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THE PROFIT SHARE AND FIRM MARK-UP: HOW TO INTERPRET THEM?

by Fabrizio Colonna*, Roberto Torrini† and Eliana Viviano*

Abstract

This paper discusses, theoretically and empirically, the relationship between two indicators: the profit share in value added and markups. While many commentators simply interpret the profit share as a proxy for markup, we show that with a production function with two inputs (i.e. labour and intermediates), the profit share can increase even if markups remain constant or diminish. This occurs when intermediate input costs grow faster than labour costs (as in the current economic situation) and input substitutability is limited (as with energy and labour, in the short run). Unfortunately, markups cannot be easily calculated using national accounts data, but approximate data are available for some sectors in Germany and Italy. We can thus show that markups in industry and in manufacturing remained constant in Germany in 2022, but increased considerably in construction, retail, accommodation and transport. In Italy, instead, markups returned to their pre-pandemic levels following a series of adjustments during the health emergency.

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1 Introduction¹

The aim of this short note is to discuss the relationship between profit margins and markups in economic theory and in practice, i.e. in the analysis of National Account data. At this stage, the topic is particularly relevant given the need to monitor the risks of high inflation.

According to economic theory, firms set their prices by applying a markup to marginal costs. Inflationary pressures can result from increases in the marginal cost of production, with constant markups, from increases in the markup itself (due to the strategic behaviour of firms), or both.

While marginal costs can be approximated by average costs under certain assumptions about the production function, markups remain extremely difficult to monitor in practice; many national statistical offices usually do not provide these variables at macro level. Timely and representative data on firm balance sheets are also not available.

Therefore, as an alternative, analysts tend to examine the dynamics of the profit share: this index, defined as the ratio of profits to value added, is much easier to compute using National Accounts. An increase in the profit share, as the one observed after the pandemic in the US, and more recently in some euro area countries, is often interpreted as a signal of inflationary pressure generated by firms' pricing strategies.

Unfortunately, an increase in the profit share cannot unambiguously be interpreted as an increase in markups, unless quite restrictive conditions on the shape of the production function are met (for example if the production function is a Cobb-Douglas).

We show that in a more general framework, with a production function with two inputs, labour and intermediates, the profit share can increase even if markups remain constant. This is the case if the following conditions (actually very reasonable in the current juncture) are met:

1. the price of intermediate inputs grows faster than labour costs (as in the current juncture);
2. inputs display limited substitutability, as for instance it is reasonable to assume in the short run for energy and labour.

The intuition goes as follows: given a constant markup rule, profits increase propor-

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tionally to total revenues². However, the profit share is not calculated relatively to total revenues, but relatively to value added, which excludes the value of intermediate goods. Thus, when the relative price of intermediate goods increases, value added may grow less than total revenues and therefore the ratio of profits to value added might also increase, even if the pricing strategies of firms have not changed.³

Based on available National Account data on markups, available only for some sectors in Germany and Italy, we also show that in Germany in 2022 markups in industry and in manufacturing remained constant, but increased considerably in constructions and in retail-accommodation-transport. In Italy, instead, after some adjustments due to the pandemic, in the last quarter of 2022 markups returned to their pre-pandemic levels.

2 A simple framework

Let's denote output by Q , its price by p , wage by w , labour by L ⁴ and profits by π . Let TC , MC and AC denote total, marginal and average cost respectively. Finally let's assume that firms are able to set prices by charging a mark-up μ over the marginal cost, i.e. $p = \mu MC$. The profit share (PS) is typically calculated, using National accounts data, by dividing profits by the nominal value added, which includes both profits and the wage bill wL , but not the cost of intermediates, i.e.:

$$PS = \frac{\pi}{\pi + wL} = \frac{pQ - TC}{pQ - TC + wL} = \frac{\mu MC \cdot Q - TC}{\mu MC \cdot Q - TC + wL} = \frac{(\mu \frac{MC}{AC} - 1)}{(\mu \frac{MC}{AC} - 1) + \frac{wL}{TC}} \quad (1)$$

Let's notice that:

- It is certainly true that if the mark-up increases the profit share also increases.
- The opposite is not necessarily true. If firms decide to maintain their mark up fixed, the profit share can still increase if the ratio wL/TC decreases (alternatively, the profit share can increase if intermediates absorb a growing share of total costs).
- The profit share can increase even if both the mark-ups and the cost shares are constant,

²With a general homogenous production function the marginal cost is proportional to average cost. With constant markups profits are therefore proportional to total revenues and total costs. (see Section 3)

³An increase in the profit share would be compatible even with a decline of markups.

⁴We focus on labor, but L can represent any other input, such as land, whose return is included in value added.

i.e. when the marginal cost increases faster than average cost. This can happen, for example, when variable costs increase while fixed costs remain unchanged.

3 On the shape of the production function

As shown by equation 1 changes in the profit shares do not depend only on markups but also by $\frac{MC}{AC}$ and $\frac{wL}{TC}$. As in standard macro models, let's start with a generic homogenous function in labour L and the intermediate good I ; the price of the latter is denoted by q . In this case, the marginal cost $MC(Q)$ is a constant fraction of the average cost $AC(Q)$:

$$MC = kAC \quad (2)$$

The parameter k captures potential economies of scale: a value lower, equal or higher than one implies, respectively, positive, constant or negative returns to scale. The profit share can therefore be written as:

$$PS = \frac{(\mu k - 1)}{(\mu k - 1) + \frac{wL}{TC}} = \frac{(\mu k - 1)}{(\mu k - 1) + \frac{wL}{wL + qI}} \quad (3)$$

What happens if, as in the current juncture, the price q of the intermediate good increases? The overall effect on the profit share will depend on the impact of the increase in q on the share of labour in total costs $\frac{wL}{TC}$, that in turns depends on the elasticity of substitution between the two inputs, L and I . In what follows we further discuss specific hypotheses on the degree of substitutability of inputs in production with a general homogeneous function of degree one. This assumption allows us to simplify notation, but the main results hold also for increasing and decreasing return to scale.⁵

3.1 CES production function

Consider a generic the CES production function with constant returns to scale:

$$Q = A[\alpha L^\rho + (1 - \alpha)I^\rho]^{\frac{1}{\rho}} \quad (4)$$

⁵In this short note we will not explore the case of non-homogenous function, that is when the marginal cost is not proportional to the average cost. However we can briefly discuss some mechanisms potentially in place. Let's suppose that firms face a constant marginal cost but they need to bear also a fixed cost (F). Therefore $\frac{MC}{AC} = \frac{MC}{(MC + F/Q)}$ where Q is total output. If marginal costs increase, output price will follow and total revenues will grow faster than total cost. The equation above shows that, for given F , Q and, μ , this could inflate the profit share.

where A is total factor productivity, $\alpha \in (0, 1)$ is the so called share parameter and $\rho < 1$ is the substitution parameter, determining the degree of substitutability of the inputs ⁶. We do not include capital as input in the production function since its returns are embedded in profits. If we did, our results would not change since the profit share is affected only by the wedge between total revenues and value added (with the latter excluding intermediate goods, as already stated).

Based on the discussion provided in the previous sections, it is rather intuitive to asses that in the case of the CES function with low degree of substitution across inputs ($\rho < 0$), an increase in the relative price of the intermediate good will only slightly decrease its demand. Independently of what happens to markups, the fraction of total cost due to labour will decrease and the profit share will go up. In what follow we prove this intuition more formally, for specific production functions.

3.2 Leontief, perfect complementarity

To get an intuition of what happens with substitutability lower than 1 - a reasonable assumption in the short run - consider the case of perfect complementarity i.e. a Leontief production function (corresponding to a CES production function with parameter ρ approaching to $-\infty$). Without loss of generality, we express both inputs in unitary terms.

$$Q = \min(L, I) = L = I; \quad (5)$$

and

$$TC(Q) = (w + q)Q. \quad (6)$$

The profit share is equal to ⁷

$$PS = \frac{(\mu - 1)}{(\mu - 1) + w/(w + q)} \quad (7)$$

If q grows faster than w , that is if the cost of intermediate inputs grows faster than wages, the profit share (profit/value added) will increase.

Intuitively, if firms cannot easily replace the intermediate good with labour when the former becomes relatively more expensive, then value added will grow less than revenues.

⁶The function can be alternatively expressed in terms of the elasticity of substitution $\sigma = \frac{1}{1-\rho}$.

⁷With the alternative formulation, $Q = A \min(\frac{L}{\alpha}, \frac{I}{1-\alpha})$, we would obtain $L = \alpha \frac{Q}{A}$, $I = (1 - \alpha) \frac{Q}{A}$. The profit share would be $PS = \frac{\mu-1}{(\mu-1)+\alpha w/(\alpha w+(1-\alpha)q)}$. Again the denominator decreases if q grows slower than w .

Since, with a constant markup rule, profits will increase in line with revenues, the profit share will increase even if firms do not change their price-setting strategies. Thus, the profit share of value added is not informative on the relationship between markups and price dynamics.

3.3 Cobb Douglas, constant shares

The Cobb Douglas production function corresponds to the case in which ρ tends to zero, i.e. unit elasticity:

$$Q = A[L^\alpha I^{(1-\alpha)}] \quad (8)$$

With a Cobb Douglas the share of input costs in total costs is constant and independent on their relative price. It follows that:

$$\frac{wL}{TC} = \alpha \quad (9)$$

In this case, and only in this case, with a constant mark-up, any change in the relative price of inputs does not impact on the profit share. It follows that any change in the profit share must be caused by a change in markups.

3.4 Linear production function, perfect substitutability

If the two inputs here considered, L and I , are substitute, as in the case of a CES function with elasticity of substitution larger than one, an increase in the relative price of the intermediate good will cause a larger shift of input demand towards labour, raising the labour share and squeezing the profit share. Let's consider the extreme case in which $\rho = 1$ (linear production function): $Q = L + I$. Then firms will use only the cheapest input and:

$$PS = \begin{cases} 1 & \text{if } q < w \\ \frac{(\mu-1)}{(\mu-1)+w} < 1 & \text{if } q > w \\ \in [\frac{(\mu-1)}{(\mu-1)+w}, 1] & \text{if } w = q \end{cases} \quad (10)$$

In the first case, labour is *too* expensive, firms will use only intermediates and the profit share is equal to 1. In the second case, intermediates are *too* expensive and firms will use only labour. The profit share will be less than one. In the third case, firms are indifferent between the two inputs and PS is comprised between the two previous cases. If q becomes higher than w , then firms might switch from the first to the second case, they will use only labour and the profit share will decrease.

4 Profit share and mark-ups in National Accounts

In National Accounts the profit share (or capital share) is defined as the share of national income distributed as a return to capital, including interests, dividends, and realized capital gains. It should ideally be computed as the ratio between the gross operating surplus (GOS) and output, but the last one is proxied by value added.⁸ Moreover, National Accounts allow to get only a proxy of GOS, so the profit share is approximated by:

$$PS = 1 - \frac{wL}{va} \quad (11)$$

where w is nominal wage, L is labour (employees or hours) and va is the valued added in nominal terms. The dynamics of the profit share can be further decomposed, disentangling the contribution of (i) real productivity (i) the value added deflator (the ratio between nominal and real valued added) and (iii) nominal wages. Denoting the time derivative of a variable x with $\dot{x} = \frac{\partial x}{\partial t}$:

$$\frac{\dot{PS}}{1 - PS} = \frac{\dot{prod}}{prod} + \frac{\dot{d}}{d} - \frac{\dot{w}}{w} \quad (12)$$

where $prod$ is the value added per employee/hour worked, in real terms and d is the deflator. For a constant level of productivity, an increase in the profit share can be driven only by a rise of the value added deflator relative to nominal labour cost. However, this is an accounting identity that does not tell us what drives, for instance, the wedge between the deflator and the nominal wages. Similarly, we cannot infer anything about the role of profit margins by decomposing the value-added deflator as the sum of unitary profits up (profits over real value added) and unitary labour cost ulc (wage bill over real value added), another decomposition sometimes used in the literature, i.e.

$$d = \frac{va}{real\ va} = \underbrace{\frac{profits}{real\ va}}_{unitary\ profits} + \underbrace{\frac{wL}{real\ va}}_{unitary\ labor\ cost} = up + ulc \quad (13)$$

Based on the analysis discussed in Sections 2 and 3, the dynamics of unitary profits are not necessarily a measure of inflationary pressures due to markups. For example, let's consider again the Leontief case and denote the base prices for output and intermediates with p_0 and q_0 , respectively:

⁸Under the assumption that the share of value added in total output is constant.

$$up = \frac{pQ - wL - qI}{p_0Q - q_0I} = \frac{(\mu - 1)(w + q)Q}{(p_0 - q_0)Q} = \frac{(\mu - 1)(w + q)}{p_0 - q_0} \quad (14)$$

$$ulc = \frac{wL}{p_0Q - q_0I} = \frac{wQ}{(p_0 - q_0)Q} = \frac{w}{p_0 - q_0} \quad (15)$$

Computing unitary profit growth rate:

$$\begin{aligned} \frac{\dot{up}}{up} &= \frac{\dot{\mu}(w + q) + (\mu - 1)(\dot{w} + \dot{q})}{(\mu - 1)(w + q)} \\ &= \frac{\dot{\mu}}{\mu - 1} + \frac{\dot{w} + \dot{q}}{w + q} \end{aligned} \quad (16)$$

As shown in 16 the growth of unitary profits does not depend only on markups' evolution but also on all inputs' prices (as extensively discussed also in the previous sections). Moreover it can be easily shown that unitary profits will grow at a faster rate than unitary labour costs (raising therefore the profit share in value added) if

$$\begin{aligned} \frac{\dot{up}}{up} &> \frac{\dot{ulc}}{ulc} \\ \frac{\dot{\mu}}{\mu - 1} + \frac{\dot{w} + \dot{q}}{w + q} &> + \frac{\dot{w}}{w} \\ \frac{\dot{q}}{q} - \frac{\dot{w}}{w} &> \frac{(w + q)\dot{\mu}}{q(\mu - 1)} \end{aligned} \quad (17)$$

Condition 17 implies that if q grows faster than w , then unitary profit will outpace unitary labour cost even if markups are constant⁹. Therefore, the simple fact that unitary profits grow more than unitary labour costs is not necessarily a signal of inflationary pressures exerted by firms' strategies.

Only the evolution of markups can signal that firm pricing strategies are driving the dynamics of the deflator. Unfortunately, National Accounts published by Eurostat do not allow us to recover good proxies for markups, because they do release neither estimates of the value of production (in nominal and real terms), nor the consumption of intermediate goods.¹⁰

There are however relevant exceptions, i.e. Destatis, for Germany, and Istat, for Italy,

⁹Unitary profits might outpace unitary labor cost even if markups are declining

¹⁰Alternatively, one can estimate the dynamic of markups with changes in the ratio of total revenues and sales, for instance by the use of balance sheet data, if available.

that produce timely data on these aggregates (or other indicators closely related to them). In particular Destatis releases, for some sectors, annual data on the value of production in real and nominal terms, the costs for intermediate goods and workers' compensation (the latter is available also in Eurostat data). It is then possible to proxy markups by the ratio of the deflator of production (determined by dividing the nominal and the real value of production) and the sum of unit variable costs (intermediate goods and labour).¹¹ Istat instead releases quarterly a direct measure of markups, defined as the ratio of the deflator of the value of production and unit variable costs, i.e. the sum of unit labour costs and unit costs for intermediate goods.

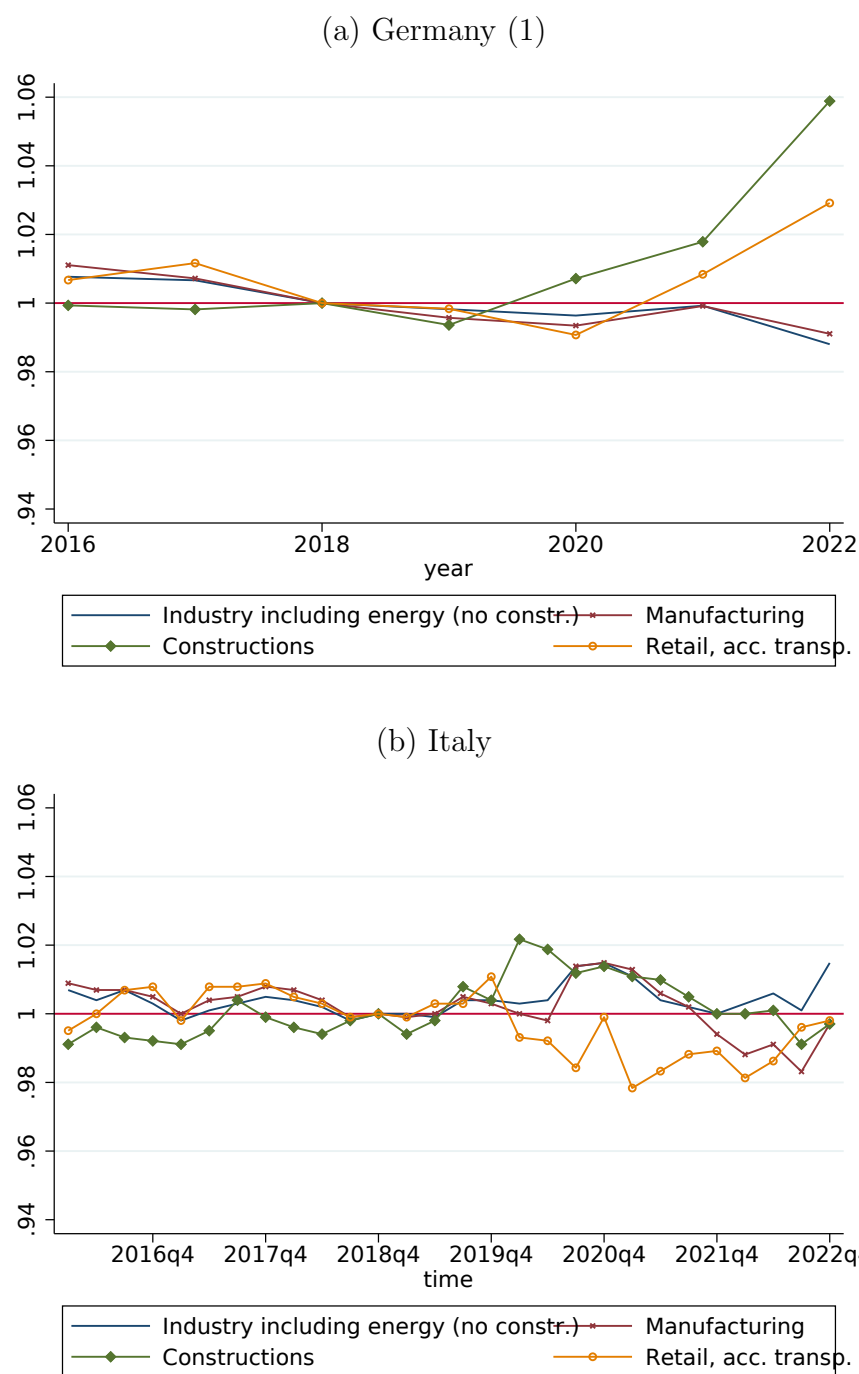
The figure reports the estimates of the markup in both countries for the following available sectoral breakdown: industry (excluding construction, including energy); manufacturing, constructions, retail-accommodation-transports. Unfortunately, it is not possible to calculate the markups for the private sector as a whole.

In Germany in 2022 markups in industry and in manufacturing remained constant. This suggests that, on average, firms price-setting strategies in these sectors did not contribute to inflation. Instead, markups increased considerably in constructions and in retail-accommodation-transports, which are non-tradeable sectors and probably more subject to domestic demand pressures. In Italy, instead, after some adjustments due to the pandemic, in the last quarter of 2022 markups in almost all sectors returned to their pre-pandemic levels. Based on this evidence, we can conclude that the pricing policies of companies in these countries are probably driving inflation in only a few specific sectors, probably those that are less subject to international competition.

Finally, in the appendix, we present some indirect evidence on mark-ups in the US. The Bureau of Economic Activity (BEA) does not produce timely statistics that allow us to assess markups dynamic as in Germany and Italy. However, with some caveats, which are discussed in detail in the appendix, some proxies can be calculated for 2022. Overall, the available evidence suggests that, unlike in Germany and Italy, the dynamics of mark-ups may have played a role in US inflation after the pandemics.

¹¹The value of production does not include goods for resale, i.e. those that are bought and resold without transformation. This leads to underestimate the value of production especially in retail trade. For this reason, the estimate of the markup for these services in Germany must be interpreted with caution. The sign of the bias in the estimates of the markup is also undetermined.

Figure 1: Estimates of markup for Germany (2018=100) and Italy (q4.2018=100)



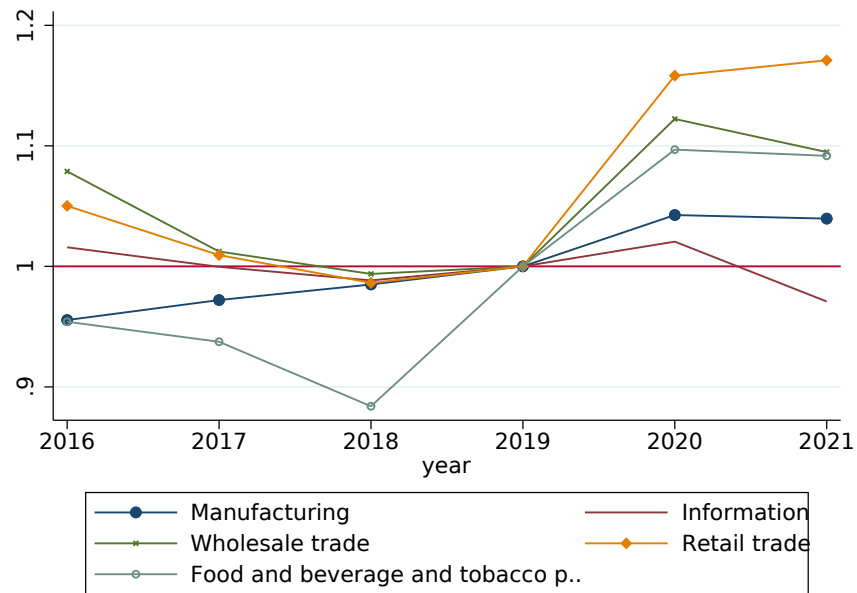
Note: Destatis, National accounts, for Germany, Istat; National Accounts for Italy. (1) Excludes goods for resale.

Appendix

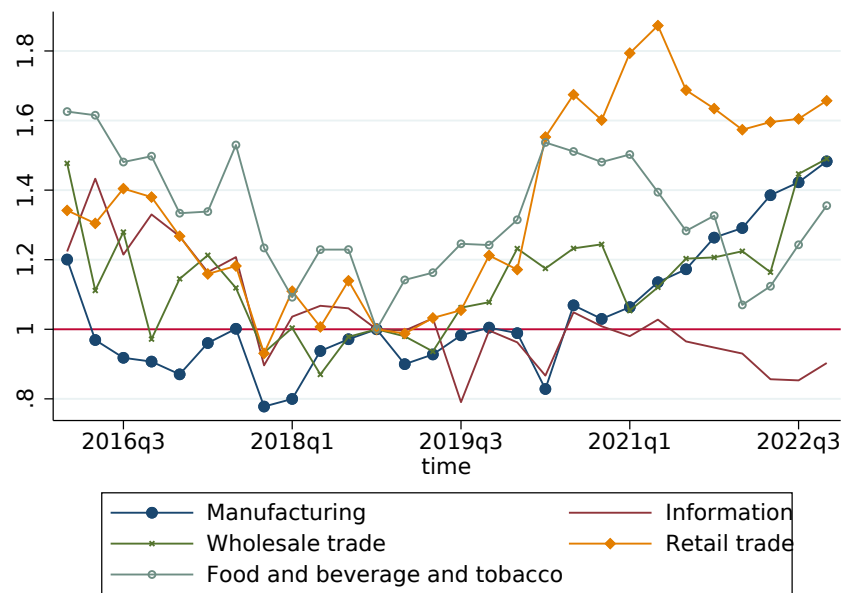
As discussed in section 4, markups can be measured by the ratio of gross operating surplus (GOS) to the value of production. Unfortunately, the Bureau of Economic Activity (BEA) does not release timely data on GOS at the industry level. Currently, they are only available on an annual basis up to 2021. However, it does publish quarterly aggregate statistics on corporate profits for some major sector. Corporate profits are one component of gross operating surplus, the latter including also consumption of fixed capital, proprietors' income and net current transfers. Its trend can provide a good approximation of profit dynamics. The correlation between the two variables is always positive and large from 2005 to 2021.

Figure A-panel (a) shows the dynamics of the ratio between GOS and total output, up to 2021 for some large sectors: it confirms that firms in the US recorded an increase in markups, in almost all sectors, at the immediate aftermath of the pandemics. Figure A-panel (b) instead shows the development of the ratio between corporate profits and the value of production at a quarterly frequency, in the same sectors as in panel (a). Data confirm a positive trend in markups in many sectors in 2022.

A. Markup dynamics in the US
(a) GOS over gross output, annual data



(b) Corporate profits over gross output, quarterly data



Note: BEA data.