Did Profits Cause Inflation?*

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January 2026

Abstract

A popular narrative has attributed the post-COVID rise in inflation to a rise in corporate profits. The literature in industrial organization offers three reasons for price increases: greater demand, greater marginal costs, and softening of competition (conduct). I argue that only sensible interpretation of the "Profits-Inflation" hypothesis is that a change in firm conduct was the primary cause of inflation. However, I also find that most of the evidence cited in favor of the "Profits-Inflation" hypothesis, such as elevated profit margins or capital share of income, is unable to distinguish between increased demand and a change in the nature of competition.

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1. Introduction

Understanding the causes and effects of inflation has long been a central question in macroeconomics. One novel feature of the most recent inflationary episode is that media coverage (and public perception) focused not only on whether the Federal Reserve could achieve a "soft landing" of getting inflation under control while keeping unemployment low, but also on the role played by competition and corporate profits. While Industrial Organization (IO) economists don't typically have much to say about the tradeoffs between inflation and unemployment, IO economists have quite a lot to say about how firms with market power compete and set prices, and how best to measure supply, demand, competition, and profits. The goal of this article is examine how this IO perspective can be used to better understand the competing narratives around the post COVID-19 inflation.

Let's start with what we'll call the "textbook economics" narrative: The COVID-19 pandemic and the related shutdowns meant consumers were stuck at home, and spending initially declined in a number of categories (e.g. gasoline, travel, meals in restaurants). In the United States, the response from both fiscal and monetary policy was swift and strong. The Federal Reserve called two emergency meetings in March of 2020 and cut rates by 150 basis points.[1] The strong fiscal response (three rounds of near-universal stimulus checks totaling $3,200 per tax filer, expanded unemployment benefits, and over $900 billion in loans and grants to businesses meant to cover payroll expenses under the Paycheck Protection Program) allowed household finances to remain solid.[2] Only one month into the pandemic, by April 2020, real personal income exceeded the pre-pandemic trend, and the personal savings rate even grew from a pre-pandemic average of around 6-8% to 32%.[3]

Under this "textbook narrative," as the economy reopened in 2021, many households were flush with cash, and there was a shift in demand away from services (travel, live entertainment, meals in restaurants) and towards physical goods (particularly durable goods like vehicles and appliances) and gasoline. See Figure 1 for the household savings rate and Real PCE by category. At the same time, "supply chain issues" meant that productive capacity in a number of industries was unable to ramp up quickly enough to respond to growing demand. Because supply was relatively constrained, this initial surge in demand

[1] See Milstein and Wessel (2024).

[2] The Tax Policy Center and Petersen Institute provide a full accounting of the fiscal response here: https://taxpolicycenter.org/briefing-book/how-did-fiscal-response-covid-19-pandemic-affect-federal-budget-outlook.

[3] See Figure 1 below and the BEA numbers here: https://www.bea.gov/news/2020/personal-income-and-outlays-april-2020.

manifested primarily as higher prices rather than greater output (at least for some industries). This is the classic “too many dollars chasing too few goods” story. It led to elevated inflation, first in goods and energy in 2021, but later by 2022 and 2023 we experienced broader inflation in services, housing, and wages (including widely reported “worker shortages”). Following the “textbook response,” the Federal Reserve tightened monetary policy and began raising interest rates in March 2022. After 10 additional rate increases, rates peaked in July 2023 at 5.25% before a series of rate cuts began in September 2024.[4] The year-on-year inflation rate (as measured by the CPI-U) peaked shortly after the rate hikes began in June 2022 at 9% and ended 2024 at 2.9%.

If previous inflation episodes are any indication, macroeconomists will likely spend the next decade dissecting whether or not the initial surge in inflation was caused primarily by demand factors (pent-up demand for durables, strong household finances, expansionary fiscal and monetary policy) or primarily by supply factors (COVID-related factory shutdowns in Asia, shortages in microchips, delays at ports and in shipping, avian flu, the slow ramp-up of oil and gas production). It will certainly be the case that not all economists who subscribe to the “textbook narrative” will agree on all of the particulars or the relative magnitudes of supply and demand factors. The truth is almost certainly some mixture of the two factors, and that strong demand and restricted supply were mutually reinforcing, but that the precise composition varied over time and across markets. For example, Giannone and Primiceri (2024); Bernanke and Blanchard (2025) both explain the initial source of inflation as primarily an increase in aggregate demand and sectoral price shocks in goods markets arising from a shift in relative preferences; while Ball et al. (2022) focus more on labor market tightness.[5] Likewise there is already a healthy debate among macroeconomists as to whether the (monetary) policy response was appropriate, and whether the Federal Reserve acted swiftly enough or waited too long before raising interest rates in March 2022 (or before cutting rates in September 2024).[6]

Starting in 2021, an alternative narrative around inflation emerged, which I will call the “Profits-Inflation” narrative. There is no monolithic or canonical version, but it is a version of the following: firms in a small number of upstream industries experienced shocks to costs (higher energy prices, higher shipping rates, lack of microchips for cars) and responded by

[4]An easy to read timeline of Federal Reserve actions is here `https://www.forbes.com/advisor/investing/fed-funds-rate-history/`.

[5]Other work attempts to econometrically disentangle the timing of supply and demand factors Shapiro (2022a,b).

[6]See Smialek (2022); Bennett and Merchant (2024)

raising prices *in excess of their cost increases*, leading to an increase in profits. Second, rather than (partially) absorbing the higher costs and reducing markups, downstream firms with market power sought to *preserve their markups* while constrained supply granted some firms a *temporary monopoly* over consumers, which they used to further raise markups. Later, others firms *took advantage of the situation* or *used inflation as an excuse or pretextual cover to raise prices*, increasing their margins (and profits) as well. Finally, as prices and profits rose, and real wages declined, workers demanded raises that could possibly restart this cycle as a new set of *cost shocks*.

Perhaps the novel feature of this "Profits-Inflation" narrative is not the focus on the exercise of market power, but the idea that inflation itself may serve as some sort of *coordination mechanism*. In an interview with CNBC, for example, FTC Chair Lina Khan said, "an inflationary environment can give cover to companies with market power or monopoly power to exploit that power."[7] In the "Seller's Inflation" papers of Weber and Wasner (2023); Weber et al. (2024), "large cost shocks that hit all competitors can function as an implicit coordinating mechanism for firms, since firms know that their competitors face the same conditions and hence have strong incentives to raise prices."

In many ways, this "alternative narrative" doesn't sound all that dissimilar from the "textbook narrative." One main difference is the focus on corporate profits and rising markups as a *cause of inflation* rather than a *consequence of the same demand conditions* driving inflation. In the "textbook narrative," profits, prices, and output all rise when *demand* rises, and while market power is not necessarily a prerequisite for inflation to occur, it also doesn't complicate the "textbook narrative" in any meaningful way (i.e., strong demand and constrained supply still lead to higher prices whether markets are characterized by monopoly or perfect competition). An optimistic way to reconcile the two narratives (setting aside *demand*) is to say that while they largely describe the same phenomenon (firms respond to demand and cost shocks by raising prices), one focuses on the *why* and the other focuses on the *how*. That is, the "textbook narrative" looks at the conditions that lead to inflation (strong demand and inelastic supply); the "alternative narrative" focuses on how higher prices are transmitted (cost shocks in one industry lead to higher prices, which become higher input costs in another industry; or supply constraints mean that firms respond to shocks by raising prices rather than increasing output).

In other words, data on the input-output linkages between industries might help explain the week-by-week timing of specific price increases, but adds little to the bigger picture issue

[7] See `https://www.youtube.com/watch?v=-95KUz5mJu8`.

of “too many dollars chasing too few goods.”

On the other hand, the two narratives differ quite a bit in how they approach the role of *demand*, and the appropriate policy response. In the “Profits-Inflation” narrative, demand features almost not at all – neither as a reason prices and profits might rise, nor as a force that constrains the “desired markups of firms.” A skeptical interpretation of the “Profits-Inflation” narrative is that it attempts to describe what happens to the economy when demand rises while assiduously avoiding using the word “demand.”

However, even larger differences arise in the policy recommendations. Under the “textbook narrative,” some combination of contractionary fiscal and monetary policy is required to cool demand and get inflation under control before inflationary expectations become entrenched.

Under the “Profits-Inflation” narrative, because a major contributor to inflation is rising profits/markups (and not strong demand), any attempt by the Federal Reserve to cool demand by raising rates is forecasted to cause a recession that would needlessly put “tens of millions out of work” *without reducing inflation* (Weber and Paul, 2022; Mabud, 2022; Brangham, 2022). This lead proponents to recommend a wholly different set of policy remedies, which focus on addressing the profitability of firms directly, rather than using monetary policy. Such policies include: expanded antitrust enforcement, laws preventing “price gouging,” a tax on “excess” or “windfall” profits, and price caps. It is worth noting that under most macroeconomic theories, when nominal demand exceeds real supply, such policies could at best reallocate profits within the economy, but interest rate hikes would be required to stabilize the aggregate price level (ie: “inflation is always and everywhere a monetary phenomenon”).

It is reasonable to ask whether “Profits-Inflation” is a novel and distinct theory of inflation that requires a different set of tools, or if it is this simply a new spin on the “textbook” supply and demand story that assiduously avoids using the word “demand” so as to keep interest rates low. One way we might approach a question like this is to ask: are there testable and falsifiable implications that are unique to the “Profits-Inflation” narrative that are not captured in the “textbook” version? Of course, if the “Profits-Inflation” theory can rationalize all possible data, then we don’t have a hypothesis at all.

In order to understand “Profits-Inflation” as a falsifiable microeconomic hypothesis, we begin by reviewing how most microeconomists explain how firms with market power set prices in Section 2. The common theme under a broad array of models and competitive environments is that profit-maximizing firms equate *marginal revenue* to *marginal cost* and trade off higher prices against selling more units. This gives us three explanations for why prices might go up: *demand increases* (consumers become *less price sensitive*); *marginal costs increase* (either because the costs of inputs rise, or because supply constraints make it difficult to produce the same number of units as before); and *changes to firm conduct*, so that marginal revenue rotates rather than demand. Conduct may change because of changes in *market structure*: perhaps firms merge or exit the industry, or because of changes in the *nature of competition*, such as if firms start to *cooperate* rather than *compete*.[8]

The most generous interpretation of the "profits-inflation" narrative as a testable hypothesis is that a widespread and coordinated change in firm conduct—rather than demand—is the primary driver of inflation. Under this view, inflation arises when a large number of firms shift from relatively competitive equilibria to more cooperative equilibria. For example, firms may move from Bertrand pricing to Cournot competition, from competitive pricing to monopoly pricing, or—under rule-of-thumb pricing—from setting prices at "cost plus 20The central insight of this interpretation is that conduct provides a mechanism through which prices and profits can rise without a corresponding increase in demand. Consequently, any econometric test of the profits-inflation hypothesis must disentangle changes in firm conduct from demand-side and cost-side factors.

The notion that firm conduct can change over time is not implausible. Antitrust authorities around the world frequently uncover evidence of organized cartels (Ghosal and Sokol, 2014, 2020). There is, however, no single canonical model explaining the formation of cartels.[9] Importantly, there is little evidence of a surge in newly organized cartels or widespread consolidation across industries during 2021–2022, nor of a subsequent decline as the Federal Reserve tightened monetary policy through 2023. A substantial theoretical literature examines the interaction between cartel behavior and the business cycle. Positive demand shocks may make cartels harder to sustain by increasing the temptation to deviate (Rotemberg and Saloner, 1986), but may also make collusion more attractive when shocks are persistent (Haltiwanger and Harrington, 1991). Capacity constraints, prominent during the 2021–2022 "supply-chain" disruptions, play a key role in this interaction. Staiger and Wolak (1992) show that capacity constraints can reduce incentives to deviate during high-demand periods, while Fabra (2006) emphasizes that such constraints may also weaken the ability to punish deviations.

[8]Macroeconomists often focus on a fourth possibility that is really a combination of the other three: when prices are *sticky* (cannot be frequently adjusted), firms may raise prices today if they think demand, costs, or conduct is likely to change in the future.

[9]See Harrington and Chang (2009); Marshall and Marx (2012) on the birth of cartels.

A more plausible explanation for a change in conduct during 2021–2022 is tacit cooperation or a broader softening of competition, rather than explicit cartelization. A classic result in industrial organization is that when capacity constraints bind, Bertrand (price) competition can resemble Cournot (quantity) competition, leading to higher markups (Kreps and Scheinkman, 1983). Recent empirical work has documented related mechanisms of softened competition. Aryal et al. (2022) study pre-COVID "capacity discipline" in airlines, where firms restrained capacity expansion despite high utilization, while Miller et al. (2021) document leader–follower behavior and reduced competitive intensity in the beer industry following a merger (also prior to COVID).

Once we restate the "Profits-Inflation" hypothesis as one that is (at least in theory) testable, what remains is to consider the evidence that might distinguish between increasing costs, rising demand, and shifts in firm conduct. News coverage has focused on a handful of studies from advocacy organizations (Bivens, 2022, 2024; Pancotti and Owens, 2024; Pancotti et al., 2024) and a few from scholars outside of the Industrial Organization (Weber and Wasner, 2023; Weber et al., 2024). For the most part, those studies establish a series of facts (such as rising profits or profit margins) which unfortunately do little to demonstrate that changes in conduct (rather than demand) are a significant cause of inflation.

In Section 3, we revisit several widely cited pieces of empirical evidence and explain why they do little to distinguish among increases in demand, increases in costs, and changes in firm conduct as explanations for rising prices. In Section 3.1, we explain why firm profitability cannot be inferred from the gap between producer prices (PPI) and consumer prices (CPI). In Section 3.2, we reexamine studies (Bivens, 2022; Pancotti and Owens, 2024) that attempt to infer the corporate profit share from national income accounts data. A key limitation of the national accounts is that they decompose changes in *value added* rather than prices. While this is appropriate for constructing GDP, it is problematic for inflation analysis because it abstracts from the role of intermediate input prices, which are a potential source of "cost-push" inflation. Even taking these exercises at face value, they imply that the after-tax share of corporate profits is only about 9% of value added over the most recent five years of data (2020 Q3–2025 Q3). This stands in sharp contrast to the "more than half" claims in the popular press (Owens, 2022b; Perkins, 2024), which rely on (i) including taxes in the profit share and (ii) selecting a narrow set of time periods. In Section 3.3, we reexamine the apparent rise in profitability among publicly traded firms during the inflationary episode and reach a somewhat different conclusion than (Konczal and Lusiani, 2022; Weber and Wasner, 2023). We document a sharp decline in net margins early in 2020, followed by elevated margins in 2021 and 2022. However, this pattern is substantially muted for supermarkets and for food and consumer-product manufacturers.

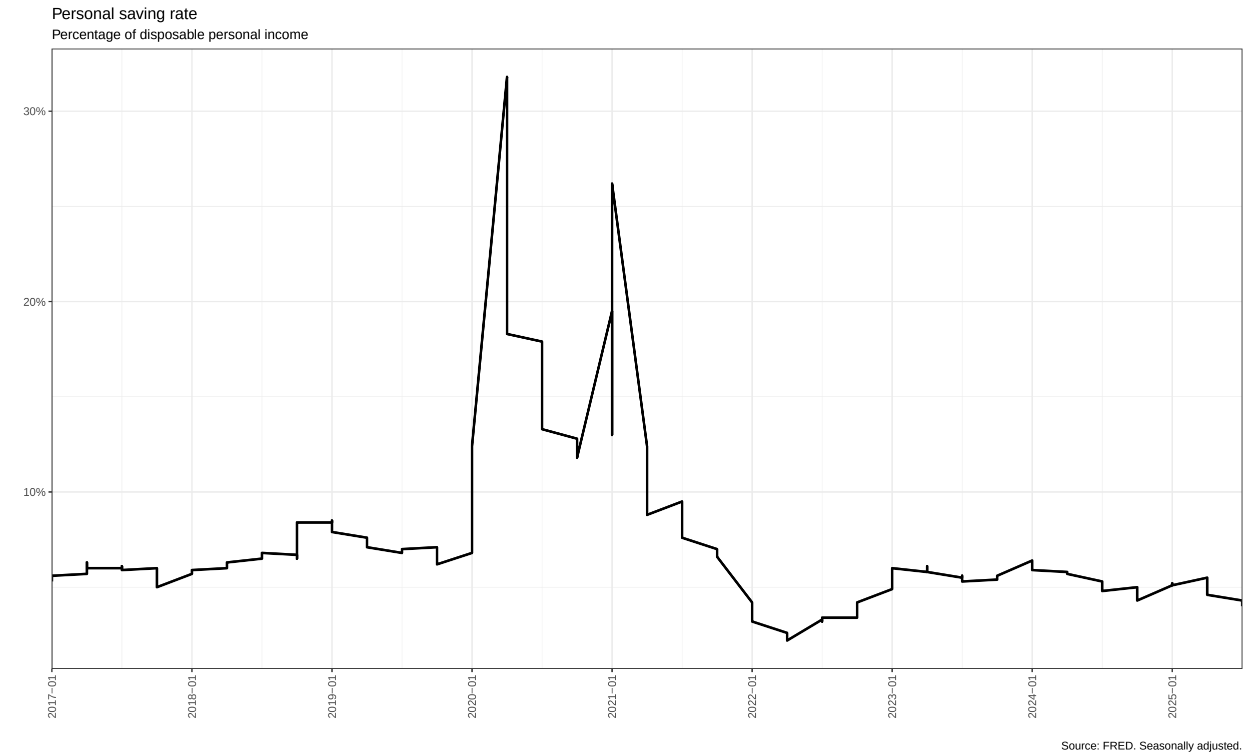
The common limitation of all of the empirical exercises above is that they fail to separate the "increased demand" story from the "softer competition" or "conduct" story. An increase in corporate profits or profit margins of the factor share of capital can be consistent with either an increase in demand or a change in firm conduct. More generally, prices rising faster than costs is a generic feature of markets with market power and does not, by itself, indicate a change in the nature of competition. The fact that accounting margins for some firms increased in 2021 and 2022, and largely declined in 2023 or 2024, at best establishes a transitory rise in profits. Without first disentangling supply and demand forces, the *underlying causes* of inflation remain unknown.

This does not imply that the "profits-inflation" hypothesis is untestable. Rather, testing any coherent version of it would require careful, industry-level econometric evidence demonstrating a significant change in competitive behavior during the post-COVID inflation period. The central takeaway of this article is that readers should be skeptical of empirical analyses that claim to decompose inflation into its "causes" or "drivers" while omitting: changes in demand, changes in marginal costs, or changes in firm conduct. Decompositions of accounting identities into labor and capital shares are informative about *where income accrued*, but they do not identify *why prices increased*. Likewise, margins and accounting profits may rise or fall for many reasons, and accounting data alone are insufficient to reveal the underlying economic forces at work.

2. How Do Firms Set Prices?

2.1 Standard Microeconomic Theories of Price Setting

Almost all microeconomic models of price-setting behavior start with the assumption that firms make choices in order to maximize profits. The core trade-off that nearly all of these models have in common is that firms trade higher per-unit profit margins against lower sales. Consider the textbook case of a monopolist choosing how much quantity to produce q in order to maximize profits $\pi(q) = p(q) \cdot q - C(q)$. Here, $p(q)$ represents an inverse demand curve and $C(q)$ represents the cost of producing q units and $mc(q)$ its derivative. This yields



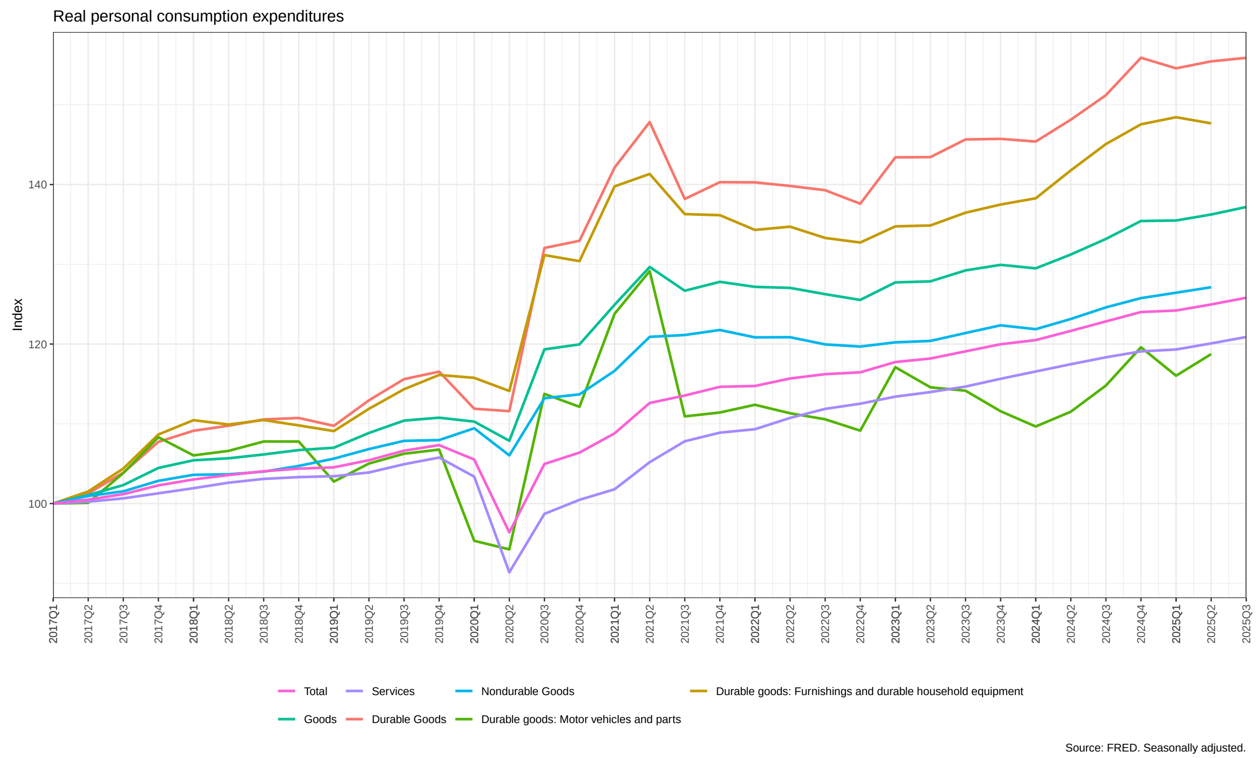


Figure 1: Increases in Personal Savings and Real PCE

Source: FRED. Real PCE (PCEC96), Goods (DGDSRX1), Durable Goods (PCEDGC96), Nondurable Goods (PCNDGC96), Services (PCESC96), Motor Vehicles and Parts (DMOTRX1Q020SBEA), DFDHRX1Q020SBEA, Furnishings and Household Durables (DFDHRX1Q020SBEA). Savings (PSAVERT).

the first-order condition:

$$p(q) + \underbrace{\frac{\partial p}{\partial q} \cdot q}_{ms(q)} = mc(q). \tag{1}$$

The monopolist chooses output so that the marginal revenue of the last unit produced is equal to the marginal cost.[10] A perfectly competitive firm would instead set $p(q) = mc(q)$ so that price is equal to marginal cost. The difference between the two arises from the wedge (sometimes called the "marginal surplus") $ms(q) = \frac{\partial p}{\partial q} \cdot q$, which corresponds to the "market power" of the firm, or the degree to which it internalizes the trade-off between selling at a higher price versus selling more units.

A common convention is to augment this wedge with a "conduct parameter" θ so that (1) becomes $p(q) + \theta \cdot ms(q) = mc(q)$. For $\theta = 1$, this corresponds to the monopoly problem, while for $\theta = 0$, this corresponds to the perfectly competitive problem. If we incorporate θ in (1), rearrange terms and divide by prices we can obtain the Lerner Index:

$$\text{Lerner Index} = \frac{p - mc}{p} = \frac{\theta}{|\varepsilon_d|}, \quad \text{where } \varepsilon_d = \frac{\partial q}{\partial p} \cdot \frac{p}{q}. \tag{2}$$

What is useful about the Lerner index is that it relates the economic markup $\frac{p-mc}{p}$ to the inverse elasticity of demand ε_d and the conduct parameter θ. Because demand slopes downward, $\varepsilon_d < 0$, we usually talk about its magnitude $|\varepsilon_d|$. The Lerner index tells us that markups will be larger for *less elastically demanded* products or that as consumers become more price-responsive, markups should fall. Likewise, we would expect that as the conduct parameter θ increases from $0 \to 1$ markups should rise.[11]

Another textbook example that fits into the framework above in (2) is a game where multiple firms have different marginal costs mc_f and choose quantities q_f to maximize profits, and the price depends on the total output of all firms $P(Q)$ where $Q = q_1 + \ldots + q_F$. In this case, the first-order condition implies that the conduct parameter θ corresponds to the market share of firm f so that $\theta_f = s_f = \frac{q_f}{Q}$. In this asymmetric Cournot game, firms with lower costs enjoy higher market shares and higher markups through the common price $P(Q)$.

The core idea is that there are essentially three reasons why a profit-maximizing firm

[10] We could have just as easily had the monopolist choose p instead of q and obtained the same result with a bit more algebra (since the monopolist would always choose a point on the demand curve the profit maximizing price must be the price that corresponds to the profit maximizing quantity).

[11] Sometimes, economists talk about the proportional markup $\mu = \frac{p}{mc}$ instead, it is worth noting that $\mu = \frac{1}{1-L}$ where $0 \leq L \leq 1$ is the Lerner index so that increasing one necessarily increases the other.

might increase prices: (a) an increase in the marginal cost mc; (b) the demand curve becoming less elastic ε_d; or (c) a change in the nature of competition/conduct θ.

The same three explanations arise in a number of different games (price setting for differentiated products, price leader/follower games, tacit coordination/collusion, etc.). Consider a more realistic example, where a firm f sells multiple differentiated products $\mathcal{J}_f$ and chooses prices. Here, the quantity sold $q_j(\mathbf{p})$ depends on *all of the prices* in the market (including those set by competitors). In this case, profits are given by:

$$\pi_f = \sum_{j \in \mathcal{J}_f} (p_j - mc_j) \cdot q_j(\mathbf{p}) - \text{Fixed Costs}_f.$$

To allow for a wider range of firm behavior, we can also allow firm f to potentially consider the profits of rival firms π_g as part of their payoffs (weighted by $\kappa_{f,g}$):

$$\max_{p_j \in \mathcal{J}_f} \pi_f(\mathbf{p}) + \kappa_{f,g} \cdot \pi_g(\mathbf{p}). \tag{3}$$

If firms simultaneously choose prices p_j to maximize these payoffs, the resulting equilibrium prices satisfy:[12]

$$p_j = \underbrace{\frac{1}{1 + 1/\epsilon_{jj}(\mathbf{p})}}_{\text{markup}} \left[mc_j + \underbrace{\sum_{k \in \mathcal{J}_f \setminus \{j\}} (p_k - c_k) \cdot D_{jk}(\mathbf{p})}_{\text{multi-product opportunity cost}} + \underbrace{\sum_{g \neq f} \kappa_{fg} \cdot \sum_{k' \in \mathcal{J}_g} (p'_k - c'_k) \cdot D_{jk'}(\mathbf{p})}_{\text{internalization of rival profits}} \right] \tag{4}$$

Just like in (2) we have that prices depend on: (a) the (inverse) elasticity of demand; and (b) the marginal cost mc_j. This differs from (2) in that the elasticity of demand $\epsilon_{jj}(\mathbf{p})$ is different for different products, and the inclusion of the additional term that captures the "opportunity cost." This opportunity cost arises because multi-product firms internalize that when they raise the price of good j, some consumers will be diverted to the substitute k, which the firms also own. That is, the true cost of selling j includes not only the cost of production, but also the fact that some fraction of customers D_{jk} might switch to k, where they would also capture some profit. This is important because it gives us another source of market power: (c) prices may be higher when close substitutes are owned by the same firm.

We also incorporate an analog of the conduct parameter θ by introducing κ_{fg} as the

[12]See Appendix A for the (non-original) derivation or Backus et al. (2020) for an example with overlapping partial ownership.

weight that firm f places on the profits of firm g. Implicitly, we assume firms to maximize their own joint profits across products $\kappa_{ff} = 1$. This could be further relaxed if we worried that different divisions of the firm set prices for products independently.[13] Under multi-product Bertrand competition $\kappa_{fg} = 0$ for all rival firms. If (f, g) are allowed to merge, then $\kappa_{fg} = 1$ and $\kappa_{gf} = 1$, highlighting how a merger increases prices by raising the opportunity cost.[14] In other cases, cartels, tacit collusion, and other less-than-competitive firm conduct can be modeled by setting one or more $\kappa_{fg} > 0$.

The point of this exercise is to highlight what can and cannot generate an increase in prices: (a) an increase in marginal costs; (b) an decrease in the elasticity of demand; and (c) a change in firm conduct (including ownership of competing brands). There is a dynamic fourth possibility that arises in many macroeconomic models but is not captured by a static price-setting game like (2) or (4): if firms are unable to freely adjust prices (e.g. sticky prices), they may increase prices today in response to expected *future* changes in $(mc, \varepsilon_d, \kappa)$. If, for example, you must commit to prices at the beginning of the year, firms may increase prices in anticipation of rising costs or less elastic demand.

Graphical Explanation

While all three causes listed above lead prices to rise, they differ in how they affect quantity or output in the market. In Figure 2, we've provided a graphical illustration of what happens to an *imperfectly competitive* market when: (a) demand increases; (b) marginal costs increase; and (c) conduct becomes less competitive. To simplify the illustration, we consider the case of a single good like (9). In all three cases, we've highlighted the period "before" the shock in blue, and the period "after" the shock in red. We've also designed the three scenarios so that prices necessarily increase in the "after" period. The graphs are designed to illustrate how prices, quantities, and industry profits all respond to changes in supply, demand, and firm conduct.

When demand increases, not only do prices rise, but quantity and firm profits also increase. When marginal costs rise, we see that prices increase, but profits and quantity/output fall. Finally, in the case where competition softens, the wedge between the demand curve and the marginal revenue curve $ms(q, \theta) = \theta \frac{\partial p}{\partial q} \cdot q$ increases as we increase θ. This leads to a steeper marginal revenue curve (holding fixed demand and marginal costs) and higher prices, lower output, and greater profits.

In actual data, it would be rare to see that only demand shifts while marginal costs and

[13]See Crawford et al. (2018) as an example.

[14]See seminal work by Nevo (2000) on this topic.

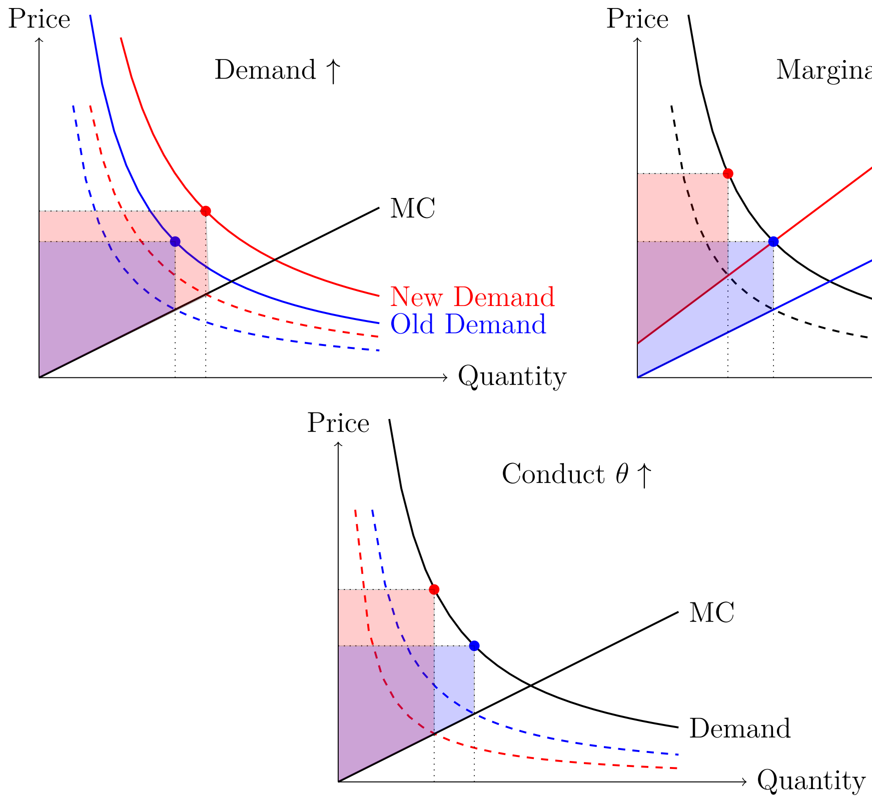


Figure 2: Responses to Changes in Demand, Costs, and Conduct Under Market Power

In all figures firms with market power set $MR = MC$.
Variable profits before the shift are blue, while variable profits after the shift are in red.

	Prices	Quantities	Industry Profits
Demand Increases	+	+	+
Costs Increase (Industry)	+	−	−
Costs Increases (Firm)	+	−	?
Softer Competition	+	−	+

Table 1: How Prices, Quantities, and Profits Respond Under Market Power

Note: If supply is *perfectly inelastic*, then increases in demand may only weakly increase quantity.

competition / conduct are kept perfectly still. The goal is often to disentangle the three factors econometrically. However, if one factor were to move at a time (or be much more significant than the others), then we could try to use changes in prices, output, and profits within a single industry to determine which force was the "dominant" factor. We summarize the conclusions of Figure 2 in Table 1. There is sometimes confusion about cost shocks that can sometimes hit *all* firms in an industry (the cost of commodity inputs or energy increases), and other cost shocks that are idiosyncratic to a *single* firm (only my supplier raises its prices). In most cases, we expect cost shocks that affect all firms in the industry to increase prices and reduce output by more than idiosyncratic cost shocks. Cost shocks to a single firm should reduce that firm's profits (and output), but increase the profits (and output) of rivals within the industry. This leads to an ambiguous effect on the profits of the industry as a whole.[15]

One case where discussion around the "Profits-Inflation" narrative may have created some confusion is what happens when costs increase for all firms in the market? Even if the common cost shock were fully passed through to consumers, it would still reduce profits (and output) of the entire industry. In the case of Figure 2, the red trapezoid is necessarily smaller than the blue trapezoid. If output doesn't fall enough so that overall profits instead increased, it would imply that firms were not profit maximizing either before or after the change in costs.[16] The simple test for whether cost increases on their own can increase profits is to ask whether firms lobby for excise taxes on their industry or not?

In short, if prices and profits are both rising, this would provide some evidence against the "cost shock" being the predominant force (at least in that particular industry). Likewise,

[15]For example, in a asymmetric Cournot game it would depend on whether the costs went up for the largest/lowest cost firm or the smallest/highest cost firm.

[16]Exceptions to this story typically require that cost shocks induce a lot of exit so that what really changes is the competitive environment θ (Anderson et al., 2001). See, for example, the case of the minimum wage increase (Rao and W. Risch, 2024).

if we wanted to determine whether the cause of higher prices was stronger demand or a weakening of competition, we would need to see how quantity/output responded. In the case of a demand shock, we would expect output to grow, while in the case of a change in conduct, we would expect output to fall.

2.2 Pass-through and Transmission of Cost Shocks

One piece of evidence often cited in favor of the "Profits-Inflation" hypothesis is that firms increased prices more quickly than costs.[17] One trivial explanation for why prices might go up more quickly than costs is that in addition to an increase in costs (a microchip shortage leads to fewer vehicles, or greater manufacturing costs), there was also an increase in demand (pent-up demand to replace old automobiles and a surplus of household savings). For now, let's suppose we can isolate the sole cause of the price response to a change in costs and determine whether or not this is helpful in determining whether *changes in conduct* were an important determinant of inflation. The good news is that there is a large literature in economics examining the pass-through of cost shocks when firms have market power; the bad news is that the answer is complicated.

Formally, pass-through considers a relationship like (2) and considers how $\rho = \frac{\partial p}{\partial mc}$ looks. The idea is that firms might respond to a \$1 increase in marginal costs by increasing prices more than \$1 or less than \$1. Unfortunately, the answer is complicated and depends on a number of factors. One case in which there is clear agreement is that if markets were perfectly competitive $\theta = 0$ (mainly not the case) and marginal costs were constant at mc (also mostly not the case), then firms will set $p = mc$ and the resulting pass-through rate will be $\rho = 1$ (or 100%, since $\frac{\partial p}{\partial mc} = 1$). In a competitive market with upward-sloping marginal costs, we expect that $\rho < 1$, or that a \$1 cost increase is met with less than a \$1 price increase, though how much less depends on the relative elasticities of supply and demand.

For all other cases (particularly those where firms possess market power), the resulting pass-through rate will depend on the curvature of demand (essentially how quickly $\varepsilon_{jj}(\mathbf{p})$ changes with prices) (Bulow and Pfleiderer, 1983). Depending on the curvature ofe demand (and marginal cost), it can be that $\rho \lesseqgtr 1$ so that firms with market power either help to absorb or amplify cost shocks. This has led some scholars to treat estimates of $\rho > 1$ as evidence of market power ($\theta \neq 0$) (Pless and van Benthem, 2019). Although $\rho > 1$ provides evidence that firms possess some market power (i.e., do not set $p = mc$), this alone does not provide evidence for a *change in conduct*.

[17] See for example (Pancotti and Owens, 2024; Pancotti et al., 2024; Tankersley and Smialek, 2024)

As a matter of theory, when firms have market power and products are differentiated, there are no clear predictions, meaning we can't rule out $\rho > 1$ or $\rho < 1$. A somewhat strong but simplifying assumption that provides some intuition can be found in Weyl and Fabinger (2013). Here, the authors assume that the conduct (or marginal surplus) in (2) is symmetric between firms $\theta_f = \theta$. This lets them derive an expression for the pass-through rate in terms of the relative elasticities of supply, demand, conduct, and marginal surplus.

$$\rho = \frac{1}{1 + \frac{\theta}{\epsilon_\theta} + \frac{\epsilon_D - \theta}{\epsilon_S} + \frac{\theta}{\epsilon_{ms}}} \text{ where } p(q) - \theta \cdot ms(q) = mc(q). \tag{5}$$

In the case of perfect competition, $\theta = 0$, $\rho = \frac{1}{1+\frac{\epsilon_D}{\epsilon_S}} < 1$ so that pass-through depends on the relative elasticities of supply and demand. In all the other cases, it also depends on how conduct θ and marginal surplus $\frac{\partial p}{\partial q} \cdot q$ change with q.[18] It is also worth pointing out that while *prices may increase in excess of costs*, it is generally the case that absent exit, *profits decrease as costs increase*. That's because as prices rise, of course, quantity sold falls. Again, this is all assuming that demand remains fixed.[19]

In summary, estimates of the pass-through parameter ρ will never be informative about whether inflation is caused by demand, supply, or conduct factors. Instead, we may merely learn about the relative elasticities of supply and demand or how the curvature of demand looks. One characteristic highlighted by (5) is that θ itself has an elasticity with respect to output ϵ_θ, so that *conduct itself may change as we change costs.* A generous interpretation of the idea that cost shocks and supply bottlenecks create a "temporary monopoly" for some sellers (Weber and Wasner, 2023; Bivens, 2024) is this possibility that ϵ_θ is large, so that these supply shocks change the nature of competition and the costs of the sellers. One possibility would be that cost shocks induced exit so that competition was reduced among the surviving firms (Anderson et al., 2001). Another might be if tightening capacity constraints shifted us from a world that looked like Bertrand competition to one that looked like Cournot competition (as in Kreps and Scheinkman (1983)). While theoretically possible, it is difficult to design a test that differentiates between these two mechanisms.

It is worth discussing how the existing literature has interpreted the role of market power and the pass-through of cost shocks. The most common estimate for the pass-through parameter (particularly from changes in sales taxes) is $\rho \approx 1$ or "complete pass-through",

[18] The derivative of marginal surplus depends on the second derivative or curvature of demand. To see recent empirical approaches explaining this issue further see Miravete et al. (2023b,a).

[19] Violations here would either imply marginal revenue curves that are not downward sloping (or more likely) a simultaneous increase in demand.

though $\rho > 1$ is not uncommon (Poterba, 1996; Besley and Rosen, 1999). For excise taxes on alcoholic beverages, estimates find $\rho > 1$ relatively consistently (Young and Bielińska-Kwapisz, 2002; Kenkel, 2005; Conlon and Rao, 2020). For other types of cost shocks in supermarket items, researchers find the pass-through to be highly incomplete $\rho \ll 1$. For example, Goldberg and Hellerstein (2013) find $\rho \approx 0.25$ for exchange rate shocks in retail beer prices, and Nakamura and Zerom (2010) find $\rho \approx 0.3$ for the commodity prices of coffee into retail prices. Recent work using pre-pandemic data by researchers at the Federal Reserve Bank of Boston estimated incomplete pass-through that was greater in more concentrated markets highlighting the role that θ from (5) might play (Bräuning et al., 2022).

Generally speaking, the empirical literature that finds evidence of incomplete pass-through (i.e. why prices rise less than marginal costs) offers some explanations. The first is that firms with market power respond to higher costs not only by adjusting prices upwards, but by adjusting markups downwards. This is the same idea that firms bear some incidence of any new tax and share the burden with consumers. The other is that while it is possible to measure the costs of material inputs (such as the commodity price of coffee), the actual product sold at retail also captures a lot of other, non-tradeable inputs (labor and distribution costs) that tend to be more difficult to measure. In summary, material inputs capture only a fraction of the true marginal costs. (This is an important point to remember when we consider some of the "evidence" for the "Profits-Inflation" hypothesis later.)

An important caveat regarding regression estimates of pass-through rates is that $\frac{\partial p_j}{\partial mc_j}$ measures how the price of good j responds to a change in its marginal cost *holding all other costs fixed*, and the parameter ρ typically corresponds to the *average* of this object across all products. In practice, we know that the prices of other goods p_k also respond to changes in mc_j (and vice versa). This means that pass-through is really a *matrix* rather than a *number*. How much pass-through to expect depends on the model of competition (Bertrand, Cournot, or the conduct parameter θ in (5)). In many examples we expect the costs of several products to change at the same time. The net effect for good j should look more like $\Delta p_j \approx \frac{\partial p_j}{\partial mc_j}\Delta mc_j + \sum_{k\neq j}\frac{\partial p_j}{\partial mc_k}\Delta mc_k$. What this means in practice is that we can have cases where own pass-through is incomplete $\frac{\partial p_j}{\partial mc_j} < 1$, and firms actually dampen cost shocks, but where prices still rise more quickly than marginal costs.[20] This can happen if there are common cost shocks and prices are strategic complements (Bulow et al., 1985). As in the case of Table 1, though costs may rise more quickly than prices, profits don't necessarily

[20]If this is not clear consider the pass-through matrix $\mathbf{P}$ with entries $\frac{\partial p_j}{\partial mc_k}$ and the where $\Delta \mathbf{c}$ is a vector where each element is the cost change for k then the predicted price change is $\mathbf{P}\,\Delta\mathbf{c}$ which may exceed Δc_j. Incomplete pass-through would imply that the diagonal of $\mathbf{P}$ has elements less than one.

have to rise in response to common cost shocks, because we expect quantity to fall (unless demand has simultaneously increased).

2.3 Discussion: Supply and Demand

While we might like to decompose price changes into outcomes caused by changes in demand, changes in marginal costs, and changes in firm conduct, first we need to understand what we mean by those terms and how we might hope to measure them using data.

When we say that *demand increases*, what we generally mean is that some consumers are willing to pay more for the good than they were before. This is because the demand curve is simply the representation of consumers sorted by their willingness to pay. Demand might increase because some consumers who weren't interested in buying homes in the suburbs or subscribing to Netflix before COVID became interested. Alternatively, willingness to pay may have increased: Consumers who may have previously valued Netflix at $15/month may now value it at $20/month.

An increase in demand can mean that existing consumers purchase similar quantities but become *less price sensitive* than they were before. Consumers may not literally purchase *more units* of laundry detergent or toilet paper relative to pre-pandemic patterns, but they may be *willing to pay* a greater premium for their preferred brand. The most common sources for changes in demand are *changes in preferences over time* (i.e., consumers in 2021 becoming more interested in cars and appliances and less interested in meals in restaurants); or *changes in income*, which relax budget constraints and make all goods more affordable.

For the purposes of pricing, if consumers' willingness to pay increases (including because some consumers might not have been willing to pay at all before), the demand curve shifts outwards. We typically expect that *demand at the same price to become less elastic*, which according to (2) means prices and markups should rise.[21]

The elasticity of demand in (4) depends on all of the prices of relevant substitutes in addition to the price of good j. If competing products become more expensive or less available this can make demand for good j less elastic, leading to a higher price. For this reason it can be hard to separate "shocks to others costs" from "shocks to your own demand" without a careful econometric analysis.

It is also important to understand that what is relevant for prices is typically *marginal costs*, or the cost of producing an additional unit. The true *marginal cost* needs to coincide with the *price a retailer pays to acquire the product* or even the *expenses incurred by a*

[21] This is true for linear demand and other demand curves that are not "too convex" so long as the elasticity is increasing in price.

manufacturer to produce a product. The true measure of marginal cost includes *opportunity costs as well.* As highlighted in (4), the opportunity cost of selling you a Corolla includes the possibility (with some probability) of selling you a Camry instead (and earning that price-cost margin, which might be higher or lower). This means as the margins on the Camry increase (or the probability of switching increases), the effective marginal cost of selling the Corolla rises. Likewise, the true marginal cost to the dealer reflects the price at which the inventory can be replaced, not necessarily the price paid to acquire the car. In normal times, these might be highly similar. However, many vehicles acquired in 2019 or 2020 at relatively low prices were sold in 2021 at relatively high prices, when supply chain disruptions made it difficult (or impossible) for dealers to acquire additional inventory, suggesting a significant increase in the *opportunity cost.* Similarly, microchips used to build the Corolla means fewer microchips available to build the Camry, raising their opportunity costs as well. Once again, in normal times, the opportunity cost of the microchip would reflect only the market price paid. However in "times of unusual market disruption," we should worry that true marginal costs can diverge from prices previously paid for inputs. This proved to be a frequent source of confusion for some of the advocates of "Profits-Inflation" theory, as they looked at the cost producers had *previously* paid for their goods rather than the cost of *replacing inventory* when assessing firms' profitability.

2.4 Discussion: Demand vs. Residual Demand

There are of course many caveats to these simple supply and demand arguments. The most important of these is that we often don't measure supply or output for the entire market in our data. Consider the context of oil production from 2019-2024. Production of oil fell globally during the pandemic shutdowns in 2020, including by 8% in the United States. Global production recovered slowly at first, but significantly by the end of 2021. In November 2022, and again in May 2023, OPEC+ announced production cuts. Meanwhile, September 2022, and again in February 2023, the G7 countries imposed sanctions on Russian oil (the third largest producer).[22] At the same time, US production continued to expand, such that by the end of 2024, the United States was the largest producer of oil in the history of the world. How should we interpret the evolution of oil production using the language of supply, demand, and firm conduct?

In part, the answer depends on whether we consider the market to be the global oil market, or just the United States. In the case of the global market, the OPEC production cuts

[22]See `https://www.eia.gov/todayinenergy/detail.php?id=61545`. for details on oil production.

led to a reduction in supply, but not a cost shock – instead a *change in firm conduct*. That is, the production costs didn't change for Saudi Arabia and Iraq. Rather, they voluntarily came together and elected to reduce output in order to maintain higher prices. Likewise, for countries participating in the sanctions, competition from Russia was largely removed from the market (which could be interpreted as a change in the conduct, or as an increase in costs after Russian supply was removed from the market).

If we focus only on the United States, we would see a different story. In the United States, production surged to record levels, leading to record profits in 2022 and 2023 for U.S. firms. From the perspective of United States oil producers, the period from 2020-2024 looked unambiguously like a *shock to demand*. Even as production cuts abroad softened competition, nothing suggests a *change in domestic conduct*. If our definition of "profits" or "producer surplus" is restricted to domestic firms, then what matters in Figure 2 is not the *global demand for oil* but rather the *residual demand* faced by U.S. firms, which increased as rivals cut production. If we are only looking at U.S. firms, the fact that Russian (or OPEC+) oil production decreased is not what is important. There is a literature on estimating residual demand (sometimes including the conduct parameter) (Baker and Bresnahan, 1988; Froeb and Werden, 1991).

We must be careful about *which market we are discussing* and *whose profits are rising* when we say that "profits increased." If we narrow the focus to domestic firms or publicly-traded firms (often for convenience, since that's what the CompuStat data capture), then we need to make sure we're measuring the *residual demand* facing those firms rather than some broader global market.

2.5 Discussion: Economics vs. Accounting (National Accounts)

The previous section highlights that *economic costs* can increase even when *accounting costs do not*. A shock to *opportunity cost* can cause prices to rise and lead *economic profits to fall* while *short-term accounting profits* appear to rise. This is not a violation of Table 1, because the predictions reflect *economic profits* rather than *accounting profits*.

This raises the broader point that *economic profits* and *accounting profits* may move in different directions and that using accounting profits to estimate economic profits can be problematic. A common starting point for nearly all of the modern empirical industrial organization literature is the idea that accounting measures of cost and markups rarely coincide with *marginal cost* (Schmalensee, 1989; Berry et al., 2019; Syverson, 2019). Most scholars in IO rely on recovering costs either from first-order conditions like (2) and (4), or from estimates of the production function.

The productivity literature considers a firm choosing inputs (labor L_t, capital K_t, and materials M_t) in order to minimize the cost of producing Q_t units of output given productivity ω_t:

$$\min_{K_t, L_t, M_t} p_t^k \cdot K + p_t^L \cdot L_t + p_t^m \cdot M_t \quad \text{subject to } Q_t = F(K_t, L_t, M_t, \omega_t). \tag{6}$$

One key feature of (6) is that increases in factor prices (p^k, p^L, p^m) may lead to higher marginal costs, but may also lead to *input substitution* between capital and labor or vice versa. As an example, increasing wages might lead wholesalers to automate warehouses or retailers to automate checkout lanes.

Many data series (including the National Income and Product Accounts) instead report the results from a "value added production function":

$$P_t \cdot Q_t - p_t^m \cdot M_t = F(K_t, L_t, \omega_t). \tag{7}$$

In this case, instead of output, this captures "value added." That is just revenue $(P_t \cdot Q_t)$ less the expenditures on materials inputs $(p_t^m \cdot M_t)$. One reason people work with value-added is that when we sum over all of the firms in the economy, we avoid "double counting" cases where the outputs of one firm are inputs to another. (This makes it attractive for constructing National Accounts, where the goal is to accurately calculate the country's total output.) Another reason is that value-added avoids the need to measure and compare "quantity" across different products, firms, and industries.

However, value-added measures make it impossible to measure the causes of inflation. The left-hand side of (7) doesn't tell us about changes in prices. It tells about changes in revenue less material expenditures. In both the "textbook narrative" and the "Profits-Inflation" narrative, how firms respond to rising costs of material inputs is a core part of understanding inflation, so subtracting it out makes it impossible to assess the impact of rising materials costs. Meanwhile, the right-hand side allows us to decompose *value added* into the capital and labor share, but now ignores the cost of materials. A high capital share or labor share of *value-added* doesn't tell us anything about the share of *price increases*, which could be almost 100% (or even 0%) changes in the prices of material inputs. This is especially true in the case of industries like *retailing*, where the expenditure share of materials is high (relative to capital and labor).

A number of recent studies embracing the "Profis-Inflation" theory try to estimate the "profit share" (really *capital share*) of *value added* from the NIPA tables (Bivens, 2022; Pancotti and Owens, 2024). We revisit those studies in Section 3.2, but they all suffer from the same flaw of calculating capital share relative to *value added* and ignoring *materials*. The deeper problem with these accounting relationships is that they do not provide a decomposition of price increases into cost shocks, demand shocks, and changes in firm conduct as we would like. There is no part of (7) that we can point to and say "that is demand" or "that is competitive conduct" – only capital and labor shares. Telling us where the money went is not the same thing as telling us why it went there.

2.6 Discussion: Economics vs. Accounting (Firm Profits)

A popular alternative to using National Accounts data to measure the profitability of firms is to use accounting measures of profitability. Publicly-traded firms, for instance, are required to issue standardized quarterly reports containing financial information to the SEC (such as 10-Ks or 10-Qs). These data are made easily accessible through electronic databases like CompuStat and WRDS. The Census also provides some aggregate statistics that include smaller and private firms in the QFR database.

Financial filings generally track revenues; cost of goods sold; expenditures on selling, general and administrative expenses; and operating expenses. While these are useful in assessing the financial health of corporations, financial filings do not give clear measures of prices, marginal costs, or demand and supply. These are well-known issues in industrial organization but perhaps not in other parts of economics. See Schmalensee (1989); Berry et al. (2019); Syverson (2019).

One major challenge is that boundaries of firms do not generally align with the boundaries of product markets. For example, PepsiCo not only sells soft-drinks but also owns Frito-Lay (chips and snacks), and Quaker Oats. When PepsiCo's revenue increases, we may not even know which division was responsible. For large diversified firms like 3M or General Electric, it's even harder to identify the relevant market. Even firms within well-defined industries such as hospitals or supermarket retailing may not be in the same geographic markets as one another.

The larger challenge is that a multi-product firm generally reports revenues $R = \sum_j Q_j \cdot P_j$ summed across all products (j) and the Cost-of-Goods-Sold (COGS) as the total costs related to the production (summed across all goods): $COGS = \sum_j Q_j \cdot C_j$. An easy measure of profitability is the gross margin:

$$\text{Gross Margin} = \frac{Revenue - COGS}{Revenue}$$

If a firm only sold one product, then the gross margin would roughly correspond to $\frac{P-AVC}{P}$. This is not the same as the Lerner index in (2) because at best we're getting the *average cost of variable inputs* instead of the *marginal cost*. These might be quite different whenever returns to scale are important, or when supply shortages make the last few units much more expensive to produce (automakers getting their hands on additional microchips, "labor shortages" making it hard to run additional shifts, etc.). As pointed out earlier, the accounting cost measures still fail to address *opportunity costs*.

An even bigger problem with trying to use gross margins as a measure of economic profit is that gross margins neglect a number of costs we expect to fall within the realm of marginal costs that affect price-setting behavior. What is included in COGS can vary across industries. In some industries (such as retail supermarkets), COGS includes the wholesale costs of acquiring the inventory (including shipping and handling) but not much else. Other expenses such as credit-card processing fees, advertising, and most salaried employees (managers) tend to be included in "Selling, General, and Administrative" (SG&A) expenses. COGS tends to include labor only if it is used in manufacturing the goods, not providing "retail services," so labor expenses related to stocking shelves or cashiers tend not to be included in COGS for retail industries.[23]

If prices are increasing because *labor costs are rising and firms are passing wage increases on to consumers, we would expect gross margins to rise*, even if economically speaking the firm is less profitable than before. This is less of an issue in manufacturing where COGS includes wages of employees involved in production (though it still omits employees involved in other aspects of the business, including the product design, engineering, sales, and administration), but it is a huge issue in retailing where wages are mostly part of SG&A.

For accounting purposes, net margins tend to provide a better picture of the financial health of the firm than gross margins. The net margin includes all operating expenses in the cost component (wages, rent, selling and interest expenses, taxes, etc.) For economic purposes, they still don't account for things like *opportunity costs* and tend to include com-

[23]See `https://www.investopedia.com/terms/c/cogs.asp?utm_source=chatgpt.com` or `https://viewpoint.pwc.com/dt/us/en/pwc/accounting_guides/financial_statement_/financial_statement___18_US/chapter_3_income_sta_US/36_operating_expense_US.html#pwc-topic.dita_1428043112145884` for example.

ponents of *fixed costs* as well as *variable or marginal costs.* We don't usually think about rent as a component of marginal cost when firms set prices, though it could be the case that rising rents lead retailers or restaurants to increase prices. Accounting measures of profitability can also be highly sensitive to one-time financial events unrelated to production (taking a large write-down from a previous acquisition, for example).

A recent literature (De Loecker and Warzynski, 2012) has taken the cost minimization problem from (6) and derived conditions under which one can convert measures of output and variable cost inputs (such as materials or labor) and estimate an *output elasticity.* After estimating the output elasticity with respect to labor or materials, one can compute the *factor share* of revenue for input i as $p_t^i X_t^i / P_t^o Q_t^o$ (the superscript o denotes output). This output elasticity can be combined with factor shares to derive estimates of the firm-level markup $\mu = p/mc$:

$$\varepsilon = \frac{\partial \log Q_{it}}{\partial \log X_t^i} = \mu \cdot \frac{p_t^i X_t^i}{P_t^o Q_t^o}. \tag{8}$$

This approach was extended by De Loecker et al. (2020) to treat COGS from accounting statements as the variable input, and revenue (rather than quantity) as the output of the production function. The idea is that the elasticity enables us to convert between the average variable input (from $COGS/Revenue$) to the marginal object, by capturing how sensitive output is to changes in the input (through the elasticity). At best this will deliver an estimate of the markup μ at the firm (rather than product) level. In order for this approach to be successful, we must correctly estimate the output elasticity from the production function. There is a large literature on estimating production functions, and some disagreements both on how to estimate the elasticity (Ackerberg et al., 2015; Gandhi et al., 2020; Hashemi et al., 2022; Doraszelski and Jaumandreu, 2021; Raval, 2019), and whether COGS is an appropriate choice as the variable input (and whether it should include SG&A)(Bond et al., 2020; Kirov et al., 2023; Flynn et al., 2019).

2.7 Can we test/estimate firm conduct?

An important question is whether or not it is possible to measure firm conduct separately from shifts in supply and demand. This has been a foundational question in the "New" Empirical IO literature since its inception (Bresnahan, 1982). Under fairly general conditions, the answer is "yes" (Berry and Haile, 2014). Doing so typically requires careful analysis of a single industry in order to estimate the own- and cross-elasticities of demand from (2) and (4).

What is generally not recommended is treating θ from (2) or (4) as a parameter to be estimated Corts (1999). As a simple example, it is hard to differentiate between the marginal costs of all firms in the industry simultaneously increasing, versus the simultaneous softening of competition (such as forming a cartel). In the first case the inputs change, while in the second the game itself changes. Following Figure 2 or Table 1, both cases would lead to higher prices and lower output. In the case of higher costs (rather than a softening of competition), we would expect profits to rise rather than fall. Telling these apart requires good measures of economic profits or marginal costs.

Because accounting measures can diverge from the true economic marginal cost, the literature has largely focused on the case where marginal costs are not directly observed. Consider the case of automobiles. Researchers might have some data on the cost of certain raw inputs (steel, aluminum), and maybe some specific intermediate inputs (microchips, tires, automotive glass), and possibly some measure of average wages of autoworkers that might be correlated with marginal cost. The firm-level cost of goods sold would tell us very little about the marginal production of one vehicle model versus another. The literature has largely focused on using available data that are correlated with cost, as well as estimates of demand elasticities, in order to *test rather than estimate* assumptions about firm conduct.

Consider the following setting, which relates prices of j in period t to its markup η_{jt} as well as some function of input costs w_{jt} (like wages, input and commodity prices, etc.).

$$p_{jt} - \eta_{jt}(\theta) = c(\mathrm{w}_{jt}) + \omega_{jt}.$$

The space of potential markup rules η_{jt} is probably infinite, making estimation difficult if not impossible. However, we can test whether one model for η_{jt}^A (like perfect competition) fits the data better than another η_{jt}^B (like monopoly). This enables a researcher to test:

$$p_{jt} - \tau \cdot \eta_{jt}^A(\theta) - (1-\tau) \cdot \eta_{jt}^B(\theta) = c(\mathrm{w}_{jt}) + \omega_{jt} \text{ where } H_0 : \tau = 1 \text{ and } H_a : \tau = 0. \quad (9)$$

In general the test depends on detecting violations of the moment restrictions $\mathbb{E}[\omega_{jt} \mid \mathrm{w}_{jt}, z_{jt}] = 0$. For a test like this to work, we need some instruments z_{jt} that affect firm markups but not marginal costs (things that shift demand, or really "rotate marginal revenue" as in Figure 2).

There is a growing literature that tries to determine firm conduct with tests like the one described above (Nevo, 1998; Villas-Boas, 2007; Bonnet and Dubois, 2010), and a more recent literature that discusses the role of instruments and which models of firm conduct are in fact *testable* (Berry and Haile, 2014; Duarte et al., 2024; Backus et al., 2021). More recently the approach described above has been used to test whether overlapping financial owners lead to less competition (Backus et al., 2021); to detect cartel behavior in generic pharmaceuticals (Starc and Wollmann, 2022); and to assess monopsony power in labor markets (Rousille and Scuderi, 2024).

The takeaway is that with good estimates of demand elasticities, and strong instruments, it is possible to separate supply from demand, and select a model of firm conduct. At least under the interpretation that the "Profits-Inflation" hypothesis is really about a significant change in firm conduct in 2021-2022 (rather than demand or marginal costs), this provides a framework to test whether or not the hypothesis is supported by the data. However, the approach proposed above differs substantially from prior work on the "Profits-Inflation" hypothesis – which illustrates an increase in corporate profits during 2021-2022, but does little to disentangle cause from effect.

2.8 Comparisons to New Keynesian Macro Models

It is also worth illustrating how the IO approach described above is similar to and different from standard macroeconomic models of price setting. As an example consider Woodford (2003) or Clarida et al. (1999). In those models the log-linearized New Keynsian Phillips Curve looks like this:

$$\pi_t = \kappa x_t + \beta \mathbb{E}_t \pi_{t+1} + u_t. \tag{10}$$

In the New Keynesian Phillips Curve (NKPC), inflation π_t depends on expected future inflation, the real output gap x_t, and an additive disturbance u_t. Within this framework, changes in aggregate demand affect inflation through the output gap (or, alternatively, real marginal cost), while u_t captures all other influences on firms' price-setting decisions that are orthogonal to real activity. In the canonical interpretation, higher values of x_t ("demand") imply higher marginal costs as we ascend the supply curve.

In practice, the term u_t is a residual that encompasses a variety of mechanisms, including changes in marginal costs not captured by x_t (often labeled "cost-push shocks") as well as changes in desired markups ("markup shocks"). This highlights an important identification issue: without additional structure, the same reduced-form disturbance u_t may reflect cost shocks, changes in market power, or shifts in firm conduct.[24]

[24]Notice in the IO models above we could also write (log-linearized) $p_t = \mu_t \cdot mc_t$ as $\log p_t = \log mc_t +$

In formulations of the NKPC written directly in terms of real marginal cost, with $x_t \approx mc_t$, the interpretation of u_t as a markup shock is more transparent. Even in that case, however, observed movements in markups may arise either from changes in demand elasticities or from changes in competitive behavior, making it difficult to separately identify demand, costs, and conduct using the NKPC alone. For this reason it is probably important to resist the urge to interpret u_t as "greed shock".

3. Reviewing the Empirical Evidence

In this section we'll review some of the evidence cited in favor of the "Profits-Inflation" hypothesis. Because there is no canonical theory (and certainly no formal, testable model or hypothesis), any review of evidence will be incomplete and is unlikely to satisfy all of the proponents. Instead, we will focus on some of the data points most widely quoted/cited/repeated as evidence.

1. Faster growth in producer prices (PPI) relative to consumer prices (CPI) is evidence that prices are rising more quickly than costs, or that profits or profit margins are expanding. (Pancotti and Owens, 2024)

2. Decomposing changes in *value-added* into *labor* and *capital* shares finds a higher capital share in some periods. This is then interpreted as evidence that "higher corporate profits caused more than half of inflation" (during selected periods) (Bivens, 2022, 2024; Pancotti and Owens, 2024).

3. The accounting profits or gross margins of selected firms or industries increased or increased more in concentrated industries. (Konczal and Lusiani, 2022; Glover et al., 2023; Weber et al., 2024)

4. Analysis of earnings calls transcripts documented executives discussing price increases, rising profits, or rising costs. In some cases statements reflect more positive sentiment when cost shocks are common to competitors rather than firm-specific. (Weber et al., 2024).

That prices and corporate profits were increasing in 2021 and 2022 is not really in dispute. (Though some studies cited above fail to accurately document that fact). The real question is whether elevated profits were a *cause of inflation* rather than a *consequence of inflation.*

$\log \mu_t + \varepsilon_t$. This has the same issue that even if we can measure the markup μ_t we don't know whether it is being caused by demand factors or conduct.

None of the evidence above enables us to separate *increasing demand* as an explanation separate from *changes in firm conduct* for why prices and profits were increasing. Of course, just because two things were increasing at the same time, does not imply that one caused the other.

3.1 Misunderstanding What PPI Measures

Some studies and news coverage have inferred that profits (or markups) are rising simply by looking at the difference between the Consumer Price Index (CPI) and the Producer Price Index (PPI) (Pancotti and Owens, 2024). This reflects a fundamental misunderstanding of what these data series measure.

Consider the following (incorrect) statement in the New York Times (Smith and Rennison, 2023):[25]

> The Producer Price Index, which **measures the prices that businesses pay for goods and services** before they are sold to consumers, reached a high of 11.7 percent last spring. That rate plunged to 2.3 percent for the 12 months through April.

and a similar statement in the Guardian (Perkins, 2022):

> The producer price index, **which tracks business inputs cost, showed deflation in July and August**. It increased by 0.4% in September, but with food and energy excluded, it remained flat.
>
> "That also supports the profiteering theory," said Lindsay Owens, Groundwork Collaborative's executive director. "We see input costs cooling more than consumer prices and companies aren't giving that pricing back to the consumer, or at least not yet."

The BLS website makes clear this is not the correct interpretation of the PPI series:[26]

> The Producer Price Index (PPI) of the Bureau of Labor Statistics (BLS) is a family of indexes that **measures the average change over time in prices received (price changes) by producers** for domestically produced goods, services, and construction. PPIs measure price change from the perspective of the seller.

[25] See also here `https://x.com/talmonsmith/status/1844725959074717998`.

[26] See further discussion here `https://www.bls.gov/news.release/ppi.tn.htm`.

The fact that PPI was declining while CPI continued to rise in 2023, was used as evidence of the "Profits Inflation" hypothesis. The mistake is that the producer price index measures the prices that domestic firms *charge* (with some notable exceptions discussed below) rather than their *costs*. For a single good, we should expect the PPI and CPI to largely coincide. The CPI tries to measure prices paid by consumers (by sending shoppers to stores, among other methods), while the PPI surveys firms on the prices they receive for output. One wedge between the two prices arises when consumers pay sales or excise taxes (which are included in the CPI but not in the PPI). The second major difference between the two series is that not all goods and services are produced domestically and therefore are not included in PPI, which surveys only domestic firms.

An even bigger difference between CPI and PPI arises when we aggregate from the prices of individual goods and services to the overall index. The weights used to aggregate the baskets differ substantially because much of the output included in PPI involves business-to-business transactions. Households tend not to consume too many intermediate goods, manufacturing equipment, diesel fuel, enterprise software, consulting and professional services, etc. Meanwhile, the CPI puts much more weight on entertainment, meals in restaurants, and most importantly shelter (including owner-imputed rent), which tends to be the largest single CPI component and the most significant component of inflation in 2023. This makes comparing the top-line CPI and PPI numbers meaningless (and certainly a terrible way to measure profitability or market power).

A third issue is that even if the prices of intermediate inputs were to grow more quickly than the prices of output, this would not even establish that profits or markups are rising. Recall the production function in (6); for economic markups to rise, prices need to grow more quickly not only than the price of intermediate inputs (prices paid by retailers to wholesalers, prices manufacturers pay for parts, etc.) but the actual marginal cost of production (which includes wages paid to workers, use of capital equipment, etc.).

Although the differences between the CPI and the PPI cannot tell us whether inflation was due to a *change in demand* or a *change in firm conduct*, we can still reproduce the comparison of the PPI and CPI from Pancotti and Owens (2024) in the top panel of Figure 3. This plots the 12-month change in the CPI and PPI for each month in 2023. Looking at the December numbers, we can see that for 2023 producer prices grew around 1%, while consumer prices grew around 3.2%. The authors used this as evidence that the prices the firms charged increased more quickly than their costs (which is not the correct interpretation).

Even if we take this exercise at face value, when we zoom out and look at the bottom

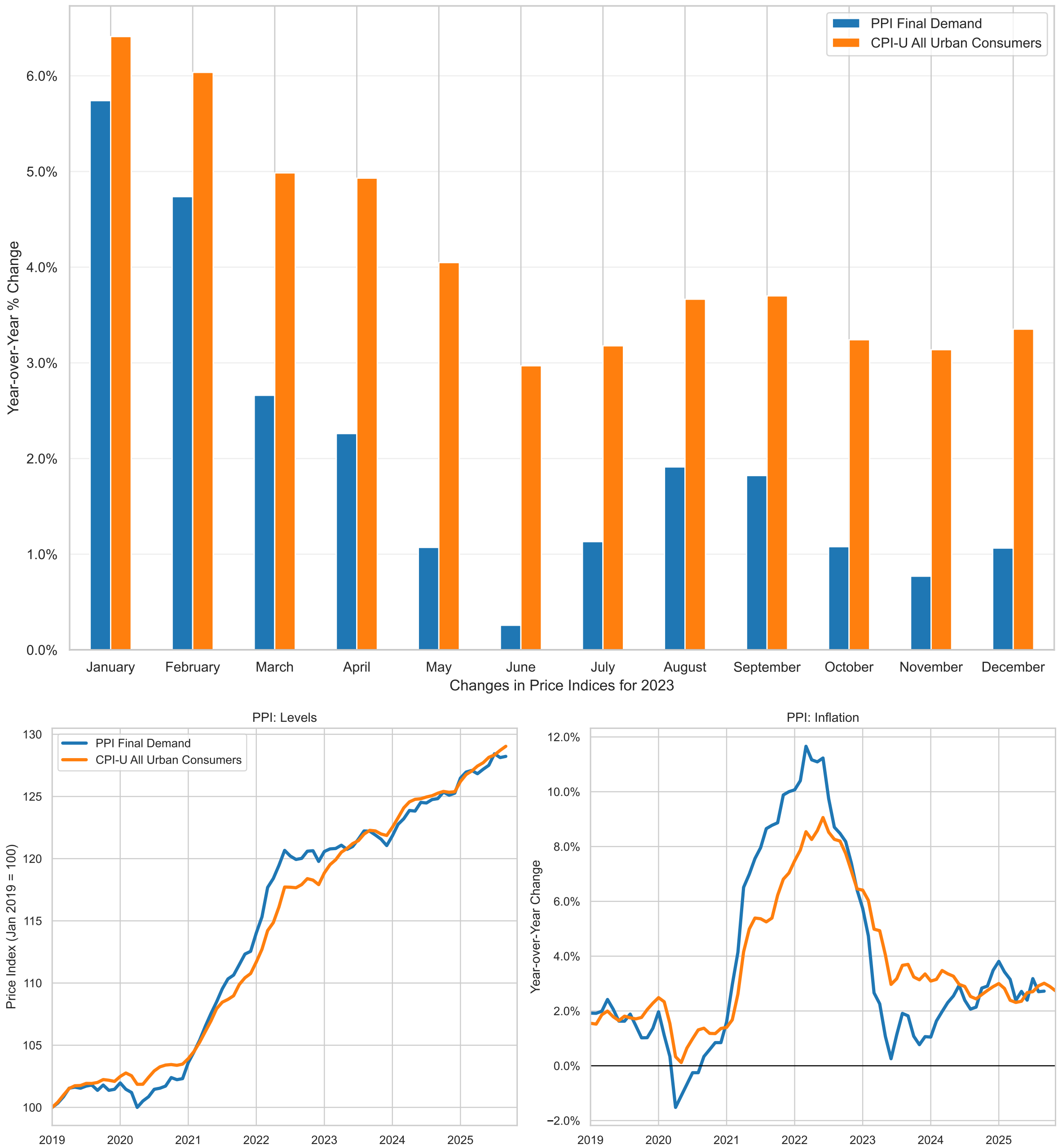


Figure 3: 12 Month Change in CPI vs PPI

Source BLS. CPI U All Urban Consumers (CUUR0000SA0); PPI Final Demand (WPUFD4). Both series are *NOT* seasonally adjusted.

panels of Figure 3, we see that for the *entire* inflationary episode from 2019-2024 – rather than just a single, conveniently chosen year – the PPI and CPI grew at nearly identical rates. The PPI series tends to be a bit more volatile than the CPI series. The CPI-U series only increased more rapidly than producer prices (for final demand) as inflation cooled in 2023 (the only period presented by Pancotti and Owens (2024)), while the opposite was true as inflation grew in 2021-2022. In fact, 2021-2022 was the period where profits grew the most quickly, yet PPI growth outstripped CPI growth, illustrating why this entire exercise is nonsensical.

It may be tempting to try to salvage this exercise by looking at the PPI sub-indices, including treating those for intermediate goods as costs that could be compared to PPI final demand prices. This still will not help us to disentangle costs, demand, and conduct contributions, but it is also insufficient to demonstrate an increase in profitability.

To illustrate why, imagine comparing the PPI for Final Demand Foods (which includes firms like Pepsi, Tyson, Campbell's Soup, Kraft Heinz) to the PPI for Supermarkets (which includes firms like Kroger, Albertson's, Ahold Delhaize). One might hope that the difference between the two series would tell us something about retail supermarket profits (which it does not).

As shown in the top panel of Figure 4, since 2019 the PPI for Supermarkets has increased by roughly 10 percentage points more than the PPI for Final Demand Food. Taken at face value, this gap could be interpreted as evidence that supermarkets have raised prices substantially more than their suppliers. However, the difference between these two series is not a measure of supermarket profitability. To illustrate the disconnect, Kroger's financial filings show that its gross margin increased only modestly, from about 22% before COVID to a peak of 23.3% in 2021Q1.

Why does a simple comparison of these PPI series suggest much larger changes than are visible in firm-level profitability? There are two main reasons. First, the BLS measures the PPI for supermarkets, and other industries classified as "trade services," in an unconventional way. Rather than tracking the topline prices charged to consumers, these PPIs measure the difference between retail prices and wholesale acquisition costs, that is, the retailer's value added as defined in (7). This has led some commentators to (incorrectly) interpret these series as direct measures of profits. However, an increase in these PPIs may reflect rising profitability, but it may also reflect higher operating costs that are passed through to consumers (notably labor costs and depreciation of fixed capital).

The second issue is that value added is small relative to total revenue in supermarket

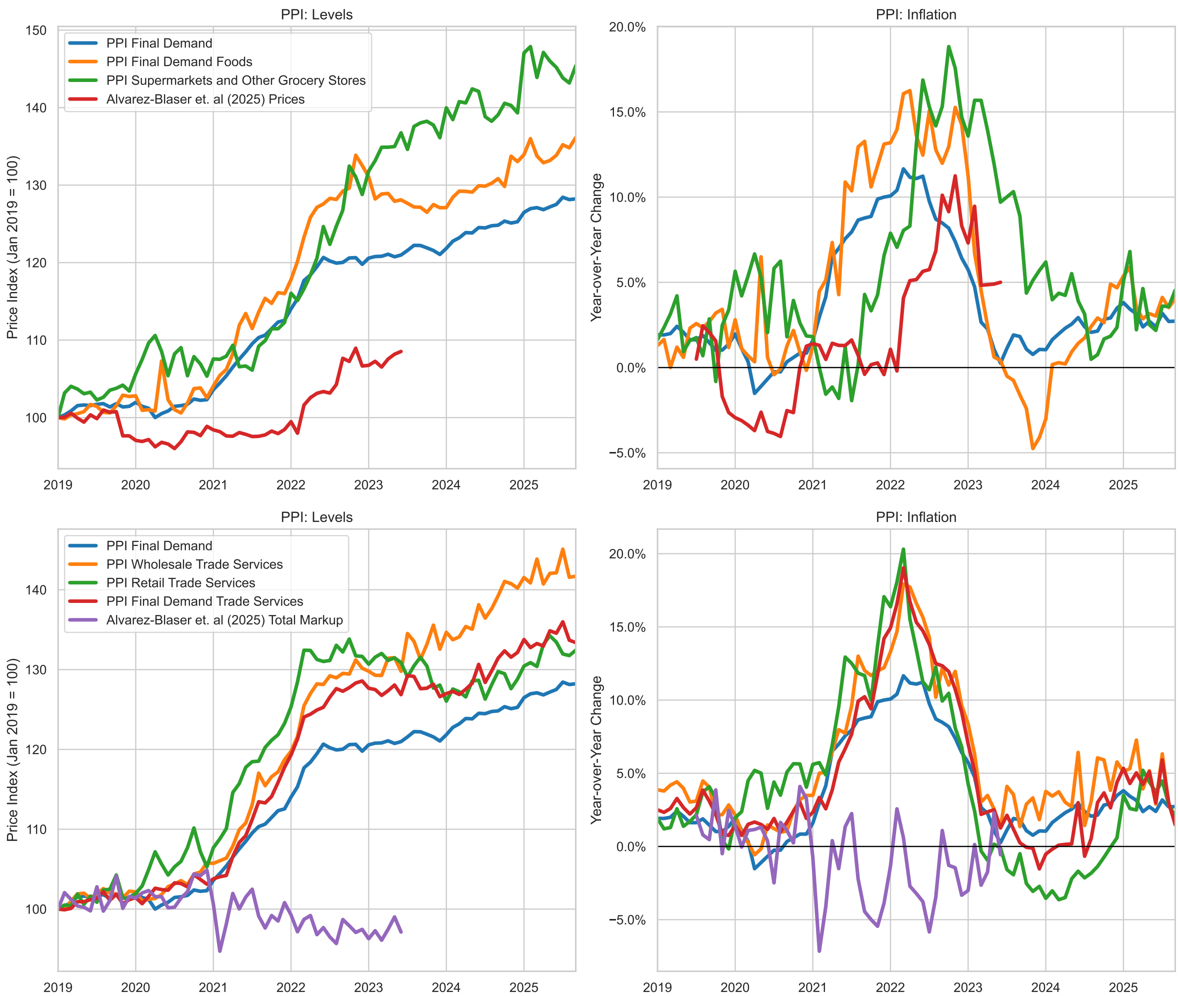


Figure 4: Producer Price Indices for Trade Services and Food Retail

Source BLS. All Final Demand (WPUFD4), Final Demand Food and Beverage (WPUFD411)
Trade Services: Food and Alcohol Retailing (WPU5811), Retail (WPU57), Wholesale (WPU58), Final Demand Trade Services (WPSFD423).
Alvarez-Blaser et al. (2025) prices (top) and Lerner index markups (bottom).
Note: Series are *NOT* seasonally adjusted and normalized to 100 at the beginning of 2019.

retailing, so modest changes in prices or costs can translate into very large percentage changes in the PPI. For example, suppose a supermarket sells a box of cereal for \$5.00 and pays \$4.75 to the manufacturer, implying value added of \$0.25. If higher wages lead the supermarket to raise the retail price to \$5.25, a 5% increase, the PPI interprets this as a doubling of the margin from \$0.25 to \$0.50. In this case, profits could rise, fall, or remain unchanged depending on how costs evolve. This mechanical amplification generates excess volatility in trade-services PPIs, as also seen in Figure 4, and explains why the BLS provides alternative PPI series that exclude trade services.[27]

The bottom panel of Figure 4 shows the evolution of PPIs for other retail and wholesale trade services, which are constructed using the same value-added methodology. As before, increases in these indices may reflect higher markups, higher non-material input costs such as labor and transportation, or some combination of the two.

To further illustrate the distinction between price increases and markup expansion, we include the “total markup” series from Alvarez-Blaser et al. (2025), which combines manufacturer, wholesaler, and retailer margins using data from a large producer of nondurable consumer goods. Their approach computes a Lerner index by comparing retail prices to manufacturers’ marginal costs, thereby capturing markups along the entire supply chain rather than focusing on value added at a single stage.

As shown in the top panel of Figure 4, prices for this firm rise by less than the overall price level and increase later than both the PPI for Final Demand Goods and the PPI for Final Demand Supermarkets. In the bottom panel, the corresponding total markup remains relatively flat at around $(P - MC)/P \approx 0.67$ throughout the inflationary episode, even as PPIs for retail and wholesale trade services increase. This pattern may reflect the idiosyncratic experience of a single manufacturer, or it may indicate that price increases during this period were driven primarily by rising manufacturing costs and or higher operating costs among retailers and wholesalers, rather than by an expansion of markups along the supply chain.

[27]These issues are explicitly discussed by the BLS in its documentation. See https://www.bls.gov/opub/btn/volume-1/wholesale-and-retail-producer-price-indexes-margin-prices.htm, https://www.bls.gov/opub/hom/pdf/ppi-20111028.pdf, https://www.bls.gov/ppi/fd-id/frequently-asked-question-on-the-producer-price-index-for-final-demand.pdf, and https://www.bls.gov/ppi/fd-id/ppi-final-demand-intermediate-demand-by-commodity-type-aggregation-structure-and htm.

Discussion

While it would be convenient if we could learn about firm profits from the PPI series, this is unfortunately not the case. The key takeaways are: (1) we should not interpret the difference between PPI and CPI as "profits" but rather mostly the difference in weights between the two series; (2) while some PPI series track the prices of intermediate goods, those are only one component of production costs, which also include capital, labor, energy, and transportation; (3) even PPI series that report something that *looks* like "margins" on "trade services" capture differences between selling price and acquisition prices ("value-added"), but ignore the costs of other inputs (often labor and transportation costs) used by wholesalers and retailers to provide those services and deliver goods to final consumers. This is especially important because we often worry that wages are a significant portion of the inflation story (particularly for retailer "worker shortages" during COVID-19).

The goal of PPI series is to measure how the prices received by U.S. firms have changed over time, not to determine the profitability of those firms. For purposes of measuring profitability, the lack of other (non-materials) inputs such as capital and, most importantly, labor makes them unable to address the Profits-Inflation hypothesis.

3.2 Profit Share from National Accounts Data

The claim most often cited by supporters of the Profits–Inflation hypothesis is that corporate profits account for "more than half" of price increases.[28] The evidence behind this claim generally comes from several studies using similar methodology. The starting point for the first two studies is Table 1.15 from the National Income and Product Accounts (NIPA) of the Bureau of Economic Analysis (BEA). The first (Bivens, 2022) examines the period between 2020Q2-2021Q4, while the second (Pancotti and Owens, 2024) considers a broader period, but reaches a similar headline number of 53% for the last two quarters of 2023. A third study (Weber and Wasner, 2023) also uses national accounts data to compute "profit" and "labor" shares.

There are three major issues with these calculations: (a) they conflate "prices" and "inflation" with value added which nets out the cost of intermediate inputs which ignores a potential source of inflation; (b) the estimated "profit share" is overstated because it includes taxes paid by firms; (c) the studies focus on periods that maximize the "profit share" but omit the period of peak inflation in mid 2022.

First, it is important to understand what the national income product accounts measure.

[28]See the reporting here (Smith and Rennison, 2023; Perkins, 2024; Zahn, 2022).

The BEA produces a variety of tables on a quarterly basis to aid in calculating the overall GDP of the United States from these National Accounts Data. NIPA Table 1.15 (which is itself derived from Table 1.14) decomposes gross value added for a single unit of output:[29]

> Corporate gross value added is defined as the total value of all goods and services produced by the corporate sector (gross output) less the value of the goods and services that are used up in production (total intermediate inputs). It is derived as the sum of consumption of fixed capital, compensation of employees, taxes on production and imports less subsidies, and net operating surplus.

The idea here is to take all non-financial corporate businesses in the U.S. (public and private) and treat them as if they were a single firm – and then compute its *gross value added* rather than all the prices being charged. One reason to work with *value added* is to avoid double-counting along the supply chain, a key challenge in estimating GDP, the second is that value added is more easily aggregated across products and firms than output. The main distinction between actual *prices* and *value added* is that *value added* is net of *intermediate inputs* denoted M_t. We can think of *intermediate inputs* as the goods and services (i.e., "parts" like seats, tires, etc.) which the firm purchases from other firms (either foreign or domestic) in order to produce the final good (like an automobile). In addition to the intermediate inputs, the firm also uses labor inputs L_t and incurs some depreciation of fixed capital K_t to produce each unit of output, and it may also incur some taxes/subsidies related to production.[30]

In this case, value added can be calculated in one of two ways, either by calculating the difference between revenue and intermediate expenditures, or constructively by adding up expenditures on all other inputs (labor, depreciation of fixed capital) and most importantly, net operating surplus/corporate profits π_t (and taxes τ_t):

$$VA_t \equiv P_t \cdot Q_t - p_t^M \cdot M_t = p_t^L \cdot L_t + p_t^K \cdot K_t + \tau_t + \pi_t \tag{11}$$

In practice, the BEA does the latter, and uses the right-hand side of the value added relationship. What NIPA Table 1.15 does is take the components of value added from Table 1.14 and unitize them, as if a single firm produces a single unit of value added (rather than

[29]See Section 2.5 for a more detailed discussion of value added measures.

[30]Some discussions have confused "nonlabor costs" with the cost of materials (already subtracted out of value added), rather than the consumption of fixed capital. This is why it is important to carefully read the description of data series.

output) using a single unit of labor, capital, at some unitized prices (denoted by $*$) and produces a unitized measure of profit. This gives the following accounting identity for unitized profits:[31]

$$\pi_t^* = p_t^{VA*} - \left(p_t^{L*} + p_t^{K*} + \tau_t^*\right) \tag{12}$$

These studies then compute the cumulative share (of value added) for each of the constituent parts (labor, depreciation of fixed capital, profits, taxes, etc.) between the initial period t and the final period T. To do that, one simply compares the cumulative change in unitized prices:

$$\text{Cumulative Share}_{t,T} = \frac{p_T^* - p_t^*}{p_T^{VA} - p_t^{VA}}. \tag{13}$$

The input data are found directly in Table 1.15 (here as Table 2). Thus, if we wanted to know the "profit share" (really capital share) for the change in real value added between 2023 Q2-Q3 (as in the Groundwork (Pancotti and Owens, 2024) study), we would obtain $\frac{0.223-0.215}{1.230-1.218} = 66.7\%$. Likewise if we considered the period between 2020 Q2 and 2021 Q4 (the same period as the EPI study (Bivens, 2022)), we get a similar number: $\frac{0.195-0.133}{1.135-1.041} = 66.0\%$. It is worth noting that both of these calculations also include the taxes paid by firms as part of the "profit share" ($\pi_t^* + \tau_t^*$), though the NIPA table makes these easy to subtract out and doing so reduces the "profit share" for the EPI study period to 48.9%.[32]

Both calculations rely on narrow and somewhat arbitrary sample periods, and both exclude the period when inflation was at its peak (around June 2022). If the goal is to assess labor share, depreciation of fixed capital, and the so-called "profit share" of inflation, it is natural to examine the full inflationary episode and to separate taxes paid from profits.

Using Table 3, when we compute profit shares over longer horizons that include the most recent data (through 2025 Q3), a very different picture emerges. Over the five-year period spanning the entire inflationary episode (2020 Q3–2025 Q3), the (after-tax) corporate profit share is 9.3%. Extending the window six years to include the pre-pandemic period (2019 Q3–2025 Q3) raises the estimate to 25.6%, but still a far cry from "more than half".

[31] Unitizing presents an additional challenge which is that the shares of factor income can change even if the prices remain the same. That is, if p_t^L remains unchanged, we can still have p_t^{L*} adjust because the quantity of labor used L_t adjusts instead. See page 13-41 of the NIPA handbook. `https://www.bea.gov/resources/methodologies/nipa-handbook/pdf/chapter-13.pdf`

[32] These numbers differ slightly from the original studies because the BEA provides periodic revisions to the NIPA Table 1.15. The Pancotti and Owens (2024) is especially sensitive to revisions because the change in value added (the denominator) is exceptionally small in 2023 as inflation was cooling.

	Prices	Labor	Nonlabor	Profits	Taxes	After Tax Profits
2019 Q2	1.037	0.611	0.294	0.131	0.019	0.112
2019 Q3	1.041	0.608	0.296	0.137	0.019	0.119
2019 Q4	1.045	0.613	0.293	0.140	0.020	0.120
2020 Q1	1.049	0.628	0.296	0.126	0.017	0.109
2020 Q2	1.041	0.652	0.256	0.133	0.020	0.113
2020 Q3	1.054	0.633	0.237	0.184	0.025	0.159
2020 Q4	1.063	0.635	0.272	0.156	0.023	0.133
2021 Q1	1.072	0.626	0.268	0.178	0.026	0.152
2021 Q2	1.093	0.632	0.260	0.201	0.031	0.169
2021 Q3	1.111	0.644	0.272	0.195	0.032	0.163
2021 Q4	1.135	0.655	0.285	0.195	0.036	0.159
2022 Q1	1.156	0.659	0.307	0.190	0.041	0.149
2022 Q2	1.186	0.666	0.314	0.206	0.043	0.164
2022 Q3	1.196	0.674	0.313	0.209	0.041	0.168
2022 Q4	1.199	0.677	0.314	0.208	0.041	0.167
2023 Q1	1.218	0.690	0.313	0.215	0.042	0.173
2023 Q2	1.222	0.694	0.311	0.217	0.041	0.176
2023 Q3	1.230	0.697	0.310	0.223	0.042	0.181
2023 Q4	1.235	0.695	0.309	0.231	0.043	0.188
2024 Q1	1.241	0.709	0.315	0.217	0.045	0.173
2024 Q2	1.253	0.713	0.315	0.225	0.046	0.179
2024 Q3	1.254	0.712	0.318	0.225	0.045	0.179
2024 Q4	1.257	0.714	0.317	0.225	0.046	0.179
2025 Q1	1.269	0.725	0.321	0.222	0.043	0.179
2025 Q2	1.268	0.721	0.327	0.220	0.042	0.178
2025 Q3	1.279	0.722	0.334	0.224	0.044	0.180

Table 2: NIPA Table 1.15: Price, Costs, and Profit Per Unit of Real Gross Value Added

Source: BEA NIPA Table 1.15 (current through Q3 2025).
Prices: Price per unit of real gross value added (nonfinancial corporate businesses) (Line 1)
Nonlabor costs: Consumption of Fixed Capital, Taxes on Production and Imports less subsidies plus transfer payments (Line 3)
Profits: Include Inventory Value Adjustment (IVA) and Capital Consumption Adjustment (CCAdj) and corporate taxes paid. (Line 7)
Corp Taxes: Corporate Taxes Paid (not including taxes paid on current production in Nonlabor costs) (Line 8)

From Q3 of	2019	2020	2021	2022	2023	2024
Labor	47.9	39.6	46.4	57.8	51.0	40.0
Nonlabor	16.0	43.1	36.9	25.3	49.0	64.0
Profits	36.6	17.8	17.3	18.1	2.0	-4.0
Taxes	10.5	8.4	7.1	3.6	4.1	-4.0
Profits After Tax	25.6	9.3	10.1	14.5	-2.0	4.0

Table 3: Factor Shares per unit of real gross value added through Q3 2025.

Source: BEA NIPA Table 1.15 (current through Q3 2025).
All periods start in Q3 of the corresponding column (t) and end in Q3 of 2025 (T).
Nonlabor costs: Consumption of Fixed Capital, Taxes on Production and Imports less subsidies plus transfer payments (Line 3)
Profits: Include Inventory Value Adjustment (IVA) and Capital Consumption Adjustment (CCAdj) and corporate taxes paid. (Line 7)
Corp Taxes: Corporate Taxes Paid (not including taxes paid on current production in Nonlabor costs) (Line 8)

As we show below, the profit share is sensitive to the inclusion of a single quarter (Q3 2020) as firms started to reopen after the COVID-19 shutdowns. For the most recent two years (2023 Q3–2025 Q3) the after-tax "profit share" is actually negative.

To illustrate the sensitivity to particular periods, Figure 5 plots each quarter's contribution to the overall change in value added (the "price" column of Table 1.15) on the top, and after tax profits on the bottom. Recall that the profit share of value added is a ratio of the two (13). The periods used in the EPI study are shown in green, while those used in the Groundwork study are shown in maroon. The EPI study emphasizes an early phase in which inflation was accelerating through 2021, but excludes the period in which inflation peaked in 2022 and wage growth accelerated in 2023. By contrast, the Groundwork study emphasizes two quarters in 2023, well after inflation had already begun to cool and were not significant contributors to overall growth in corporate profits or the "price" of value added. The calculation in (13) is a ratio, and when the change in the unit price of value added is small, as is often the case over short horizons, the resulting factor shares can be arbitrarily large or small and therefore difficult to interpret.[33]

The implied factor shares are extremely sensitive to whether the calculation includes the change between the first and third quarters of 2020, during which "profits" increased from

[33]Related work by Leduc et al. (2024) estimates aggregate markups using factor shares rather than NIPA profit measures. They find higher markups in select industries, such as energy and automobiles, but little change at the aggregate level. One advantage of factor-share-based approaches is that NIPA profit measures are sensitive to changes in factor prices, monetary policy, and pandemic-related transfers and subsidies.

0.126 → 0.184. Over these two quarters, the unitized "price" of value added increased by only 0.005 units (in part because of the decline during 2020 Q2), while unitized "profits" rose by 0.058, implying a profit share of 1,160%. This brief interval leads to the discrepancy in the profit share in Table 3; starting before this period in 2019 Q3 leads to a 25.6% share and starting after this period in 2020 Q3 leads to a 9.3% share.

Discussion

Of course, the real issue is whether a labor or profit share of 10% or 50% tells us anything meaningful about the causes of inflation. As an example, for the most recent three years (2022 Q3–2025 Q3) – the implied labor share was 57.8%. This doesn't mean that recent inflation was caused by "greedy workers", nor does this indicate an unusually bad period for corporate profits (which peaked in 2023 Q4 even though the profit share was only 14.5%). The Groundwork study emphasized the 53% profit share they calculated (2022 Q3-2023 Q3), but did not highlight the 73% labor share during the same period.[34] In fact, the only mention of the labor share in that report was a discussion of its longer-term decline.

This illustrates the challenge in trying to causally reason from an accounting identity. The factor shares of labor, depreciation of fixed capital, taxes, and profits tell us where the change in value added went, but not why it went there. The even larger problem is that factor shares cannot tell us whether inflation was caused by demand factors (expansionary monetary policy, rising incomes, etc.), supply factors (disrupted supply chains, spikes in commodity prices, droughts and weather events), or changes in firm conduct (mergers and acquisitions, the beginning or demise of a cartel, coordination on a higher markup equilibrium, etc.).

tA better way to think about this is to ask: "If inflation was caused by strong demand, how would that show up in these NIPA tables?" The answer is that this isn't clear at all. There is no obvious mapping from a surge in demand to the factor shares of value added. It could manifest as a higher profit share, but it could just as easily manifest as a higher labor share or non-labor (consumption of fixed capital) share. There is no clear theory that relates these objects. Likewise, if firms responded to a surge in demand by investing in expanding output (which we were likely rooting for in 2021-2022), would that show up as "profits," "nonlabor" (i.e., depreciation of fixed capital) costs, or something else?

Similarly, if our theory of inflation is that "firms face higher costs and pass them along to consumers" (the textbook "cost-push" story), things become even less clear. NIPA tables 1.14 and 1.15 measure changes in *value added*, which have already subtracted expenditures

[34] Both of these numbers are different from Table 2 due to revisions to the NIPA tables.

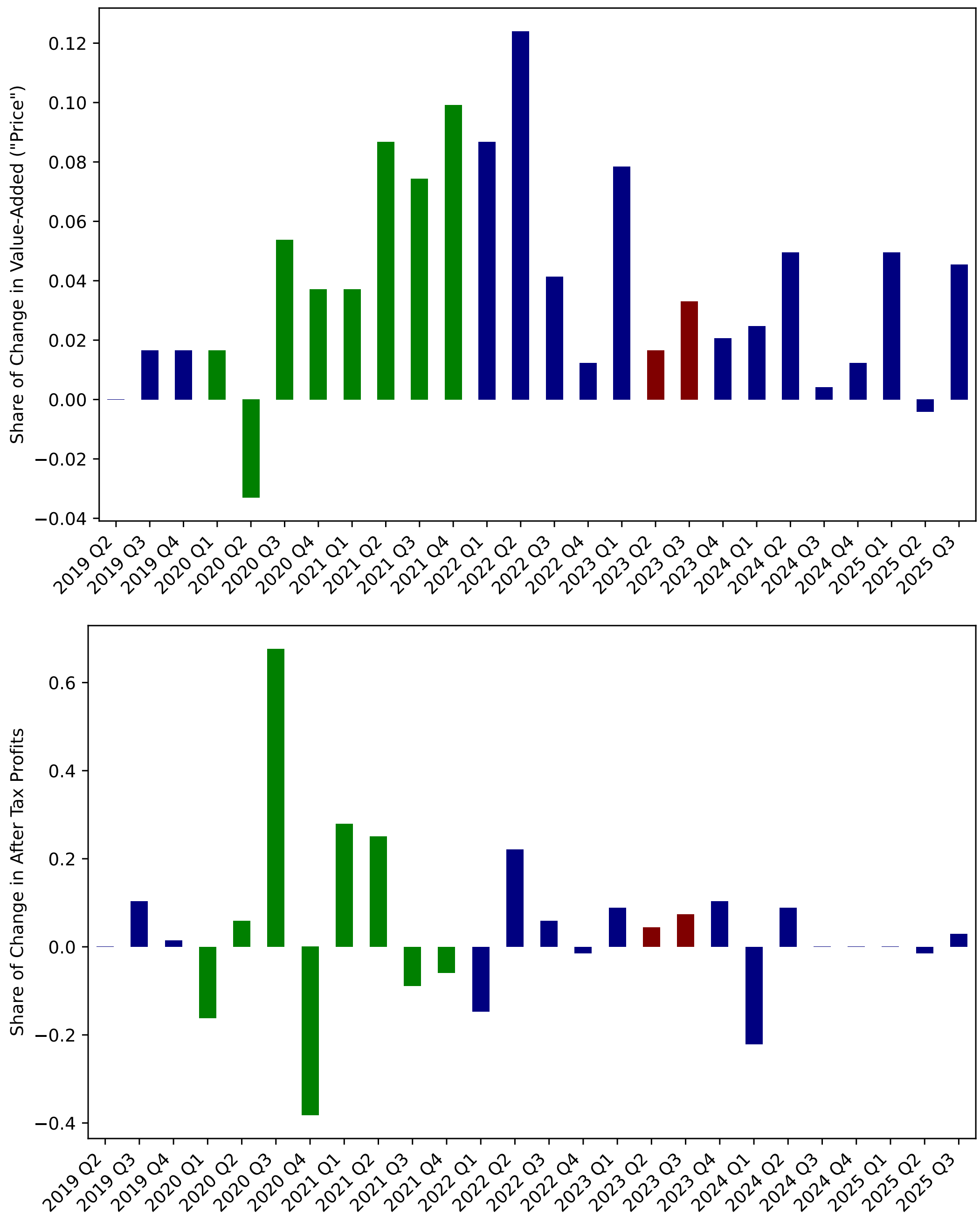


Figure 5: Quarterly Share of changes $\frac{p_t - p_{t-1}}{p_T - p_1}$, in value added (top) and after-tax profits (bottom)

Source: BEA NIPA Table 1.15 (current through Q3 2025).
Green: EPI Study (Bivens, 2022)
Maroon: Groundwork Study (Pancotti and Owens, 2024)

on intermediate inputs in (11) and (12). If our firm simply bought intermediate inputs from other firms and added 2% to the price, a \$1 cost increase might appear as an additional \$0.02 of value added. Unless wages or nonlabor (other capital) expenses increased, we might incorrectly interpret this as "greater profits" rather than rising costs of material or intermediate inputs.[35] In short, as discussed in Section 2.5, if a core prediction of the Profits–Inflation hypothesis is that inflation is caused by firms raising prices more quickly than input costs, then value added measures make it impossible to shed light on the matter.

3.3 Firm Profit Margins and Markups

A number of studies document that gross margins, net margins, or estimated markups increased for a number of firms in 2021-2022 (Konczal and Lusiani, 2022; Weber and Wasner, 2023). We typically expect that when demand becomes less elastic, the Lerner index (economic markup) increases, as illustrated in (2). Increased profitability alone doesn't differentiate between the "strong demand" and the "softened competition/conduct" explanations for price increases. However, we can still document that there was a significant increase in profitability (even if we can't ascertain whether it was caused by changes in demand or changes in conduct).

In Figure 6, we calculate the net margins for 9,414 publicly traded US firms using the Compustat database of quarterly financial filings. We compute the average deviation from the firm-level average margins by running the following regression with firm f, and industry-quarter t fixed effects:[36]

$$\text{Margin}_{f,t} = \gamma_f + \lambda_{\text{industry}(f),t} + \varepsilon_{f,t}$$

What we see in Figure 6 is that there was a significant decline in net margins in 2020 during the COVID shutdowns, and that (sales-weighted) net margins remained elevated starting in 2021 continuing until 2022 Q3 (after the Federal reserve started raising interest rates). The pattern is slightly different if we weight the regression by COGS instead, suggesting that net margins remained at or below pre-pandemic levels until being slightly elevated in 2023. The "Sellers Inflation" paper of Weber and Wasner (2023) provides margin data on a select set of firms, which we also highlight in Figure 6. Reminsicent of the "Ashenfelter Dip" these

[35]Some have also incorrectly conflated "other nonlabor costs" which in the NIPA tables are primarily consumption of fixed capital with the prices of intermediate inputs (which are subtracted form value added in (11)).

[36]We weight the regression by either revenues or COGS in 2017 to capture the fact that margins of larger firms are more important in explaining the aggregate profit margin.

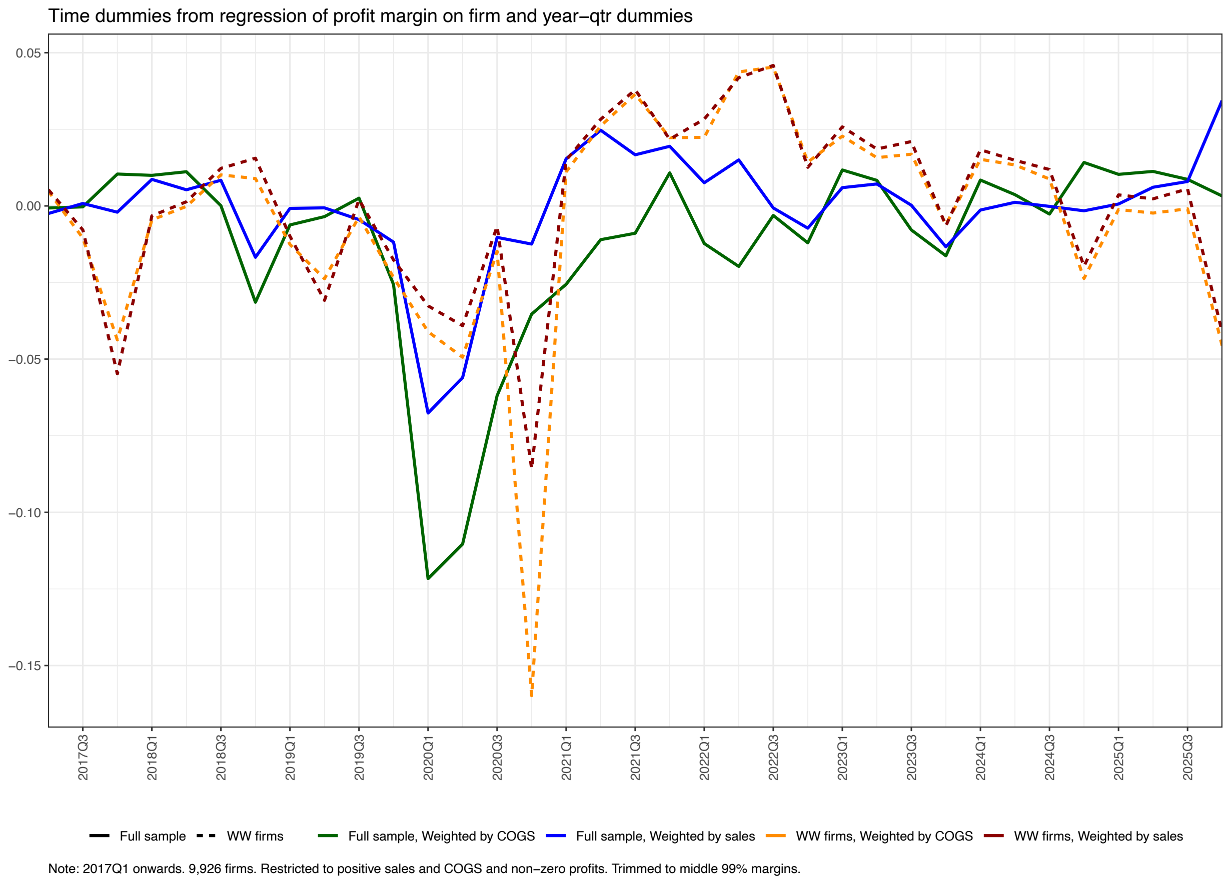
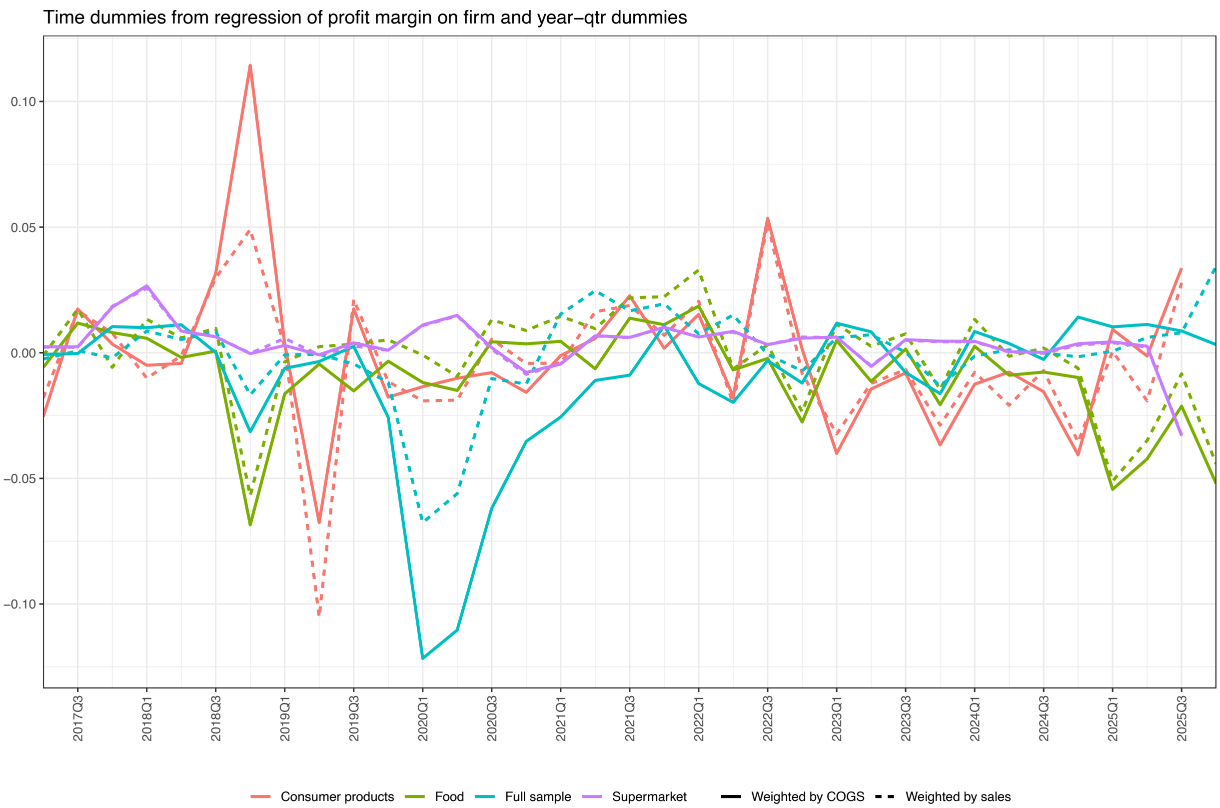


Figure 6: Deviations in Net Margins for Compustat Firms

Source: Compustat. Balanced Panel of 9,926 firms. Weighted by Revenues or COGS.
Dotted lines: Selected firms match Weber and Wasner (2023).

firms experienced unusually large declines in margins in 2020 Q4, and a larger and longer rebound than the than the overall Compustat sample. These are mostly larger firms, but even after weighting both samples by sales or COGS, the pattern for the Weber and Wasner (2023) firms deviates substantially from the full Compustat sample.

We perform the same exercise in Figure 7, but here we focus on estimating the time deviations for industries that are of specific concern to households (retail supermarkets, food manufacturers, and consumer products manufacturers). The overall trend corresponds to the previous plot Figure 6, with the exception that we filter firms with complete margin data and complete industry code data so that we have only 7,634 firms. We see that food manufacturers and supermarkets were largely unaffected by the 2020 shutdowns (as one might expect, and that profits margins vary over time but not too much. If anything, we see



Note:
Data from Compustat. 2017Q1 onwards. 9,926 firms. Restricted to positive sales and COGS and non−zero profits. Trimmed to middle 99% margins.
Supermarkets are NAICS 445110 (Supermarkets and Other Grocery (except Convenience) Stores). Consumer products are NAICS 322 (Paper Manufacturing) and 3256 (Soap, Cleaning Compound, and Toilet Preparation Manufacturing). Food is NAICS 311 (Food Manufacturing) and 31211 (Soft Drink and Ice Manufacturing).

Figure 7: Deviations in Net Margins for Supermarket, Food, and Consumer Products Firms

Source: Compustat. Balanced Panel of 7,634 firms. Weighted by Revenues or COGS.
Dotted lines: Sales Weighted; Solid lines: COGS weighted.

a drop in the margins of food manufacturers in 2024. The margins of the consumer products firms were slightly more volatile, declining in 2020 (and also in 2019 Q2) and then spiking in 2022 Q3. The margins of individual firms follow different patterns, some are below pre-pandemic averages, some are persistently above, and some increased significantly in 2021 or 2022 only to return to the pre-pandemic levels.

As a final exercise, we can compute the change in markups using the approach in (8). Here we can follow the De Loecker et al. (2020) paper and use their estimated industry-level output elasticities from 2018 and apply them to the Compustat revenue and COGS data. The idea is to recover the proportional markup $\mu = p/mc$ at the firm-year level subject to all the caveats discussed in Section 3.3. We want to innovate as little as possible and simply extend the data series through 2024 Q2. In the upper part of Figure 8 we see that the sales-weighted aggregate markup estimate increased from around 1.6 in 2018 to around 1.66 in 2021 before declining to 1.61 in 2023.[37]

This also allows us to repeat the exercise from Conlon et al. (2023) using data through 2024 instead of 2022. We compare the change in markups from 2018 to the change in the PPI of the corresponding 6-digit NAICS industry code. The question is whether industries with faster markup growth were those with faster price growth, and the answer is a resounding "no". What Figure 8 shows is that there is almost zero correlation between PPI inflation and markup increases between firms. Even if we look within two-digit industry codes, we still find little correlation between price growth and growth in estimated markups.

Discussion

It seems safe to say that at least in a number of industries there was a significant increase in accounting profits, profit margins, and estimated markups during 2021 and 2022. Both proponents and opponents of the "Profits-Inflation" hypothesis have produced some version of Figure 8 showing markups rising in 2021 and 2022 with substantial heterogeneity across industries.

Consumer products firms, food manufacturers, and supermarket retailers have received a lot of attention and did experience higher profit margins in 2021 or 2022 before returning to more or less normal or slightly elevated levels in 2023 and 2024. However, in general the industries with the fastest price growth did not seem to be the ones where estimated

[37]Konczal and Lusiani (2022) perform a similar exercise, but only with data through 2022. That paper focuses on the correlation between the change in the markup and its pre-pandemic level, suggesting that markups tend to increase proportionally? It is unclear how to interpret this finding as evidence for the demand or the conduct story.

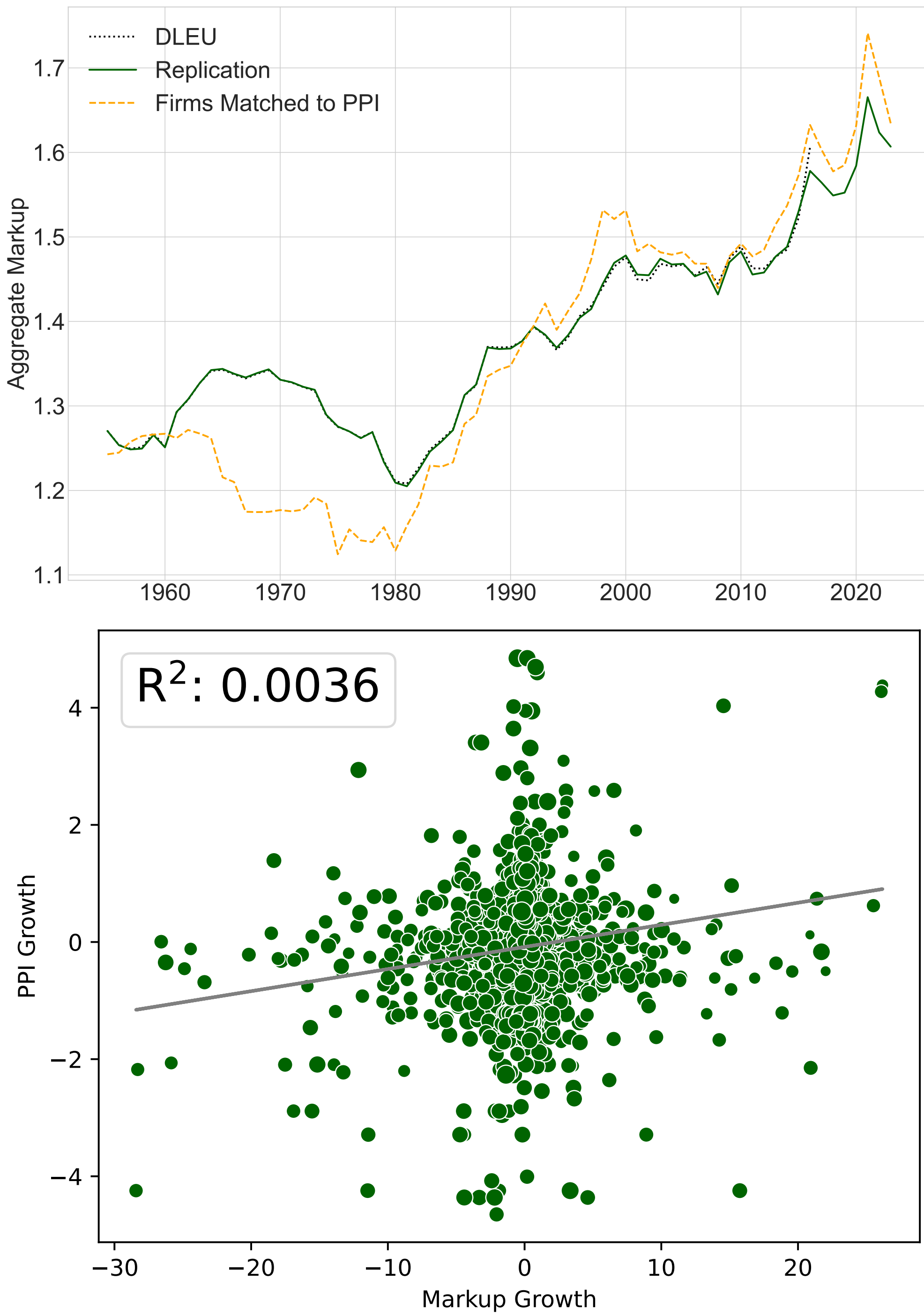


Figure 8: Estimated Markups p/mc and Changes in Relevant PPI (2018Q1 - 2024 Q2)

Replication of Conlon et al. (2023). Figure extended through 2024 Q2.
The figure shows the PPI CAGR (vertical axis) and markup CAGR (horizontal axis) for firms in the matched samples. The line of best fit is estimated with weighted least squares, using CPI-adjusted sales for the period closest 2018:Q1. We exclude 53 firms (right panel) with PPI or markup growth outside the range of the axes.
Markups estimated using method of De Loecker et al. (2020); De Loecker and Warzynski (2012).

markups grew the most. We've also performed more detailed industry by industry calculations (not shown above) consistent with the idea that accounting profits and estimated markups increased in industries such as: energy, automobile manufacturing, and mining in 2021 and 2022.

At the same time, some of the patterns across industries of the markups, don't necessarily coincide with the narratives around price increases. As an example, Konczal and Lusiani (2022) found the industry with the largest increase in markups in 2021 was the Financial Services industry (which is not the typical inflation story). Baioni (2023) found that the timing of markups and inflation suggests that inflation "Granger causes" markups, rather than the other way around. To be clear, this tells us about the predictive power in forecasting, rather than the kind of causality that disentangles supply from demand.

Some authors have taken this lack of correlation as consistent with the rising cost explanation for rising markups (Miller, 2024). That is, if price increases were primarily driven by cost increases, we wouldn't expect to see a correlation between changes in markups and changes in prices. Glover et al. (2023) rely on BEA data like Section 3.2 but also come down in favor of the cost story. An alternative is simply that measurement of markups is difficult and the assignment of firms to a single industry with corresponding PPI is far from foolproof.

The bigger problem is that rising markups (or profits) and rising prices are both consistent with the increased demand story and the softer competition/conduct story. Rejecting the demand explanation is the larger problem for the "Profits-Inflation" hypothesis.

3.4 Analysis of Earnings Calls

A common piece of evidence cited in favor of the "Profits-Inflation" hypothesis has been to analyze the transcripts of earnings calls, and observe executives discussing pricing strategies. Given that we know inflation was taking place in 2021-2023, a price increase alone is not particularly surprising, nor does increasing prices in excess of cost increases distinguish between "strong demand" or "changes in conduct" as the *underlying cause of price increases*.

One challenge is that we might worry that many of these statements on earnings calls are the definition of "cheap talk", where the goal of executives is to make vague but optimistic sounding statements. The second challenge is that company executives are not economists and do not necessarily speak in the language of demand elasticities, marginal costs, and firm conduct. Below I consider several statements from earnings calls highlighted in the Senate Budget Committee Testimony of Lindsay Owens of Groundwork Collaborative (Owens, 2022a).

In at least one case the CFO of Proctor and Gamble made clear prices were increasing because of the elasticity of demand:

> P&G CFO Andre Schulten announced price increases: "Building on the strength of our brands, we are thoughtfully executing tailored price increases... We see a lower reaction from the consumer in terms of price elasticity than what we would have seen in the past." (Owens, 2022a)

Other statements seem to suggest proft-maximizing behavior but little else. The question is what constrains price increases if not the elasticity of demand?

> One credited his company's "successful pricing strategies." Another patted his team on the back for a "marvelous job in driving price." These executives weren't just passing along their rising costs; they were going for more. Or as one C.F.O. put it, they were "not leaving any pricing on the table." (Owens, 2022b)

In another example, the CFO mentions that while costs have increased, prices have increased more, but doesn't offer an explanation why (was it strong consumer demand, or coordinating with competitors to soften competition?):

> In their fourth quarter earnings call, the Chief Financial Officer of Tyson Foods made the strategy clear. He explained to investors that their "pricing actions" were able to "more than offset" their higher cost of goods sold (or input costs). Tyson is passing along their rising costs, and a little extra, bringing in record profits. (Owens, 2022a)

In another example, the CEO of Hostess says something that is definitely true but somewhat vacuous:

> As Hostess' CEO Andy Callahan said on a March 2022 earnings call, "When all prices go up, it helps". (Owens, 2022a)

In related work Weber et al. (2024) feed earnings transcripts through ChatGPT and score the transcripts based on sentiment where they test two hypotheses:

1. "Firms express a more positive sentiment towards economy-wide cost shocks compared to firm-specific increases in costs."

2. “Firms express a more positive sentiment toward economy-wide cost shocks when they coincide with supply constraints compared to firm-specific increases in costs.”

The main challenge here is that even if both hypotheses are true, it is not clear that we learn anything useful about the causes of inflation. The fact that firms prefer a scenario in which their competitors’ costs also increase in cases where only their own costs increase is consistent with most competition models (including Cournot and differentiated Bertrand), as documented in Table 1.

An important aspect of empirical IO for some time has been to focus on *revealed preference*, and to observe what firms *actually do* rather than *what they say*. Earnings calls can provide some color, and explanations for unusual data points in financial statements (such as one-time write downs, etc.) but are probably not a great way to measure firm pricing strategies.

4. Conclusion and Policy Implications

The goal of this article has been to try to understand the “Profits-Inflation” narrative using the tools of Industrial Organization. One advantage IO economists have is a long history of trying to understand how firms set prices in imperfectly competitive markets. The common thread among most microeconomic models of oligopoly price setting is that firms maximize profits by equating *marginal revenue* and *marginal cost*. This gives us three reasons why prices can go up: (a) less elastic demand; (b) higher marginal costs; and (c) a change in the competitive game/environment.

The typical “textbook explanation” for inflation typically focuses on the first two explanations. We argue that the most generous way to interpret that “Profits-Inflation” hypothesis is that it is really about the third possibility, that there was a widespread change in *firm conduct* in 2021-2022. In this scenario, something about pandemic-related disruptions caused firms to *coordinate on a different equilibrium* that allowed for higher markups at the *same levels of demand and marginal costs*.

The challenge for proponents of this theory will be providing empirical evidence that there was a significant change in the *nature of competition* that was really distinct from simply “strong demand” and “constrained supply”. This is where almost all of the existing work has fallen short. What proponents have done (or tried to do) is demonstrate that corporate profits, accounting profit margins, or the capital share of value-added increased in 2021 or 2022. However, higher prices and greater profits can easily be rationalized by either *rising demand* or a *change in firm conduct* and the existing evidence largely fails to separate the two explanations.

A major obstacle thus far has been the tendency to treat *higher profits* as the cause of *higher prices* rather than symptoms of some underlying phenomenon. Much of the confusion stems from imprecise language in the discussion of the "Profits-Inflation" hypothesis: "Companies... using the cover of inflation to raise prices and increase profits" or "The longer inflation lasts and the more widespread it is, the more air cover it gives companies to raise prices"(Owens, 2022b) are both a bit like saying "inflation causes inflation." Other statements like "Despite clear evidence that a majority of price increases are not justified by rising costs" (Owens, 2022b) seem to suggest that *costs alone should determine prices* (leaving no role for consumer demand).

The empirical IO literature has modern tools to separate demand, from costs, from firm conduct, but the data requirements are significant and require analyzing a single industry at a time. A falsifiable hypothesis for the "Profits-Inflation" narrative is that at least in some industries, there was a structural break in firm conduct at some time between 2021-2022. The alternative hypothesis is that changes in prices, quantities, and profits are well explained by changes in demand and marginal costs while conduct remained unchanged. So far, there is nothing in the literature approaching a test like this.[38] A good rule of thumb for evidence is that it should try its best to provide a decomposition of inflation into stronger consumer demand, higher costs (including labor costs), and changes in competition/conduct. Unfortunately, these causes cannot be easily discerned from accounting statements or transcripts of earnings calls.

Because both prices and profits increased in 2021-2022, much of the existing evidence fails to separate the "strong demand" explanation from the "change in firm conduct" explanation, while in other cases it fails to provide any information at all. As discussed in Section 3.1, there are no circumstances when the difference between the Consumer and Producer Price Indices is a useful measure of anything. Similarly, many studies in Section 3.2, substitute changes in value-added for changes in prices and decompose the changes into a "Labor Share" and "Profit Share". Treating changes in value-added as changes in prices ignores the possibility that higher prices might be caused by higher costs of material inputs. Likewise, treating changes in value-added as changes in profits ignores the fact that firms don't merely buy intermediate inputs, but they also pay wages to employees and invest in capital equipment. Claims that "more than half of inflation was caused by corporate profits" as in Section 3.2

[38] Macroeconomists have tried to separate the changes supply and demand (Glover et al., 2023; Leduc et al., 2024) but not changes in *firm conduct*.

evaporate after considering the entire inflationary period (and subtracting taxes paid from the "profits" measure).

This dispute is more than merely "academic" in nature, and getting the story straight is incredibly important. This is especially true if the policy recommendations of "Profits-Inflation" proponents are to be taken seriously. Although their explanations for the causes of inflation may differ slightly from each other, they were remarkably consistent in insisting that the Federal Reserve did not raise interest rates (Bivens, 2022; Perkins, 2022; Owens, 2022b; Weber and Paul, 2022; Peiser, 2024). We can't say for sure what would have happened if the Federal Reserve had kept interest rates near zero, or if Congress had enacted an "windfall profits tax" on oil producers like the one proposed by Senator Whitehouse which would tax oil at 50 cents on every dollar above $54/barrel.[39] It could have been the case that the threat of an excise tax ended a period of tacit cooperation and significantly reduced the price of oil, and that inflation would have come down on its own without help from the Federal Reserve. Of course, it could also be the case that a $15 excise tax when oil prices were already $85/barrel would have killed incentives to expand domestic production and led to even higher oil prices.

We may never know what would have happened if we had followed the policy recommendations of the "Profits-Inflation" proponents. Thankfully, after 11 rate hikes, the Federal Reserve appears to have gotten inflation under control without significantly increasing unemployment, while domestic oil production reached record highs.

[39]See the text here `https://www.congress.gov/bill/118th-congress/senate-bill/408/cosponsors`.

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A. Details for Calculations

Note: There is no promise of originality below

Starting with (3), we can take the first-order condition with respect to j:

$$0 = q_j(\mathbf{p}) + \sum_{k \in \mathcal{J}_f} (p_k - c_k) \frac{\partial q_k}{\partial p_j}(\mathbf{p}) + \kappa_{fg} \sum_{k \in \mathcal{J}_g} (p_k - c_k) \frac{\partial q_k}{\partial p_j}(\mathbf{p}).$$

Separate the $k = j$ term in the $\mathcal{J}_f$ sum:

$$0 = q_j + (p_j - c_j) \frac{\partial q_j}{\partial p_j} + \sum_{k \in \mathcal{J}_f \setminus \{j\}} (p_k - c_k) \frac{\partial q_k}{\partial p_j} + \kappa_{fg} \sum_{k \in \mathcal{J}_g} (p_k - c_k) \frac{\partial q_k}{\partial p_j}.$$

Rearrange to isolate $(p_j - c_j)$:

$$(p_j - c_j)\Big(- \frac{\partial q_j}{\partial p_j} \Big) = q_j + \sum_{k \in \mathcal{J}_f \setminus \{j\}} (p_k - c_k) \frac{\partial q_k}{\partial p_j} + \kappa_{fg} \sum_{k \in \mathcal{J}_g} (p_k - c_k) \frac{\partial q_k}{\partial p_j}.$$

Divide both sides by $-\frac{\partial q_j}{\partial p_j}$ (assume $\partial q_j / \partial p_j < 0$) to solve for p_j and define the *diversion ratio* as $D_{jk}(\mathbf{p}) = \frac{\partial q_k}{\partial p_j}(\mathbf{p}) / - \frac{\partial q_j}{\partial p_j}(\mathbf{p})$ for $k \neq j$. Substituting this in allows us to solve for p_j:

$$p_j = c_j + \frac{q_j(\mathbf{p})}{-\frac{\partial q_j}{\partial p_j}(\mathbf{p})} + \sum_{k \in \mathcal{J}_f \setminus \{j\}} (p_k - c_k)\, D_{jk}(\mathbf{p}) + \kappa_{fg} \sum_{k \in \mathcal{J}_g} (p_k - c_k)\, D_{jk}(\mathbf{p}). \tag{A1}$$

Define the own-price elasticity $\epsilon_{jj}(\mathbf{p}) = \frac{\partial q_j}{\partial p_j}(\mathbf{p}) \cdot \frac{p_j}{q_j(\mathbf{p})}$. Then $q_j / - \frac{\partial q_j}{\partial p_j} = -\frac{p_j}{\epsilon_{jj}}$. Substitute this identity into (A1) and collect the terms involving p_j on the left-hand side to set $MR = MC$, and then solve for p_j

$$\begin{aligned}
p_j &= c_j - \frac{p_j}{\epsilon_{jj}} + \sum_{k \in \mathcal{J}_f \setminus \{j\}} (p_k - c_k)\, D_{jk} + \kappa_{fg} \sum_{k \in \mathcal{J}_g} (p_k - c_k)\, D_{jk}. \\
\Big(1 + \frac{1}{\epsilon_{jj}(\mathbf{p})}\Big) p_j &= c_j + \sum_{k \in \mathcal{J}_f \setminus \{j\}} (p_k - c_k)\, D_{jk}(\mathbf{p}) + \kappa_{fg} \sum_{k \in \mathcal{J}_g} (p_k - c_k)\, D_{jk}(\mathbf{p}), \\
p_j(\mathbf{p}_{-j}) &= \frac{1}{1 + 1/\epsilon_{jj}(\mathbf{p})} \left[c_j + \sum_{k \in \mathcal{J}_f \setminus \{j\}} (p_k - c_k)\, D_{jk}(\mathbf{p}) + \kappa_{fg} \sum_{k \in \mathcal{J}_g} (p_k - c_k)\, D_{jk}(\mathbf{p}) \right].
\end{aligned}$$

Which gives us (4).