it. I am thankful to Alessio de Vincenzo, Federico Maria Signoretti, Sabrina Pastorelli and Valentina Nigro and two anonymous referee for their comments and suggestions. I also thank for their comments participants at the Workshop on "New insights from financial statements" in Madrid organized by the ECCBSO, IFC-BIS, Banco de Espana; the 14th Annual Conference on "Central Bank Business Survey and Liaison Programs" in Rome organized by the Bank of Italy and the European Central Bank; the Workshop on "Applied microeconomics" in Rome organized by the Bank of Italy and the Einaudi Institute of Economics and Finance; the 5th Workshop on "Challenges for Monetary Policy transmission – Transmission through the real economy" in Brussels organized by the ChaMP – ESCB Research network. The views expressed do not necessarily represent the views of the Bank of Italy. All remaining errors are my responsibility.

Overall, price-setting behaviour offered limited protection against input price shocks, underscoring the constrained role of price–setting behaviour as a buffer against cost shocks.

The empirical analysis draws on firm–level survey data from the Bank of Italy's Survey on Inflation and Growth Expectations (SIGE) for the period 2016–2023. The sample comprises primarily unlisted Italian firms with at least 50 employees, operating in the manufacturing, services, and construction sectors, and includes approximately 1,500 observations per year. To complement price information, the dataset is augmented with firm–level financial data from the Cerved database, which provides detailed records on revenues, intermediate input costs, value added and operating profits.

A key advantage of using value added –defined as the difference between revenues and the cost of intermediate goods and services– is that it offers a more granular perspective on firms' gross economic margins. This measure is particularly informative in sectors where intermediate inputs and energy represent a substantial share of total costs: in the euro area, these shares range from approximately 80 percent in manufacturing to 60 percent in services.[3] While value added is highly correlated with operating profit measures such as gross operating surplus, unit profits, or mark–ups, it differs in that it excludes personnel expenses and other fixed costs, thereby isolating the impact of input cost shocks on firms' core production margins.

Previous studies have explored the relationship between firms' pricing behaviour and their economic margins, focusing on two complementary research questions: (i) how inflationary environments affect firms' profits, and (ii) how profits, in turn, feed back into inflationary dynamics.

The first strand of research suggests that profits tend to expand during periods of moderate inflation, but may decelerate or decline when inflation becomes particularly high. For instance, Andler and Kovner (2022), using quarterly firm–level data for U.S. listed companies, show that during 2021–2022, profit margin growth was more pronounced in industries experiencing higher inflation. However, over the long run, they find that in high–inflation regimes, gross profit growth weakens and eventually contracts. These findings align with the earlier insights of Moore (1983), who argued that profits expand only when output prices rise faster than input prices —a condition more likely to hold in moderate inflation environments.

The second strand of literature examines whether and to what extent firms' pricing policies —often measured through mark–ups, defined as the premium over total costs— contribute to inflation. The prevailing narrative suggests that inflation may be exacerbated when firms raise prices beyond what is justified by cost increases. In the wake of the 2020–2022 shocks, including surging energy and input prices, the anticipated decline in corporate profits did not materialize. Instead, non–financial firms' operating profits rebounded sharply, raising concerns that firms may have increased prices more than proportionally to their costs, thereby amplifying inflationary pressures.

However, empirical evidence challenges this interpretation. Mark–ups largely remained stable or reverted to pre–pandemic levels. In Italy, Colonna et al. (2023) used national accounts data to show that despite an increase in the profit share (gross operating surplus relative to value

[3] Panetta, F., 2024, "Economic developments and monetary policy in the euro area", Speech by the Governor of the Bank of Italy, 30th Assiom Forex Congress. The figures for the U.S. economy are not different and about half of firms' total costs are due to intermediate input; Moro, A., 2010, "Biased technical change, intermediate goods and total factor productivity", working paper.

added), mark–ups remained broadly unchanged.[4] Similar findings were reported for the United States by Leduc et al. (2024). Moreover, studies by Ganapati et al. (2020) and Champion et al. (2023) in the U.S. and Australia, respectively, found that cost pass–through to output prices was incomplete: on average, a 1 percent increase in input costs led to only a 0.7 percent rise in output prices. Notably, pass–through was lower in more concentrated industries, contrary to the expectations of competitive market theory.

At the industry level, high mark–ups appear to buffer consumer prices from economic shocks. Firm–level data for the euro area (Kouvavas et al., 2021) show that inflation in high mark–up sectors is less sensitive to oil supply, global demand, and monetary policy shocks. This suggests that firms with greater market power may be less inclined to pass cost shocks onto consumers. Similarly, Kharroubi et al. (2023) find that in sectors with higher mark–ups, the impact of global oil supply shocks on producer price inflation is attenuated. However, the protective role of high mark–ups is asymmetric: while they offer limited insulation from inflationary oil shocks, they dampen the transmission of disinflationary shocks, allowing firms to maintain or even increase revenues and profits.

This paper makes several contributions to the existing literature. First, unlike prior studies, the dynamics of intermediate input prices and their heterogeneity across firms is specifically accounted for. By leveraging granular firm–level data on both input and output prices, we are able to assess how price changes affect value added, while capturing the variation in these effects across different types of firms. Second, although sample size is limited to a subset of Italian non–financial corporations, we apply survey weights to ensure that our findings are representative of the broader population, thereby enabling generalization to the Italian business sector. Third, the use of survey data offers a unique advantage in identifying firms' responses to cost shocks —defined as deviations between actual and expected changes in intermediate input prices— providing insight into the behavioural dimension of pricing decisions.

Our findings indicate that the pass–through of intermediate input prices to output prices is, on average, incomplete. Contrary to the predictions of perfect competition, a substantial share of cost increases is absorbed by firms themselves, with no sector exhibiting full pass–through. The contribution of price-setting behaviour —capturing both output and input price changes— to the annual growth rate of value added is generally small and often negative. However, during the 2021–2023 period, we observe a notable shift in the role of prices, with very large firms exhibiting higher operating pass–through stemming from a dual pricing power in both negotiating input costs and in the setting output prices. Even so, price-setting behaviour provided only limited protection against rising costs. Finally, we show that while firms adjust their pricing behaviour in response to adverse cost shocks, these adjustments do not translate into significant improvements in value added or profits. This suggests that firms aim to preserve existing profitability levels by sharing part of the economic burden with consumers or business partners, likely in an effort to maintain market share.

[4] In national accounts data, an increase in the profit share (the ratio between gross operating profits and value added), as many advanced economics witnessed in the post-pandemic recovery, is often interpreted as a signal of inflationary pressure generated by firms' price-setting behaviour. Colonna et al., (2023) provide a decomposition of the profit share which demonstrates how its increase is also compatible with constant mark-ups if a) intermediate input cost increase outpace labour costs and b) there is limited substitutability amongst input. Thus the profit share is not unambiguously informative of the relationship between mark-ups and price dynamics.

The remainder of the paper is structured as follows. Section 2 outlines the modelling framework. Section 3 describes the data sources and sample construction. Section 4 presents the decomposition of value added growth at various levels of aggregation—economy−wide, by firm size, sector and intermediate input intensity and, Section 5 discusses the results of the regression analysis. Section 6 concludes.

2. Data

2.1 Price data

Firm−level price information is sourced from the SIGE, conducted quarterly by the Bank of Italy. The survey collects data on firms' inflation expectations over various horizons, changes in their own selling and purchase prices, and qualitative assessments of macroeconomic conditions. The sample is representative of medium−sized and large Italian firms and is constructed using a stratified random sampling approach based on economic sector, firm size, and geographical location. To ensure representativeness, sampling weights are provided for each observation, reflecting the ratio between the number of respondent firms and the total number of firms in the reference population.

The price level dataset used in this study spans the period 2016–2024 and is based on responses to the following two survey questions:

- "What was the average variation in the output price of the products or services sold by your company over the last 12 months?"
- "What was the average variation in the intermediate input price of the products or services purchased by your company over the last 12 months?"

The extent to which firms pass changes in intermediate input prices onto customers, referred to as operating pass−through, is proxied by the ratio of the 12−month change in output prices to the 12−month change in input prices.[5] While this ratio provides a useful upper−bound estimate of pass−through, it does not capture the full complexity of firms' price−setting behaviour (e.g. degree of competition, elasticity of demand, strategic complementarities). In particular, it abstracts from state− and time−dependent pricing frictions, as documented in Riggi and Tagliabracci (2022), which would be incorporated in a structural model of firm behaviour.[6] Moreover, we acknowledge that this empirical proxy is not equivalent to the theoretical concept of marginal cost pass-through. Marginal cost encompasses a broader set of production costs which include also labour and capital.

In the 2016−24 period, the average firms' operating pass−through was incomplete (Figure 2 – panel a). For a 1 percent change in intermediate input prices, only approximately 0.6 percent was passed on to sale prices in the same year. However, given the limited share of intermediate

[5] The term "output price" in this paper refers to the price at which firms sell their goods, which may not correspond to the final consumer price. In many cases, firms sell to other firms or to retailers, and thus the output price reflects a business-to-business transaction. This distinction is important, as the pass-through measured here also pertains to upstream pricing decisions rather than final retail prices.

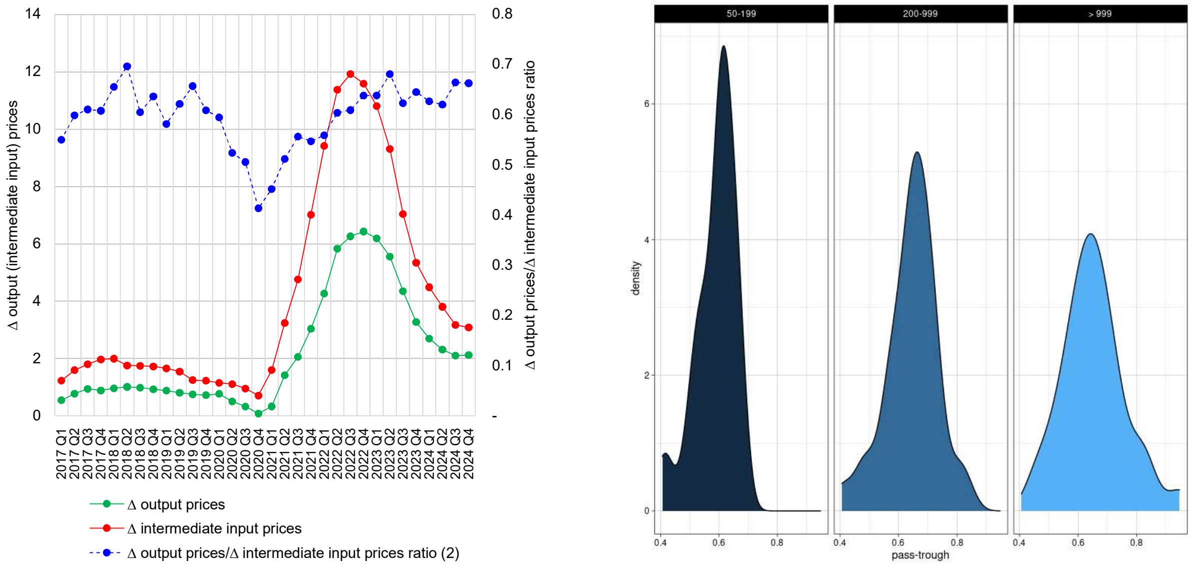
[6] The probability of a firm adjusting its prices can vary with (1) time and (2) macroeconomic or firm-specific conditions. The latter case belongs to the theoretical modelling framework of state-dependent models: changes in firm-level costs for intermediate products, revenues, utilization capacity are found to be important state variables (Lein, 2010). For empirical studies that look at the importance of both state- and time-dependent factors for firm-level price setting see also Dixon and Grimme (2022), and Riggi and Tagliabracci (2022).

input costs on total costs, one may question if this value may be still consistent with complete pass–through. Back of envelope calculations suggest that this is not the case. Assuming that firms' cost shares of about 75 and 25 percent for intermediate and labour costs respectively –in line with national accounts figures– the overall pass–through ratio would rise only to 0.77 percent.[7]

Note that this result corroborates evidence of incomplete and sluggish pass–through of cost increases to output prices reported in Bruine de Bruin et al. (2024), Champion et al. (2023), Amiti et al. (2019) whose estimates range between 0.6–0.7 but with considerable heterogeneity at the firm level.

Figure 1: Firms' pass–through

panel a: operating pass–through (per cent) | panel b: heterogeneity across firm sizes (units)



Source: Bank of Italy's SIGE, Cerved.
Note: panel a) illustrates the reported 12–month weighted average percentage changes in output and intermediate input prices and the pass–through, i.e. ratio between the two for the whole sample of firms included in the SIGE; panel b) shows the distributions of firm level pass–through pooled across the years 2016–2024 period. Pass–through is winsorized at the 1, 99th percentiles. Firm size is defined using number of employees, with medium firms having between 50 and 199 employees, large firms between 200 and 999 and very large firms with more than 1000 employees.

Additionally, Figure 1 suggests that time variation in the average pass–through over the sample period is modest. During the 2021–2022 inflationary period, pass–through declined, reflecting firms' limited ability or willingness to fully transfer cost increases to customers. A rebound in 2022 coincided with the easing of energy price pressures, returning pass–through to pre–pandemic levels.[8] This pattern supports the idea of persistent output pricing behaviour and

[7] Back of envelope calculation for the operating pass-through are based on intermediate input and labour cost shares from national accounts 2024 data. Starting from an initial value of 0.6 (i.e. the ratio between 2 and 3.5 percent for output and intermediate input price changes), if the yearly labour unit prices is assumed constant, which is a reasonable assumption in the short-term, the operating pass-through would increase only to 0.77 (i.e. the ratio between 2 and the sum of 3.5 and 0 times their respective weights).
[8] Riggi and Tagliabracci (2022) find that the pass-through of input costs to output prices is quantitatively limited over the period 2017-22: a one per cent increase in the prices of intermediate input leads to roughly a 0.2 per cent rise in Italian firm's selling prices.

non–linear responses to cost shocks, consistent with findings in Kharroubi et al. (2023).[9] In cases of inflationary cost–shocks, firms may choose to absorb some of the negative impact by reducing pass–through to customers and retain market shares. Other potential explanations, based on survey approach, suggest that the limited pass-through is attributable to both nominal and real rigidities, including competition, weak demand, long-term contracts, administrative burdens, regulatory factors and other considerations (Gödl-Hanisch and Menkhoff, 2024).

Firms' pass–through display significant heterogeneity across different size classes (Figure 2 – panel b). On average, over the whole period, larger firms exhibit a wider ranging pass–through distribution centred around a higher average level with respect to smaller firms. Compared to larger firms, medium firms average intermediate input price changes are about one and half times higher. A noteworthy aspect of the price data is the occurrence of above one pass–through for firms in the 90th percentile of the distribution, especially for the largest. These are instances that potentially hold support for firms' boosting their profits thought their pricing policies.

Table 1: Firm prices

	Medium			Large			Very large		
	Δ Output	Δ Input	Pass-trough	Δ Output	Δ Input	Pass-trough	Δ Output	Δ Input	Pass-trough
Average	2.27	4.31	0.59	2.21	3.84	0.65	1.82	3.06	0.65
P. 10	0.00	0.00	0.00	0.00	0.00	0.00	-0.20	0.00	0.00
P.25	0.00	0.05	0.00	0.00	0.20	0.00	0.00	0.00	0.00
P. 50	1.00	2.00	0.50	1.00	2.00	0.60	0.75	1.30	0.60
P. 75	4.00	5.00	1.00	3.50	5.00	1.00	2.49	4.27	1.00
P. 90	9.00	13.00	1.33	7.00	10.00	1.50	5.00	10.00	1.50

Source: Bank of Italy's SIGE.
Note: The table reports weighted averages and different percentiles of firm-level output, intermediate input price percentage changes and the pass through ratio for the firms included in the SIGE for the years 2016–24. Percentage changes (Δ). The average pass–through is computed from firm-level ratios which are then averaged and winsorized at the 1st – 99th percentiles. Firm size is defined using number of employees, with medium firms having between 50 and 199 employees, large firms between 200 and 999 and very large firms with more than 1000 employees.

To characterize firms exhibiting superior pass-through capacity –defined as a pass-through rate above one– we rely on descriptive evidence through both unconditional and conditional mean comparisons. Notably, high pass-through firms are associated not only with greater output price variations but also with smaller input price changes (Table A.1). Moreover, the ability to pass through more than one-to-one appears to be a persistent trait (see lag $D^{PT} | 1$), typically observed in larger, less leveraged, and more profitable firms (Table 2).

[9] The time dependence of pass-through from output prices is mirrored in our sample from higher correlations between output price changes and pass-through levels (0.4) with respect to the analogous correlation calculated using intermediate input price changes (0.2).

Table 2: High pass-through firms

Dependent Var.:	$D^{PT} \mid 1$
$lag(D^{PT} \mid 1)$	1.118 *** (0.0531)
log(Age)	-0.0110 (0.0341)
log(Assets)	0.0680 *** (0.0138)
log(ROA)	0.0449 * (0.0232)
Leverage	-0.1399 ** (0.0583)
Other industrials	-0.0357 (0.0891)
Retail	0.1028 ** (0.0515)
Services	-0.0570 (0.0594)
Constructions	-0.1385 ** (0.0571)
Fixed-Effects:	------------------
year	Yes
S.E.: Clustered	by: firm & year
Observations	15,892
Squared Cor.	0.13
Pseudo R2	0.12
BIC	206,092

Source: our estimates based on SIGE and Cerved data.
Note: The table reports probit estimates using panel data from the SIGE–Cerved sample for the 2016–22 period. The model estimates the probability of a firm being in the high pass-through category. Observations are weighted using survey weights.

Overall, descriptive statistics suggest that very large firms may possess dual pricing power –both upstream, in negotiating input costs, and downstream, in setting output prices. This dual advantage enables them to better manage cost shocks and maintain or even expand mark–ups. In contrast, smaller firms often lack such leverage on both fronts, limiting their ability to pass through cost increases to consumers and compressing their mark–ups in the face of adverse shocks.

2.2 Financial data

The SIGE sample was matched with balance–sheet information from Cerved Group, the primary source for all incorporated Italian firms' annual reports. Due to a one–year lag with which financial information becomes available, the resulting dataset (Table 2) includes observations for the period 2016–23.[10]

Table 3: Descriptive statistics

Year	N. Firms	Δ Output price	Δ Intermediate input price	Δ Revenues	Δ Intermediate costs	Δ Value added	Δ Ebitda
	units	percent	percent	percent	percent	percent	percent
2016	586	0.16	0.94	3.55	4.13	3.54	-11.38
2017	580	0.91	1.96	5.74	7.60	4.03	4.83
2018	628	0.91	1.69	3.25	4.23	2.12	5.82
2019	672	0.63	1.16	0.29	0.83	-1.45	3.89
2020	839	0.17	0.69	-8.74	-7.22	-10.38	-21.57
2021	997	3.12	6.93	19.53	19.52	22.12	19.60
2022	1028	6.53	11.32	15.81	20.05	11.25	1.97
2023	1042	3.20	5.01	2.63	2.75	6.70	10.18
Average	1996	2.20	4.12	6.05	7.29	5.68	2.81

Source: Bank of Italy's SIGE, Cerved.
Note: The table reports the number of firms included in the matched SIGE–Cerved dataset and weighted averages (using survey weights) of relevant variables. Percentage changes (Δ). Value added is the difference between revenues and intermediate costs. Ebitda is the difference between value added and labour cost. Financial data are winsorized at the 1st – 99th percentiles. The number of firms over the whole sample period corresponds to the total number of unique firms.

[10] Despite SIGE survey data being available since 1999, the years prior to 2016 were not considered in the analysis because intermediate input price data were not collected.

The matched sample includes about 800 firm−year observations, covering about 2.000 unique companies.[11] During the 2016–2023 period, the growth rates of intermediate costs and input prices outpaced those of revenues and output prices. Nevertheless, both average value added and profit growth rates remained positive. This provides intuitive support for the idea that, even with incomplete pass-through, economic margin dynamics can still be favourable -a result consistent with comparative statics analysis.

In this paper, value added (VA) is used as the primary measure for firms' economic margin. Unlike operating profits (Ebitda) it is gross of labour costs providing a broader view of production margins. However, due to the relative rigidity with which labour costs adjust to changes in demand, supply and consumer price dynamics, VA and operating profits are highly correlated —with a correlation coefficient of 0.8 in our sample.[12]

The SIGE dataset allows for the direct observation of changes in intermediate input prices, enabling a more precise decomposition of value added (VA) without relying on external estimates or proxies. However, despite this advantage, the survey's structure requires firms to report average price changes for inputs and outputs across their entire range of products or services. While this approach may ease the burden on respondents, it introduces potential inaccuracies, as the price trajectories of individual products can diverge significantly from the reported averages in the case of multi−product companies.

To put our matched SIGE−Cerved sample into context, Figure 3 illustrates the nominal and real growth rate of value added from both the non−financial firms accounts, as provided by the national bureau of statistics and, the matched sample data. As a proxy for the real value added growth rate, the contribution of quantities to its variation as in (4) is used. The two series are very close in level and their correlation exceeds 0.95 over the period, suggesting that the SIGE−Cerved sample is also representative of developments affecting the whole business sector.

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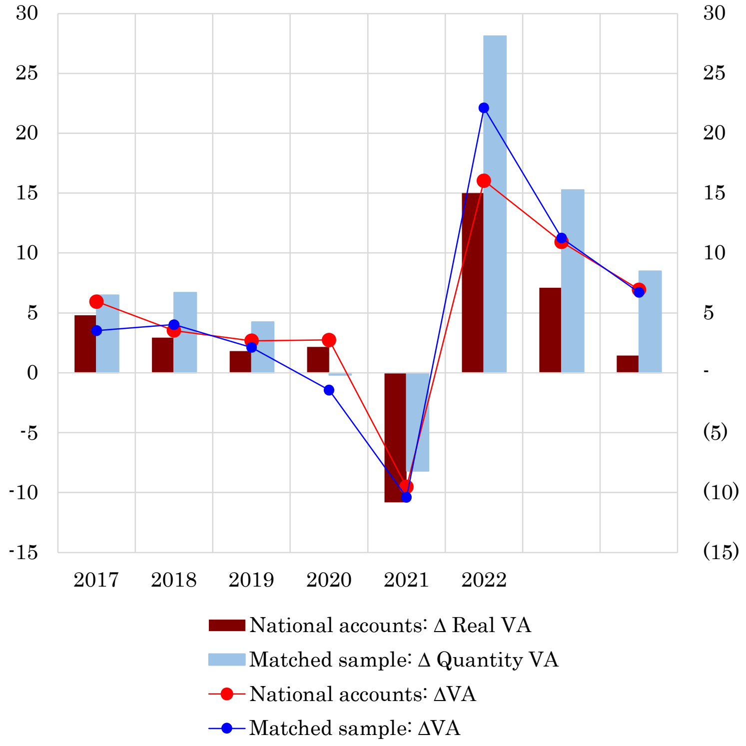
[11] Despite fluctuations in the size of the matched SIGE-Cerved sample over the entire period, its composition by firm-size classes remains relatively stable. Therefore, the sample's representativeness is not compromised.

[12] When labor costs adjust slowly to changes in demand, supply, or consumer prices, firms experience less variation in their cost structures in the short term. This rigidity tends to preserve the proportional relationship between VA and profits.

Figure 2: Benchmarking matched SIGE−Cerved sample with National Accounts (per cent)



Source: Bank of Italy's SIGE, Cerved, Non−financial firms' national accounts.
Note: The figure shows the nominal and real value added growth rate for the non−financial corporate sector (National Bureau of Statistics) and for the firms included in the matched SIGE−Cerved dataset. Survey weights are used to report sample observations to the population of Italian companies. Percentage changes (Δ). Value added is the difference between revenues and intermediate costs.

3. Price and quantity contributions to value added

To evaluate the contribution of pass–through to firms' performance, this study adopts two complementary methodological approaches. First, it introduces an accounting decomposition designed to disentangle the relative importance of three additive components: a pricing policy or "price" component, an intermediate input productivity or "quantity" component, and an interaction term that captures the joint effect of price and quantity changes. This decomposition provides a descriptive assessment of the channels through which pass-through mechanisms relate to corporate performance. Second, Section 4 implements an instrumental variable (IV) approach to identify the causal impact of firm–level pricing behaviour on value–added and, ultimately, on profit growth rates. Specifically, idiosyncratic input price shocks are employed as instruments to isolate exogenous variation in firms' pricing policies, thereby addressing potential endogeneity concerns and strengthening causal inference.

We start by outlining an accounting decomposition of firms' nominal growth rates of revenues, intermediate input costs, and value added into price and quantity components. This is achieved by holding either previous−period quantities or prices constant, thereby attributing changes to one factor at a time. Specifically, we use firms' self−reported changes in output and input prices over the past 12 months, along with observed growth rates in revenues and intermediate costs, to construct the decomposition. This approach allows us to disentangle the effects of pricing behaviour from those of production volume changes, providing a clearer understanding of the mechanisms driving value added growth.

Formally, the annual growth rate (Δ) of revenues can be decomposed as follows:

$$\Delta Rev_{t,\, t\text{-}1} = \frac{p^o_t q^o_t - p^o_{t\text{-}1} q^o_{t\text{-}1}}{p^o_{t\text{-}1} q^o_{t\text{-}1}}$$

$$\Delta Rev_{t,\, t\text{-}1} = \Delta p^o_{t,\, t\text{-}1} + \Delta q^o_{t,\, t\text{-}1} + \Delta p^o q^o_{t,\, t\text{-}1} \quad (1)$$

where, $\Delta p^o_{t,\, t\text{-}1}$ is the firms' reported change in output prices between t and t−1 (from survey data), $\Delta q^o_{t,\, t\text{-}1} = \left[(1+\Delta Rev_{t,t\text{-}1})/\left(1+\Delta p^o_{t,\, t\text{-}1}\right)-1\right]$ is the implied change in output quantities and $\Delta p^o q^o_{t,\, t\text{-}1} = \left[\Delta p^o_{t,\, t\text{-}1} * \Delta q^o_{t,\, t\text{-}1}\right]$ is the interaction between price and quantity components. Similarly, the annual growth rate of intermediate costs ($\Delta Cost_{t,\, t\text{-}1}$) is decomposed in an intermediate input price changes $\left(\Delta p^i_{t,\, t\text{-}1}\right)$, a quantity and an interaction component as in Equation (1). Rearranging the revenues and intermediate costs decompositions yields, in short, the following decomposition for the growth rate of value added:

$$\Delta VA_{t,t\text{-}1} = \frac{VA_t - VA_{t\text{-}1}}{VA_{t\text{-}1}} = \frac{1}{VA_{t\text{-}1}}\left[(\Delta Rev * Rev_{t\text{-}1}) - (\Delta Cost * Cost_{t\text{-}1})\right]$$

$$\Delta VA_{t,\, t\text{-}1} = \Delta p^{VA}_{t,\, t\text{-}1} + \Delta q^{VA}_{t,\, t\text{-}1} + \Delta pq^{VA}_{t,\, t\text{-}1} \quad (2)$$

where: the contribution made by firms' pricing policies (output and intermediate input prices), productivity and the interaction term between prices and quantities are defined in Equation (3) to (5). For the derivation of (1) and (2) see Appendix 1.

$$\Delta p^{VA}_{t,t\text{-}1} = \frac{1}{VA_{t\text{-}1}}\left[\left(Rev_{t\text{-}1} * \Delta p^o_{t,\, t\text{-}1}\right) - \left(Cost_{t\text{-}1} * \Delta p^i_{t,\, t\text{-}1}\right)\right] \quad (3)$$

$$\Delta q^{VA}_{t,t\text{-}1} = \frac{1}{VA_{t\text{-}1}}\left[\left(Rev_{t\text{-}1} * \Delta q^o_{t,\, t\text{-}1}\right) - \left(Cost_{t\text{-}1} * \Delta q^i_{t,\, t\text{-}1}\right)\right] \quad (4)$$

$$\Delta pq^{VA}_{t,t\text{-}1} = \frac{1}{VA_{t\text{-}1}}\left[\left(Rev_{t\text{-}1} * \Delta p^o_{t,\, t\text{-}1} * \Delta q^o_{t,\, t\text{-}1}\right) - \left(Cost_{t\text{-}1} * \Delta p^i_{t,\, t\text{-}1} * \Delta q^i_{t,\, t\text{-}1}\right)\right] \quad (5)$$

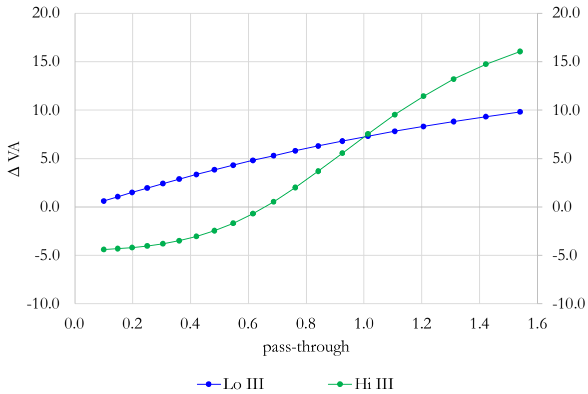
The contribution of prices (3) and quantities (4) to the nominal value added growth rate is thus pinned down by three factors: (1) the difference between output and input price changes ($\Delta p^o_{t,\, t\text{-}1}$ - $\Delta p^i_{t,\, t\text{-}1}$) a proxy for a firm's pricing policy (PP) or, equivalently, its operating pass−through; (2) the difference between output and intermediate input quantity changes ($\Delta q^o_{t,\, t\text{-}1} - \Delta q^i_{t,\, t\text{-}1}$), a proxy for the productivity of intermediate inputs (IIP) and; (3) the difference between revenues and intermediate input costs ($Rev_{t\text{-}1}$ - $Cost_{t\text{-}1}$) a proxy for the intensity of intermediate inputs (III). Under a positive elasticity of intermediate goods and services to output quantities, for firms with low intermediate input intensity, intermediate costs per unit of revenues weigh less and even a substantial increase in their price could have little impact on marginal costs.

Figure 3 illustrates the relationship between firms' pricing policies, measured for ease of interpretation by the ratio between output and input price changes, and the growth rate of value added. It is assumed that the share of intermediate input used by two hypothetical firms to produce 1 unit of output is 0.1 and 0.9, respectively. These two polar and hypothetical cases demonstrate how a firm's value added is influenced by the interaction of its production function and pricing policy; output quantities are held constant thus changes in value added are driven exclusively by changes in pricing policies holding its production function (the share of intermediate input used) fixed.

As the figure suggests, an increase in value added is compatible with pass–through below one especially when firms' intensity in the use of intermediate input is low. Nonetheless, even for firms with high intermediate input intensity positive changes in value added are achievable when the pass–through reaches a certain threshold (e.g. 0.6). It also noteworthy that firms with high III experience a more substantial impact on their value added as a result of changes in pass–through; this is evident from the steeper slope of the curve.

In the context of the extraordinary increase in firms' value added over the years 2021–22 and consequential policy debate regarding its sources, Figure 3 adds two elements to this discussion that are helpful to note: (1) evidence of firms' higher profits is not unambiguously informative of greedy pricing policies (firms' passing on their cost increases to customers more than one–to–one). In turn, pass–through lower than one are compatible with value added and profits growth, especially if the intensity of intermediate input is not too high and productivity gains (or, equivalently, changes in the input mix) allow savings in the use of intermediate inputs; (2) high (low) intensity of intermediate input can amplify (dampen) the response of value added growth rate to changes in pricing policies and, equivalently, gains (losses) in productivity.

Figure 3: Change in pass–through and value added growth



Note: The figure illustrates the relationship between a firm's pricing policy, measure by the ratio between output and intermediate input price changes (a proxy for pass–through) and its value added growth rate. Two hypothetical firms are considered: (1) having low and (2) high intermediate input intensity defined by setting intermediate input quantities equal to 0.1 and 0.9 for each unit of output. Output quantities are held constant therefore changed in value added are solely due changes in pass–through.

3.1 Pricing policies over time

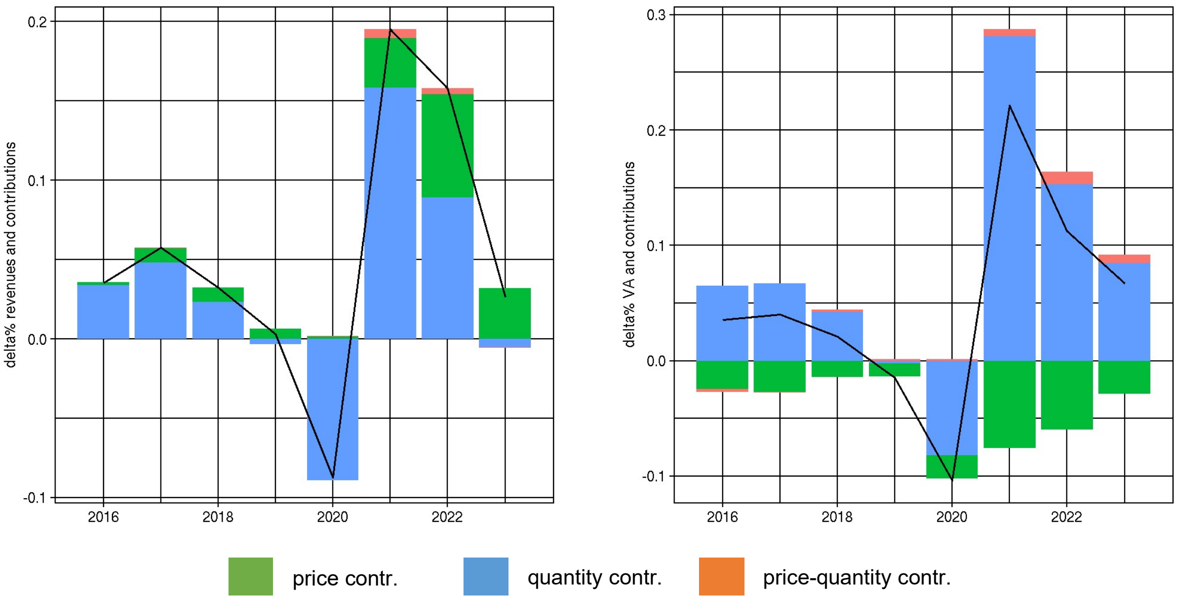
Figure 4 decomposes the growth rates of revenues and value added (solid lines) into their respective price and quantity components (histograms), as defined in Equations (1) and (2). Fluctuations in firms' revenues (Panel a) over the 2016–2023 period are closely correlated with output prices, which, on average, account for approximately one–third of revenue growth. Notably, during the post–pandemic economic recovery, the sharp rise in inflation significantly increased the contribution of output price inflation to revenue growth.

The aggregate dynamics of value added is only modestly influenced by firms' price-setting behaviour, with its contribution being negative (Panel b). This finding suggests that, on average, the incomplete pass–through of rising input costs to output prices –combined with the intensity of intermediate input use– does not provide firms with an effective hedge against input price increases. Instead, value added growth appears to be primarily driven by gains in the productivity of intermediate inputs. This may reflect advances in the production processes or increased substitutability of inputs that became scarcer and relatively more expensive during 2021–2023.

These aggregate results contribute to the ongoing debate on the role of firms' pricing behaviour during recent inflationary episodes. Our findings indicating a negative contribution of price-setting behaviour on value added dynamics align with previous evidence from Italy, which suggests that firms maintaining constant mark-ups did not significantly contribute to the inflation surge (Colonna et al., 2023).

Figure 4: Price and quantity contributions to revenues and value added

Panel a – delta% revenues Panel b – delta% value added



Source: Bank of Italy's SIGE and Cerved.
Note: The histograms decompose the weighted average revenue and value added growth rates (solid lines) into a price, quantity and an interaction component derived according to equations (1) and (2). A matched firm–level price (SIGE) and balance–sheet (Cerved) dataset of about 2.000 companies is used ranging the 2016–23 period.

Nonetheless, aggregate dynamics may hide significant heterogeneity in the contribution of prices to economic margins. In 62 percent of cases, prices contribute negatively to value added, thereby driving the overall aggregate trend (Table 4). Yet, this pattern is not uniform across the sample. Notably, in 19 percent of instances, both prices and quantities contribute positively to the dynamics of value added, highlighting the presence of firms that experience simultaneously gain in both pricing power and output volumes. These results suggest that some firms are better positioned to adapt to cost shocks due to several factors: (i) greater pricing power, which enables them to pass input cost increases on to customers; (ii) more efficient or innovative production processes, allowing them to maintain output levels despite rising costs; and (iii) operation in more inelastic markets, where demand is less sensitive to price changes. These differences underscore the importance of examining firm–specific heterogeneities —an issue we explore in greater detail in the following sections.

Table 4: Breakdown of price and quantity contributions
(per cent)

Price contribution		Quantity contribution: -	Quantity contribution: +
	+	20%	19%
	-	21%	41%

Source: Bank of Italy's SIGE and Cerved.
Note: The table breaks down firms that in a given year reported positive or negative contributions of quantities and prices to the growth rate of value added. Price and quantity components are derived according to equations (1) and (2). A matched firm–level price (SIGE) and balance–sheet (Cerved) dataset of about 2.000 companies is used ranging the 2016–23 period.

3.2 Firm heterogeneity across size classes, sectors, and production functions

Firm size, measured by the number of employees, can serve as a useful proxy for distinguishing companies with varying degrees of market power, exposure to cost fluctuations, and international competition. Figure 5 decomposes the nominal growth rates of revenues and value added into their price, quantity, and interaction components across three firm–size categories: medium (50–199 employees), large (200–999), and very large (1,000 or more).

Over the sample period, average output price changes ranged between 2 per cent for medium–large firms and 1.7 per cent for very large firms. As expected, these figures closely mirror overall inflation trends, given that firms' sale prices are partially captured in consumer price indices. The differences in the contribution of prices to revenue growth between medium–large and very large firms are relatively modest, with price effects accounting for approximately one–quarter of total revenue growth in both groups.

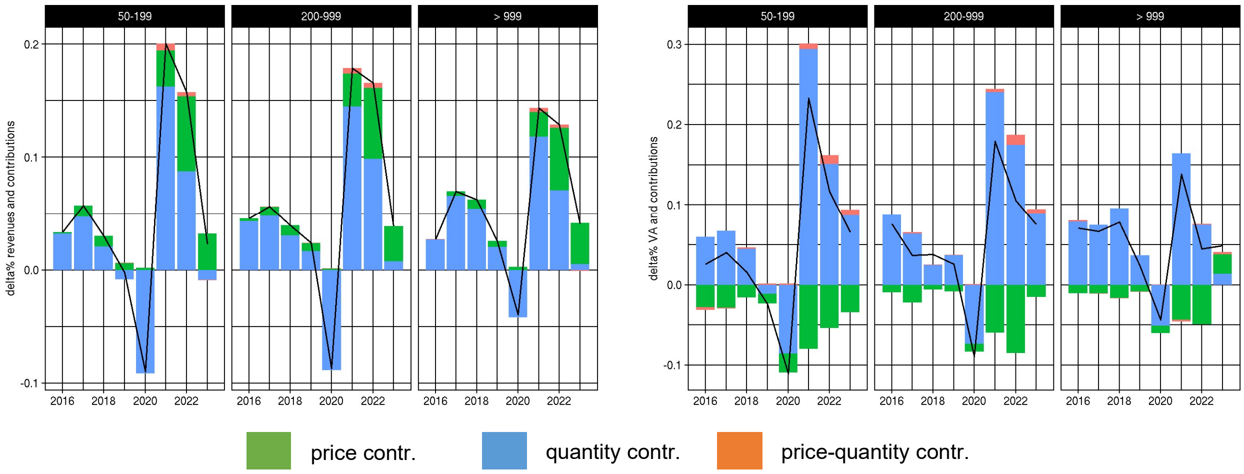
More pronounced differences emerge when examining the contribution of prices to value added across firm sizes. On average, larger firms exhibit a negative but more muted contribution of pricing policies to value added compared to smaller firms. On average, the price component accounts for roughly 40% of value added growth in larger firms, versus about 60% in smaller ones.[13] This discrepancy may reflect the greater resilience of larger firms to intermediate input price fluctuations, as the impact of such cost increases is approximately half as strong as for smaller firms. Notably, these divergences became more pronounced in the aftermath of the pandemic.

Although firm size and market power –measured by a firm's market share– are often considered close proxies, they yield notably different decompositions of value-added dynamics. Figure A.1 in the Appendix presents revenue and value-added growth rates, broken down by firms' revenue market shares within each sector and grouped in three buckets of low, medium and high market shares. The analysis reveals that the price contribution to value-added growth becomes increasingly negative as firms' market power rises. In contrast, the opposite pattern emerges when firms are grouped by size classes. Indeed, cross tabulation of our sample along the two dimensions reveal low overlap between size and market shares (Table A.4).

[13] These shares are computed as the ratio between the average absolute value of firm-level price components ($\Delta p^{VA}_{t,\,t\text{-}1}$) and the average annual value-added growth rate ($\Delta VA_{t,\,t\text{-}1}$).

Figure 5: Revenues and value added decompositions by firm size

Panel a – delta% revenues | Panel b – delta% value added

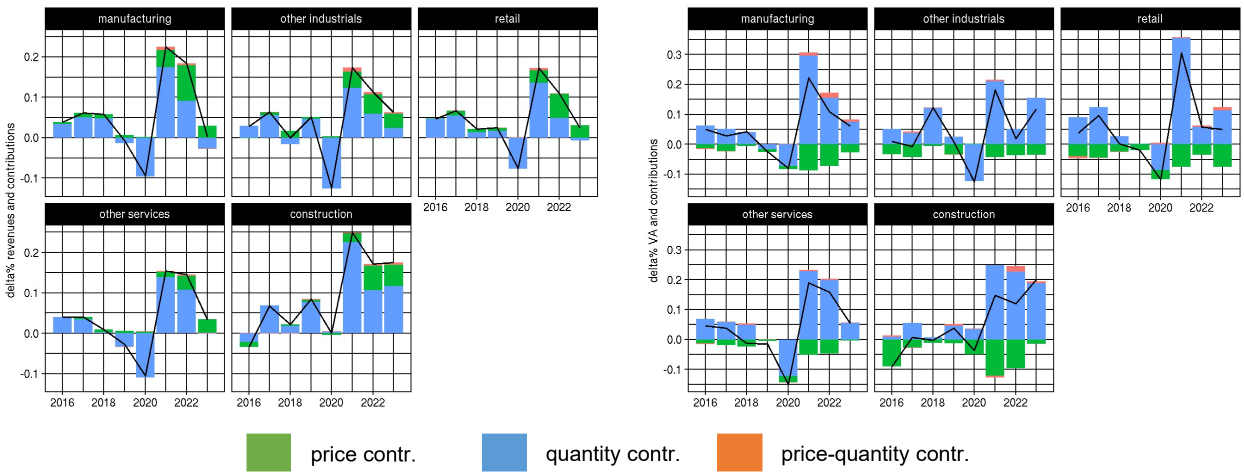


Source: Bank of Italy's SIGE and Cerved.
Note: The histograms decompose the weighted average revenue and value added growth rates (solid lines) into a price, quantity and an interaction component derived according to the equations (1) and (2). A matched firm–level price (SIGE) and balance–sheet (Cerved) dataset of about 2.000 companies is used ranging the 2016–23 period. Firm size is defined using number of employees, with medium firms having between 50 and 199 employees, large firms between 200 and 999 and very large firms with more than 1000 employees.

Sectoral heterogeneity is less pronounced. Sale price increases exhibit a broadly consistent pattern across industries, and —similar to the aggregate trend— their contribution to revenue growth became notably more significant only after the pandemic (Figure 6). On average, the contribution of pricing policies to sectoral value added growth is negative across all sectors, intensifying in the post–pandemic period. This negative impact is particularly pronounced in the construction sector, where pricing dynamics appear to have exerted a stronger drag on value added growth.[14]

Figure 6: Revenues and value added decompositions by sector

Panel a – delta% revenues | Panel b – delta% value added



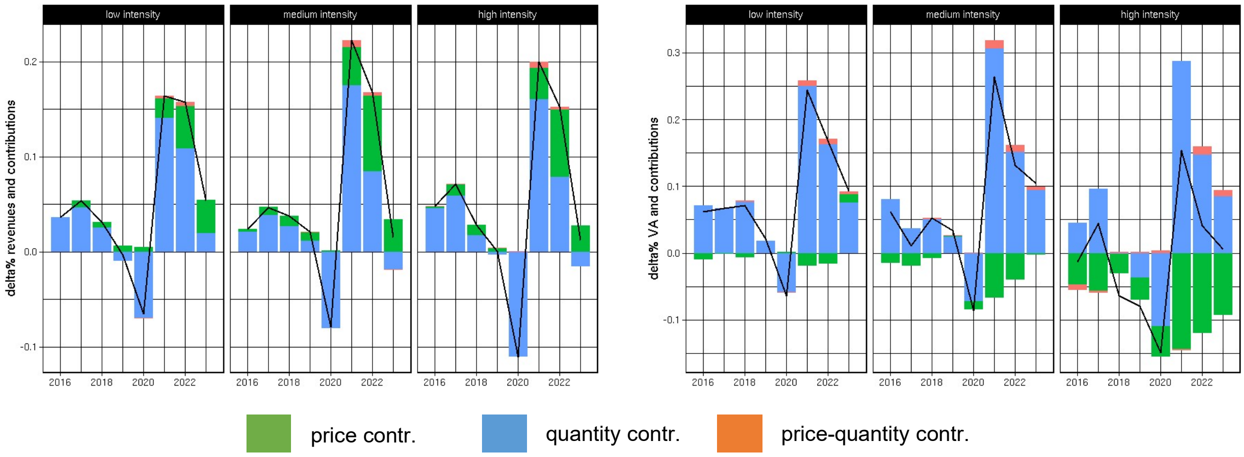
Source: Bank of Italy's SIGE and Cerved.
Note: The histograms decompose the weighted average revenue and value added growth rates (solid lines) into a price, quantity and an interaction component derived according to equations (1) and (2). A matched firm–level price (SIGE) and balance–sheet (Cerved) dataset of about 2.000 companies is used ranging the 2016–23 period.

[14] Fiscal subsidies may have distorted prices in the construction sector. See Accetturo et al (2024).

Finally, grouping firms by their intermediate input intensity provides further insight into the role of pricing policies in shaping value added dynamics. For firms in the highest bucket of input intensity within their respective sectors, changes in input prices contribute more significantly to nominal value added growth (Figure 7). This finding aligns with the comparative statics presented in Figure 1, which highlight how the structure of a firm's production function influences the effectiveness of price-setting behaviour in buffering cost shocks.

Figure 7: Revenues and value added decomposition by intermediate input intensity

Panel a – delta% revenues Panel b – delta% value added



Source: Bank of Italy's SIGE and Cerved.
Note: The histograms decompose the weighted average revenue and value added growth rates (solid lines) into a price, quantity and an interaction component derived according to equations (1) and (2). A matched firm–level price (SIGE) and balance–sheet (Cerved) dataset of about 2.000 companies is used ranging the 2016–23 period. Firm groups are defined by splitting firms into three groups based on their intermediate input costs to revenues ratio.

4. Firms' pricing policy and economic margins

The evidence presented in the previous section, based on an accounting decomposition approach, suggests that pricing policies alone tend to have a negative effect on firms' economic margins. According to the decomposition framework in Equation (2), this outcome may stem from both incomplete pass–through of input costs and the degree of intermediate input intensity. Prior research on the cyclical behaviour of mark–ups indicates that firms often face demand–side or technological constraints that limit their ability to fully adjust prices in response to cost shocks. Additionally, competitive pressures and market structure play a critical role in shaping pricing decisions and the transmission of cost shocks.

To examine how changes in a firm's pricing policy affect its economic performance we adopt a reduced–form panel data regression approach, controlling for both firm–specific and time–fixed effects to account for unobserved heterogeneity. However, identifying a causal relationship in this context is challenging due to potential endogeneity concerns. These include:

(i) simultaneity bias, whereby value added and pricing policies are jointly determined, as outlined in Equation (2);

(ii) omitted variable bias, where unobserved factors —such as market power, competitive intensity, or exposure to international markets— may influence both pricing behaviour and value added.

We begin by estimating the endogenous specification in Equation (2), which includes the full set of controls. We then compare these results with a more parsimonious semi–identity model presented in Equation (6), which imposes fewer assumptions and serves as a robustness check.

$$\Delta VA_{i,t,t\text{-}1} = \alpha + \beta_1 PP_{i,t,t\text{-}1} + \beta_2 IIP_{i,t,t\text{-}1} + \gamma_i + \tau + \varepsilon_{i,t,t\text{-}1} \qquad (6)$$

where: $\Delta VA_{i,t,t\text{-}1}$ is the firm-level value added growth rate, $PP_{i,t,t\text{-}1}$ is the firm's pricing policy measured by the difference between output and input price changes ($\Delta p_t^o - \Delta p_t^i$), and $IIP_{i,t}$ is the firm intermediate input productivity measured by the difference between output and input quantity changes ($\Delta q_t^o - \Delta q_t^i$) term, γ_i and τ are firm and time fixed effects.[15]

Simultaneity and omitted variables bias, are addressed in (7-8) using instrumental variable (IV) approach where idiosyncratic shocks to intermediate input costs occurred in the t−1 period ($Z_{i,t\text{-}1}$) are used in the first stage to isolate exogenous variations in a firm's pricing policy (see Figure 8):

$$\Delta VA_{i,t,t\text{-}1} = \alpha + \delta d\widehat{PP_{i,t,t\text{-}1}} + \gamma_i + \tau + \varepsilon_{i,t,t\text{-}1} \qquad \text{(7, second stage)}$$

$$dPP_{i,t,t\text{-}1} = \alpha + \gamma Z_{i,t\text{-}1} * X_i + \gamma_i + \tau + \mu_{i,t,t\text{-}1} \qquad \text{(8, first stage)}$$

where: $Z_{i,t\text{-}1}$ is the lagged value of the difference between the realized $\Delta p^i_{i,t,t\text{-}1}$ and expected $\widehat{\Delta p}^i_{i,t,t\text{-}1}$ intermediate input price changes between t and t−1, dPP is the change in operating pass−through and, X_i is a vector of firms' characteristics which is used differentiate the response of dPP depending on firms' characteristics.

The definition of shock that we follow aligns with the concept of surprise or unexpected change, operationalized as the forecasting error in intermediate input prices. The instrument is considered relevant under the assumption that firms revise their current pricing policies in response to deviations between realized and expected input prices from the previous period; i.e. firm learn from their forecasting errors. Empirically, we observe a moderate correlation (approximately 0.5) between firm–level input cost shocks and changes in pricing policy, supporting the instrument's relevance.

The exogeneity of the instrument relies on two key conditions:

(1) independence between the instrument and the outcome variable (value added and operating profits growth), and

(2) the exclusion restriction, which requires that the instrument affects the outcome only through its impact on the endogenous regressor.

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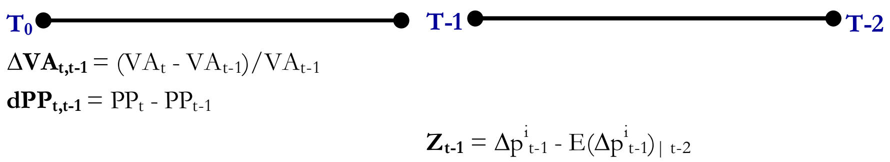
[15] In Equation (6), the pricing policy and intermediate input productivity terms are computed as differences between growth rates rather than as ratios. While the ratio-based approach is more common in the literature due to its intuitive interpretation as an elasticity, it presents a significant drawback: observations with a zero denominator must be excluded, resulting in a loss of data. Another source of reduction in usable observations would occur if logarithmic transformations were applied, as these require strictly positive values. Moreover, due to well-documented nominal rigidities in firms' price setting behaviour (*i.e.* menu costs, strategic complementarities) firms may not adjust promptly their output prices in response to cost increases resulting in a hypothetical zero pass-through when in fact is it negative. By using differences in growth rates, the analysis retains a broader set of observations and avoids the computational issues associated with undefined or infinite values, thereby enhancing robustness without sacrificing interpretability.

The near–zero correlation (0.03) between the instrument and the outcome variables provides suggestive evidence in support of the independence condition. However, the validity of the instrument also rests upon a second and more conceptual condition, namely: a firm's input price forecasting error influences its value added only through adjustments in its pricing policy. In what follows, we assume that the nature of the shock is idiosyncratic, that is, firm-specific rather than aggregate. This assumption appears reasonable insofar as firms within the same industry or economy are exposed to input price fluctuations of varying magnitudes. The evidence presented in Table 1 supports this view, suggesting that larger firms tend to be less exposed to such fluctuations.

In contrast, had we used generalized cost shocks —such as an economy-wide spike in energy prices— their impact on value added could have manifested through multiple channels, including shifts in aggregate demand or supply. Such indirect effects would violate the exclusion restriction, thereby complicating the identification of firm-level cost pass-through dynamics.

Figure 8: Timeline of variables used in the regression



Note: The figure illustrates the main variables used in the regression and their temporal references.

The distribution of firms' intermediate input price forecasting errors is centred around zero yet exhibits considerable dispersion over the sample period (Figure A.2). Notably, during phases of high inflation, firms' expectations became more uncertain, reflected in a higher variance of price shocks. This feature underscores a potential shortcoming of the analysis: if forecasting errors are less informative about shifts in a firm's pass-through behaviour during periods of elevated economic uncertainty, the instrument's predictive power may be compromised. Furthermore, exposure to input cost shocks appears to vary by firm size, with very large firms reporting significantly smaller forecasting errors, suggesting greater resilience or more sophisticated forecasting capabilities.

4.1 Cost–shock driven pricing changes and the impact on economic margins

Using firm–level panel data spanning 2016 to 2023 to estimate the regression model specified in Equation (2) we compare pooled estimates with those obtained from a panel specification that includes firm– and time–fixed effects. The results from the endogenous regression (columns 1–2 in Table 5) confirm that the firm–level contributions of prices and quantities decompose nominal value added growth in an additive manner, as evidenced by coefficient estimates close to unity and intercepts near zero.[16]

[16] When running a linear regression on an additive accounting identity, if the X_i are orthogonal (i.e., uncorrelated) and measured without error, then the regression will recover the true coefficients $\beta_i \approx 1$, for all i and the residual ε will be close to zero. Typically, estimation result in a perfect fit (an adjusted R^2 of 1.00), a zero constant, and coefficients of one for the components that make up the identity. However, this is not the case in our regression due to winsorization of all regressors.

Table 5: Testing accounting decomposition

Dependent Var.:	ΔVA_t	
	Pooled (1)	FE (2)
(Intercept)	0.0016 (0.0034)	
ΔP_t^{VA}	0.9413 *** (0.0369)	0.9362 *** (0.0359)
ΔQ_t^{VA}	0.9939 *** (0.0192)	0.9870 *** (0.0275)
ΔPQ_t^{VA}	0.5225 ** (0.1983)	0.5383 ** (0.2097)
Fixed-Effects:	------------------	------------------
year	No	Yes
firm	No	Yes
S.E.: Clustered	by: firm & year	by: firm & year
Observations	6,371	6,371
R2	0.86	0.91

Source: our estimates based on SIGE and Cerved data.
Note: The table reports OLS estimates of Equation (2) using panel data from the SIGE–Cerved sample for the 2016–22 period. Observations are weighted using survey weights.

Secondly, we employ the more parsimonious semi–identity model specified in Equation (6) to further investigate the roles of pricing policies (PP) and intermediate input productivity (IIP). These terms are derived from the differences between price and quantity changes. The elasticity of value added growth to the contemporaneous IIP term is positive and statistically significant, consistent with the descriptive evidence presented earlier (Table 5). This confirms that quantity dynamics play a substantial role in driving value added growth. Within–firm estimates indicate that a one–standard deviation increase in IIP (13 percentage points) is associated with a 7 percentage point increase in value added (column 3).

Changes in PP are also positively correlated with value added, although the magnitude of this effect is slightly lower than that of productivity and exhibits temporal variation. Specifically, a one–standard deviation increase in PP (5 percentage points) corresponds to a 6 percentage point increase in value added (column 3). However, during the 2021–2022 period, increased pass–through from intermediate input to output prices did not shield firms' economic margins, resulting in either a decline or a statistically insignificant effect on value added (columns 2 and 4). Table A.2 in the Appendix presents estimates of Equation (6) using changes in operating profits (Ebitda) as the dependent variable. The results reinforce the central role of quantity effects in driving Ebitda dynamics, particularly during the post–pandemic recovery period. This finding further supports the conclusion that improvements in intermediate input productivity have been a key factor in sustaining firms' economic performance amid cost pressures.

This finding aligns with prior evidence indicating that firms possess limited operational hedging capacity over their gross operating cash flows through sale price adjustments. Specifically, firms exhibit a constrained ability to pass input cost increases onto output prices, resulting in pricing policy changes that yield only marginal or statistically insignificant effects on value added and Ebitda.

Table 6: The effect of pricing policies and productivity on value added

Dependent Var.:	ΔVA_t			
	Pooled (1)	Pooled (2)	FE (3)	FE (4)
(Intercept)	0.0580 (0.0314)	0.0618 * (0.0315)		
PP_t	1.262 *** (0.1111)		1.240 *** (0.1046)	
IIP_t	0.5868 ** (0.2004)		1.175 *** (0.1600)	1.232 *** (0.1118)
PP_t * 2016		1.630 ** (0.4926)		0.0092 (0.8004)
PP_t * 2017		1.890 *** (0.5258)		1.744 ** (0.5097)
PP_t * 2018		2.440 *** (0.5418)		2.272 *** (0.6429)
PP_t * 2019		3.708 *** (0.5548)		3.180 *** (0.5925)
PP_t * 2020		2.500 *** (0.3499)		2.376 *** (0.5855)
PP_t * 2021		-0.1618 (0.3315)		-0.4825 (0.2975)
PP_t * 2022		0.4760 (0.2694)		0.4907 (0.2760)
PP_t * 2023		1.104 ** (0.3158)		1.947 *** (0.4308)
Fixed-Effects:	------------------	------------------	------------------	------------------
year	No	No	Yes	No
firm	No	No	Yes	Yes
S.E.: Clustered	by: firm & year	by: firm & year	by: firm & year	by: firm & year
Observations	6,371	6,371	6,371	6,371
R2	0.15	0.16	0.50	0.48

Source: our estimates based on SIGE and Cerved data.
Note: The table reports OLS estimates of equation (6) using panel data from the SIGE–Cerved sample for the 2016–23 period. Observations are weighted using survey weights.

The previous estimates derived from the endogenous specification highlight the correlation between pricing policies and changes in value added and profits, while also suggesting potential heterogeneity across firms. However, these correlations may be biased due to simultaneity and omitted variable concerns. To address these issues, we implement a two–stage least squares instrumental variables (2SLS–IV) approach. Specifically, we use lagged input cost shocks (or "surprises") from period t–1 as instruments to shift the operating pass–through in period t, thereby recovering local average treatment effects on value added and profit changes. Results are reported in Table 7.

The first–stage regression confirms that firms adjust their pricing policies in response to idiosyncratic input cost shocks (column 2, 4). Specifically, a one–standard deviation cost shock (6 percentage points) leads to a 4 percentage point increase in operating pass–through. Moreover, an F-statistic significantly greater than 10 supports the instrument's relevance.

However, this adjustment in price-setting behaviour does not translate into a statistically significant effect on value added or profits (column 1, 3).

Table 7: The pass–through of cost shocks to economic margins

Dependent Var.:	ΔVA_t (second stage) (1)	dPP_t (first stage) (2)	$\Delta Ebitda_t$ (second stage) (3)	dPP_t (first stage) (4)
dPP_t	0.1427 (0.3197)		0.6828 (0.8971)	
Lag(Input cost shock$_t$)		0.7368 *** (0.0796)		0.7368 *** (0.0796)
Fixed-Effects:	--------------	------------------	--------------	------------------
year	Yes	Yes	Yes	Yes
firm	Yes	Yes	Yes	Yes
S.E.: Clustered	by: firm & year	by: firm & year	by: firm & year	by: firm & year
Observations	2,717	2,717	2,716	2,716
R2	0.38	0.52	0.39	0.52
F-test (1st stage)		1,206		1,205
Wald (1st stage)		85.68		85.64

Source: our estimates based on SIGE and Cerved data.
Note: The table reports estimation of equations (6) and (7) using panel data with firm–time fixed effects. Robust standard errors in parenthesis.

Cost shocks do not affect firms' pricing behaviour uniformly (Table 8). By splitting the sample by firm size in the first stage, we account for heterogeneity in firms' ability to translate unexpected input price changes into output price adjustments. The results indicate that very large firms demonstrate a greater capacity to absorb cost fluctuations and increase their operational pass–through (column 4). Notably, this enhanced pass–through leads to a statistically significant improvement in the value added growth rate for very large firms only, while no such effect is observed for the rest of the sample. In contrast to firms' size, market power metrics suggest opposite results: firms with larger market shares generally pass-through input price shocks relatively less than other firms (see Table A.3 in the Appendix).[17] While corroborating descriptive evidence in Section 3 and Figure A.1, these results also align with previous empirical evidence (Hong and Li, 2017; Tan and Zhou, 2017; Kouvavas et al., 2021) showing that firms with higher market power tend to buffer their customers from cost shocks by adjusting their mark-ups.

The finding of statistically insignificant effects of idiosyncratic cost shocks on profits aligns with the notion that firms are generally unable to fully pass on firm–specific cost increases to consumers in a way that enhances profitability. This suggests that price adjustments in response to such shocks are primarily defensive rather than opportunistic. Firms may raise prices to offset rising costs, but competitive pressures, demand elasticity, and customer retention concerns limit their ability to do so beyond cost recovery.

This behaviour is generally pronounced in markets with high competition or where consumers are price–sensitive. In such settings, unilateral price increases risk eroding market share if competitors are not similarly affected. Consequently, many firms may choose to absorb part of the cost shock internally—through reduced margins or operational adjustments—rather than jeopardize customer relationships.

However, our results reveal a notable exception: very large firms. These firms not only exhibit a greater capacity to increase pass–through in response to cost shocks, but also show a statistically significant improvement in profits. This suggests that firm size confers strategic

[17] While the first stage is significant, please note that the even when splitting the sample by market power, second-stage estimates are statistically insignificant (Table A.3).

advantages that allow them to both shield margins and enhance profitability when faced with cost shocks.

The ability of very large firms to convert cost shocks into profit gains may reflect their superior pricing power combined with greater control over supply chains. These firms may also face less elastic demand, enabling them to raise prices without proportionate losses in sales volume. In contrast, smaller firms, lacking these advantages, are more constrained in their pricing responses and thus unable to translate cost shocks into improved financial performance.

Taken together, these findings challenge simplified narratives such as "greedflation" by showing that most firms do not profit from cost shocks. Instead, they highlight the importance of firm heterogeneity in shaping the transmission of input cost shocks to prices and profits, and underscore the structural advantages that allow only the largest firms to benefit from such dynamics.

Table 8: Heterogeneity in pass−through of cost shocks – firm size

Dependent Var.:	medium-large		large		very-large	
	ΔVA_t (second stage) (1)	dPP_t (first stage) (2)	ΔVA_t (second stage) (3)	dPP_t (first stage) (4)	ΔVA_t (second stage) (5)	dPP_t (first stage) (6)
dPP_t	0.1671 (0.3590)		-0.2668 (0.4944)		1.017 ** (0.2527)	
Lag(Input cost shock$_t$)		0.6926 *** (0.0900)		0.7475 *** (0.0821)		1.149 *** (0.0758)
Fixed-Effects:	--------------	------------------	--------------	------------------	--------------	------------------
year	Yes	Yes	Yes	Yes	Yes	Yes
firm	Yes	Yes	Yes	Yes	Yes	Yes
S.E.: Clustered	by: firm & year	by: firm & year	by: firm & year	by: firm & year	by: firm & year	by: firm & year
Observations	1,486	1,486	872	872	358	358
R2	0.42	0.54	0.48	0.55	0.28	0.61
F-test (1st stage)		1,198		660		386
Wald (1st stage)		78.51		59.02		82.92

Source: our estimates based on SIGE and Cerved data.
Note: The table reports estimation of equations (6) and (7) using panel data with firm−time fixed effects. Robust standard errors in parenthesis.

5 Conclusion

The sharp rise in inflation during 2021–2022 sparked an intense debate over its underlying causes and the appropriate policy responses. In Europe, attention turned to potential shifts in firms' price−setting behaviour. The "greedflation" hypothesis ─suggesting that firms opportunistically raised prices beyond cost increases─ gained traction in public and policy discourse. However, our findings do not support this narrative. We find no systematic evidence that firms expanded their economic margins in response to cost shocks in a way that would validate the greedflation hypothesis.

We leverage firm−level data on output and intermediate input price changes to decompose the growth rate of value added into two components: the contribution of pricing policies and that of intermediate input productivity. This approach uncovers important heterogeneities that aggregate statistics typically obscure, including differences in firms' input intensity, exposure to input price fluctuations, and ability to pass cost changes through to output prices.

On average, the consistent and significant role of intermediate input productivity in explaining both value added and profits growth suggests that quantity−based improvements, rather than price-setting behaviour, are the main engine of firms' economic performance. This implies that (1) firms that invest in process innovation, efficiency gains, or input substitution are better positioned to maintain or grow margins and, (2) policies that support technological upgrading, digitalization, and supply chain resilience may be more effective than those focused solely on price stabilization.

In contrast, the contribution of pricing policies is weaker and more variable over time indicating that firms face constraints in passing through costs, likely due to competitive pressures or demand elasticity. Even when pass-through occurs, it often fails to fully offset rising input costs, especially for firms with high input intensity. This challenges the notion that firms broadly contributed to inflation through margin expansion, supporting evidence of limited mark−up behaviour in some economies.

To isolate causal effects, we exploit exogenous variation in firms' pass−through behaviour induced by idiosyncratic input cost shocks. We find that firms tend to raise their pass−through rates following unexpected input price hikes, with larger firms doing so to a greater extent. For the latter, their pricing power is dual stemming from both the sell-side and the buy-side. However, this adjustment does not necessarily translate into significant improvements in value added or profits – which is limited only to the very large firms. This suggests that increased pass−through may reflect an effort to preserve existing profit margins rather than a sign of resilience.

6 References

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7 Appendix

A1. Firms' revenues, intermediate costs and value added growth rates decomposition

In what follows we illustrate the accounting decomposition of the revenues and value added percentage changes into price, quantity components and the interaction between the two.

Superscripts (o, i) indicate output and input while (Δ) the percentage change between t and t−1.

$$\Delta Rev_{t,\ t-1} = \frac{p^o_t q^o_t - p^o_{t-1} q^o_{t-1}}{p^o_{t-1} q^o_{t-1}} \qquad 1$$

by defining $p^o_t = p^o_{t-1} * (1+\Delta p^o_{t,\ t-1})$ and $q^o_t = q^o_{t-1} * (1+\Delta q^o_{t,\ t-1})$ we obtain:

$$\Delta Rev_{t,\ t-1} = \frac{p^o_{t-1} * \left(1+\Delta p^o_{t,\ t-1}\right) * q^o_{t-1} * \left(1+\Delta q^o_{t,\ t-1}\right) - p^o_{t-1} q^o_{t-1}}{p^o_{t-1} q^o_{t-1}} =$$

$$\Delta Rev_{t,\ t-1} = \frac{p^o_{t-1} * pq^o_{t-1} * \left[\left(1+\Delta p^o_{t,\ t-1}\right) * \left(1+\Delta q^o_{t,\ t-1}\right) - 1\right]}{p^o_{t-1} q^o_{t-1}} =$$

$$\Delta Rev_{t,\ t-1} = \left[\left(1+\Delta p^o_{t,\ t-1}\right) * \left(1+\Delta q^o_{t,\ t-1}\right) - 1\right]$$

Given $\Delta p^o_{t,\ t-1}$ (1.a) from firms' responses in SIGE, we are able to retrieve the followings (1.b) as the quantity component

$$\Delta q^o{}_{t,\ t-1} = \left[\left(1+\Delta Rev_{t,\ t-1}\right) / \left(1+\Delta p^o_{t,\ t-1}\right) - 1\right] \qquad 1.b$$

and (1.c) as the interaction between price and quantity:

$$\Delta p^o_{t,\ t-1} q_{t,\ t-1}{}^o = \left[\Delta p^o_{t,\ t-1} * \Delta q^o_{t,\ t-1}\right] \qquad 1.c$$

So that the summation of the three components (1.a,b,c) totals the overall $\Delta Rev_{t,\ t-1}$.

Expressions from 1 to 1.c can be adapted to intermediate costs (*i.e.* the difference between Revenues and Value added) to obtain a similar decomposition.

$$\Delta Cost_{t,\ t-1} = \frac{p^i_t q^i_t - p^i_{t-1} q^i_{t-1}}{p^i_{t-1} q^i_{t-1}} = \left[\left(1+\Delta p^i_{t,\ t-1}\right) * \left(1+\Delta q^i_{t,\ t-1}\right) - 1\right] \qquad 2$$

The percentage change in value added is thus defined as follows:

$$\Delta VA = \frac{(Rev_t - Cost_t) - (Rev_{t-1} - Cost_{t-1})}{(Rev_{t-1} - Cost_{-1})} = \frac{(Rev_t - Rev_{t-1}) - (Cost_t - Cost_{t-1})}{(Rev_{t-1} - Cost_{-1})} \qquad 3$$

$$= \frac{(Rev_t - Rev_{t-1})}{(Rev_{t-1} - Cost_{-1})} * \frac{(Rev_{t-1})}{(Rev_{t-1})} - \frac{(Cost_t - Cost_{t-1})}{(Rev_{t-1} - Cost_{-1})} * \frac{(Cost_{t-1})}{(Cost_{t-1})}$$

by defining VA = Rev-Cost we obtain:

$$\Delta VA = \frac{1}{VA_{t-1}} \left[\left(\Delta Rev_{t,\ t-1} * Rev_{t-1}\right) - \left(\Delta Cost_{t,\ t-1} * Cost_{t-1}\right)\right]$$

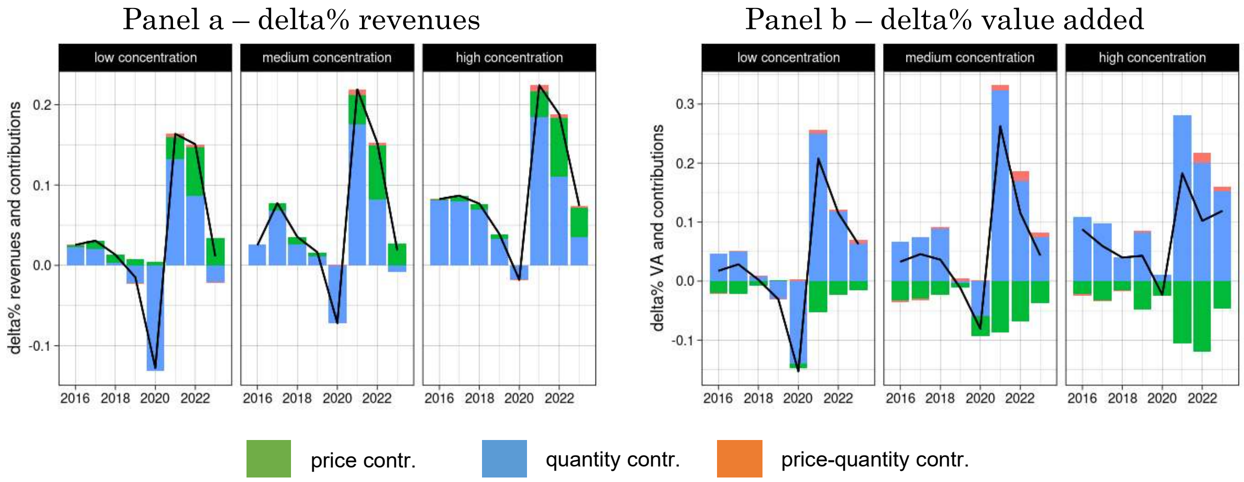
From (1-3) we are able to retrieve the following VA additive decomposition into price, quantity, and the interaction between the two components:

$$\Delta p^{VA}_{t,\ t\text{-}1} = \frac{1}{VA_{t\text{-}1}}\left[\left(Rev_{t\text{-}1} * \Delta p^{o}_{t,\ t\text{-}1}\right) - \left(Cost_{t\text{-}1} * \Delta p^{i}_{t,\ t\text{-}1}\right)\right] \quad 3.1$$

$$\Delta q^{VA}_{t,\ t\text{-}1} = \frac{1}{VA_{t\text{-}1}}\left[\left(Rev_{t\text{-}1} * \Delta q^{o}_{t,\ t\text{-}1}\right) - \left(Cost_{t\text{-}1} * \Delta q^{i}_{t,\ t\text{-}1}\right)\right] \quad 3.2$$

$$\Delta pq^{VA}_{t,\ t\text{-}1} = \frac{1}{VA_{t\text{-}1}}\left[\left(Rev_{t\text{-}1} * \Delta q^{o}_{t,\ t\text{-}1} * \Delta p^{o}_{t,\ t\text{-}1}\right) - \left(Cost_{t\text{-}1} * \Delta q^{i}_{t,\ t\text{-}1} * \Delta p^{i}_{t,\ t\text{-}1}\right)\right] \quad 3.3$$

Figure A.1: Revenues and value added decomposition by market power

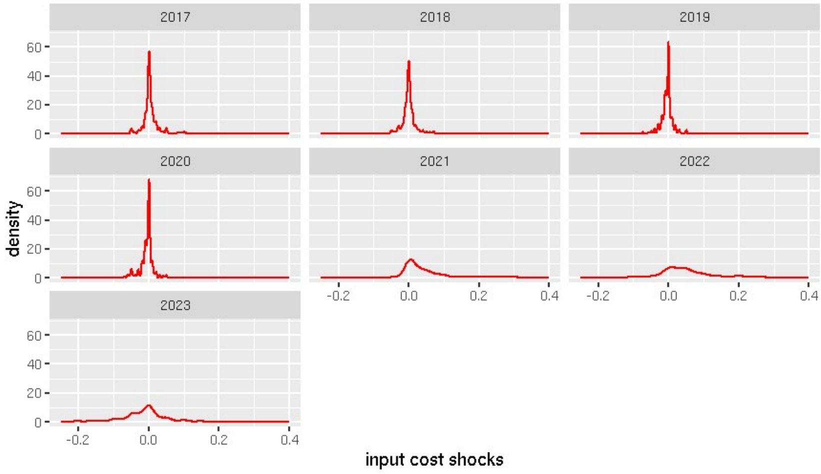


Source: Bank of Italy's SIGE and Cerved.

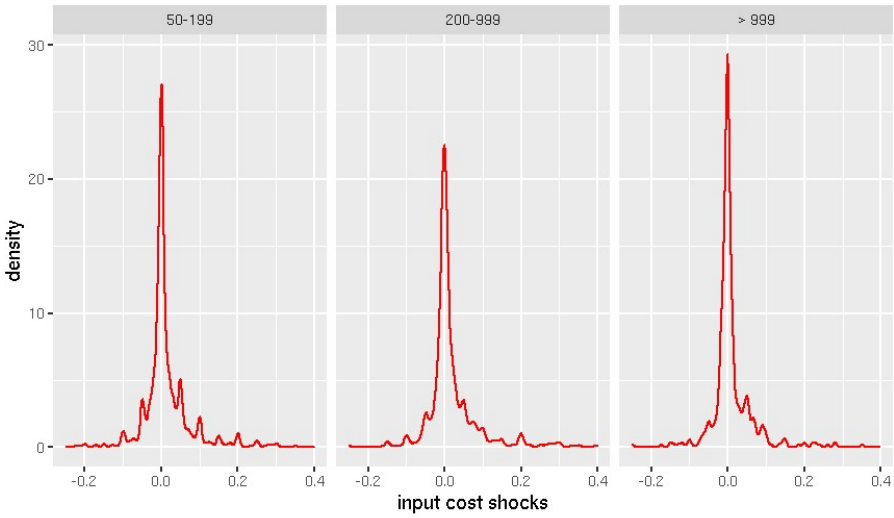
Note: The histograms decompose the weighted average revenue and value added growth rates (solid lines) into a price, quantity and an interaction component derived according to equations (1) and (2). A matched firm–level price (SIGE) and balance–sheet (Cerved) dataset of about 2.000 companies is used ranging the 2016–23 period. Firm groups are defined by splitting firms into three groups based on their market shares —in terms of revenues— within each sector.

Figure A.2: Idiosyncratic input cost shocks

panel A: shocks over time



panel B: shocks between firm sizes



Source: our estimates based on SIGE and Cerved data.
Note: The figure reports densities of input cost shocks defined as the difference between the realized $\Delta p^{i}_{i,t,t\text{-}1}$ and expected $\widehat{\Delta p}^{i}_{i,t,t\text{-}1}$ intermediate input price changes between t and t−1. Panel data from the SIGE−Cerved sample for the 2016−23 period are used. Size classes correspond to medium (between 50 and 199 employee), large (between 200 and 999 employee) and very large (more than 999 employee) firms.

Table A.1: Firms' characteristics by pass-through rate

Averages	Pass-trough <=1	Pass-trough >1
Δ Output	2.51	4.35
Δ Input	5.79	2.56
Pass-through	0.38	2.02
Age	36.38	37.09
Assets	102,576	206,781
ROA(%)	7.26	7.89
Revenues	85,962	125,257
Debt_assets_ratio	0.23	0.22
Leverage	0.66	0.63
Industrials	36.10	40.41
Other industrials	4.43	4.37
Retail	15.87	18.16
Services	30.93	24.51
Constructions	12.67	12.54

Source: our calculation based on SIGE and Cerved data.
Note: The table reports averages for the 2016–23 period for firms' characteristics belonging to the different groups: with pass-through level below or above 1, respectively. Observations are weighted using survey weights.

Table A.2: The effect of pricing policies and productivity on Ebitda

Dependent Var.:	$\Delta Ebitda_t$			
	Pooled (1)	Pooled (2)	FE (3)	FE (4)
(Intercept)	0.0506 (0.0498)	0.0495 (0.0501)		
PP_t	1.450 *** (0.3003)		1.547 *** (0.3361)	
IIP_t	1.767 ** (0.6251)		3.210 *** (0.7442)	1.480 *** (0.3483)
PP_t * 2016		5.670 *** (1.120)		8.450 (5.197)
PP_t * 2017		1.918 * (0.8483)		3.239 (1.766)
PP_t * 2018		-3.129 ** (1.005)		-3.594 (2.102)
PP_t * 2019		2.630 ** (0.9042)		0.7019 (3.626)
PP_t * 2020		1.788 ** (0.5876)		2.003 (1.714)
PP_t * 2021		0.9902 (0.5521)		0.9751 (0.7188)
PP_t * 2022		1.948 *** (0.4826)		1.439 (0.7820)
PP_t * 2023		2.655 *** (0.5665)		5.447 ** (1.814)
Fixed-Effects:	-----------------	------------------	------------------	------------------
year	No	No	Yes	No
firm	No	No	Yes	Yes
S.E.: Clustered	by: firm & year	by: firm & year	by: firm & year	by: firm & year
Observations	6,368	6,368	6,368	6,368
R2	0.01	0.01	0.41	0.41

Source: our estimates based on SIGE and Cerved data.
Note: The table reports OLS estimates of equation (6) using panel data from the SIGE–Cerved sample for the 2016–23 period. Observations are weighted using survey weights.

Table A.3: The pass−through of cost shocks to economic margins by market shares

Dependent Var.:	low market shares		medium market shares		high market shares	
	ΔVA_t (second stage) (1)	dPP_t (first stage) (2)	ΔVA_t (second stage) (3)	dPP_t (first stage) (4)	ΔVA_t (second stage) (5)	dPP_t (first stage) (6)
dPP_t	0.4493 (0.6337)		-0.2279 (0.3270)		0.1323 (0.5873)	
Lag(Input cost shock$_t$)		0.6935 *** (0.0964)		0.7437 *** (0.1097)		0.6507 *** (0.0661)
Fixed-Effects:	----------------	------------------	----------------	------------------	------------------	------------------
year	Yes	Yes	Yes	Yes	Yes	Yes
firm	Yes	Yes	Yes	Yes	Yes	Yes
S.E.: Clustered	by: firm & year	by: firm & year	by: firm & year	by: firm & year	by: firm & year	by: firm & year
Observations	739	739	944	944	1,033	1,033
R2	0.54468	0.61354	0.36222	0.55634	0.46536	0.50914
Within R2	-0.00288	0.32066	0.00124	0.31893	-0.00169	0.28711
F-test (1st stage), d_w_PT2	347.88	--	441.13	--	415.22	--
F-test (1st stage)	--	347.88	--	441.13	--	415.22
Wald (1st stage), d_w_PT2	51734	--	45992	--	96966	--
Wald (1st stage)	--	51734	--	45992	--	96966

Source: our estimates based on SIGE and Cerved data.
Note: The table reports OLS estimates of equation (6) using panel data from the SIGE−Cerved sample for the 2016−23 period. Observations are weighted using survey weights. Firms' market shares are identified by the ratio between a firm revenue and the sum of revenues within its sector. The overall sample of firms is split in approximately equally sized buckets using firms' market shares as a split variable.

Table A.4: Cross tabulation between size and market shares

		Market shares		
		low	medium	high
Size	medium	29,7	21,2	10,0
	large	4,6	10,4	14,4
	very large	0,2	1,7	7,8

Source: our calculations based on SIGE and Cerved data.
Note: The table cross tabulates the shares (percent) of firms belonging to size and market shares buckets. Firms' market shares are identified by the ratio between a firm revenue and the sum of revenues within its sector. The overall sample of firms is split in approximately equally sized buckets using firms' market shares as a split variable.