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Working Paper

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Working Paper, No. 2023-2

Provided in Cooperation with:

Department of Economics, University of Massachusetts

Suggested Citation: Weber, Isabella; Wasner, Evan (2023) : Sellers' inflation, profits and conflict: Why can large firms hike prices in an emergency?, Working Paper, No. 2023-2, University of Massachusetts, Department of Economics, Amherst, MA, <https://doi.org/10.7275/cbv0-gv07>

This Version is available at:

<https://hdl.handle.net/10419/283956>

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2023

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Recommended Citation

Weber, Isabella M. and Wasner, Evan, "Sellers' Inflation, Profits and Conflict: Why can Large Firms Hike Prices in an Emergency?" (2023). *Economics Department Working Paper Series*. 343.
<https://doi.org/10.7275/cbv0-gv07>

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Sellers' Inflation, Profits and Conflict: Why can Large Firms Hike Prices in an Emergency?

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'...a couple of recent force majeure in the industry ... [are] making the price environment even more conducive.'
(Lori Koch, CFO Dupont Nemours)

Abstract

The dominant view of inflation holds that it is macroeconomic in origin and must always be tackled with macroeconomic tightening. In contrast, we argue that the US COVID-19 inflation is predominantly a sellers' inflation that derives from microeconomic origins, namely the ability of firms with market power to hike prices. Such firms are price makers, but they only engage in price hikes if they expect their competitors to do the same. This requires an implicit agreement which can be coordinated by sector-wide cost shocks and supply bottlenecks. We review the long-standing literature on price-setting in concentrated markets and survey earnings calls and compile firm-level data to derive a three-stage heuristic of the inflationary process: (1) Rising prices in systemically significant upstream sectors due to commodity market dynamics or bottlenecks create windfall profits and provide an impulse for further price hikes. (2) To protect profit margins from rising costs, downstream sectors propagate, or in cases of temporary monopolies due to bottlenecks, amplify price pressures. (3) Labor responds by trying to fend off real wage declines in the conflict stage. We argue that such sellers' inflation generates a general price rise which may be transitory, but can also lead to self-sustaining inflationary spirals under certain conditions. Policy should aim to contain price hikes at the impulse stage to prevent inflation from the onset.

JEL Codes: D21, D22, D43, E31, E53

Keywords: pricing behavior, market power, conflict inflation, profits, monetary policy

1. Introduction

As annual CPI inflation took off and rose to 4.8 percent in the second quarter of 2021, profit margins of non-financial US corporations (after tax) broke a new record and climbed to 13.5 percent, surpassing the previous series high during the post-war inflation in 1947 (Figure 1). Yet, until recently it was considered heretical to point to a possible relationship between the first signs of a profit explosion and sharp price increases.¹ Most economists have considered the return of inflation from the perspectives of the dominant interpretations of the 1970s: Inflation originates from macro dynamics, with the (New) Keynesian interpretation positing a matter of excess aggregate demand in relation to capacity on the one hand, and the classic Monetarist postulation of too much money chasing too few goods on the other (Weber et al., 2022). In so far as costs are considered to play any role from either perspective, it is purely a matter of inflated wages

¹ For example, in a debate involving leading economists unleashed by an article in The Guardian (Weber, 2021) critics took equal issue with the possibility of a return of price policies and with a relationship between profits and inflation (e.g. Tooze, 2022a).

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We would like to gratefully acknowledge a fellowship from the Berggruen Institute. We would like to thank Benjamin Braun, Nancy Folbre, James Galbraith, André Kühnlenz, Lucas Teixeira for conversations and comments that have informed this paper. Gregor Semieniuk has provided critical feedback at various stages of this paper for which we are grateful. We thank Jesús Lara Jáuregui and Esosasere Osunde for research assistance. All remaining mistakes are our own.

deriving from tight labor markets. There is no role for profits or the power of firms to set prices in this view of inflation. In fact, the post-war inflation that was driven by bottlenecks and coincided with a sharp increase in profits might be the closer historical parallel.

Yet, more evidence for a relationship between the sharp increase in profits and the general rise in prices is mounting, while indicators of aggregate excess demand or a wage-price spiral are weak (Bivens, 2022a, b, Glover et al., 2023, Stiglitz and Regmi, 2022). Leading central bankers in the US and Europe have now prominently acknowledged the contribution of profits to inflation.² Konczal and Luisiani (2022) document that a range of profitability measures jumped in an unprecedented fashion in 2021 in the US. Profits approximated as gross operating surplus account for 9.4 percent of the 14.1 percent increase in the GDP deflator since the onset of inflation in the third quarter of 2020 to the second quarter of 2022, with wages accounting only for 4.7 percent (Figure 2). An increase in profits in the context of inflation is furthermore not only a US phenomenon. For example, a study of price increases in Germany shows that in some sectors firms used price increases to enhance profits (Ragnitz, 2022).

This raises the question of how to explain the coincidence of price and profit jumps. Firms' market power has been cited as a candidate. But the increase in profits during the COVID-19 inflation is happening against a background of a decades-long increase in profits, markups and corporate concentration under conditions of remarkable price stability (De Loecker et al., 2020). To link market power to the sudden increases in profits it is necessary to examine why large firms have raised prices in the context of the pandemic but kept prices stable in the preceding decades.

This paper is an exploratory study that aims to conceptualize the inflation dynamic from the perspective of price setting by firms with market power. We start by reconsidering principles of price setting by firms with market power, drawing on long-standing literatures of imperfect competition, administered prices and institutional economics as well as quarterly earnings calls, where firms present quarterly financial results to investors. This follows other recent examples that have established firms' earnings call transcripts as a valuable source to study the current inflation (Dayen and Mabud, 2022, Mabud, 2022a, b, Owens, 2022a, b).³ We argue that firms with market power typically refrain from lowering prices and raise prices only if they expect other firms to do the same. Besides a formal cartel and norms of price leadership, there can be implicit agreements that coordinate price hikes. Sector-wide cost increases can generate such an implicit agreement: since all firms want to protect their profit margins and know that the other firms pursue the same goal they can increase prices, relying on other firms following suit. If firms deviate from this price hike strategy, the threat of share sell-offs by financial investors can enforce compliance with such implicit agreements. Bottlenecks can create temporary monopoly power which can even render it safe to hike prices not only to protect but to increase profits.

This implies that market power is not constant but can change dynamically in a changing supply environment. Publicly reported supply chain bottlenecks and cost shocks can also serve to create legitimacy for price hikes and create acceptance on the part of consumers to pay higher prices, thus rendering demand less elastic. Meanwhile cash transfers have enabled some groups of consumers to accommodate higher prices that they could not otherwise have paid. Absent such a

² Fed Vice Chair Lael Brainard (2022), for example, points to record profits in the US and argues that '[r]eductions in markups could ...make an important contribution to reduced pricing pressures'. Isabel Schnabel (2022), a Member of the Executive Board of the European Central Bank, finds for the Eurozone that 'on average, profits have recently been a key contributor to total domestic inflation, above their historical contribution'.

³ A compilation of quotes from earnings calls on pricing is available at <https://endcorporateprofiteering.org/>. For this paper we have conducted an independent analysis of earnings calls.

temporary monopoly or implicit agreement, firms must lower costs to increase profit margins – which is what happened in the decades before the pandemic.

We conceptualize this inflation as what Lerner (1958) called a ‘seller-induced inflation’ driven by the pricing decisions of firms. Lerner observed: ‘There is... no essential asymmetry between the wage element and the profit element in the price asked for the product.’ A sellers’ inflation can just as well be set off by firms trying to protect or increase their profits as by rising wages. Whether profits or wages are the main driver of inflation depends on power relations in the economy.

Based on these pricing principles and drawing on a survey of earnings calls of large US corporations we propose a stage-by-stage analysis of the inflationary dynamic in the wake of the COVID-19 pandemic (see Figure 3). We start by sketching the process of the shifting from a period of stable prices to one in which price shocks in upstream sectors function as an *impulse* which *propagates* through supply chains, as downstream firms react to higher costs by raising prices to protect their profit margins. In addition to this *propagation* of cost shocks, firms in some sectors – in particular, ones facing supply-side bottlenecks or product-specific demand shocks – can raise prices by enough to *enhance* profit margins, resulting in an *amplification* of cost shocks. Labor eventually reacts in the *conflict* stage, attempting to protect real wages. However, in the context of a sellers’ inflation kicked off by commodity price shocks, windfall profits and profit protection, this conflict is not the origin but the consequence of inflation. Furthermore, given the weakness of organized labor in the contemporary US, it is highly unlikely that this conflict stage of inflation triggers a wage-price spiral, as is the case in the classical conception of conflict inflation (Rowthorn, 1977). Labor has struggled merely to return to its pre-pandemic share in national income, rather than surpass it. Thus in contrast to, for example, Blanchard (2023), who derives from conflict inflation to argue that the ideal way to contain inflation is through an economy-wide bargain between workers and businesses to fix prices and wages, we argue for targeted interventions that control price and profit spikes at the impulse stage and prevent propagation and amplification.

We map the three-stage inflation dynamic onto the empirical sequence of aggregate contributions of profits and wages to inflation, and, finally, provide descriptive evidence from earnings calls to illustrate our argument. To analyze the contributions of prices and sales volumes to profits we have further manually compiled quantitative firm level-data from quarterly earnings reports (see Appendix). This allows us to trace changes in price setting and compare them to profit margins and total profit flows on the level of specific corporations. Previous studies show that firms in the top quartile and especially the top decile of the distribution have driven the profit increases before and during the pandemic (Konczal and Lusiani, 2022, De Loecker et al. 2020), reflecting the increasing importance of large ‘superstar’ firms (Autor et al. 2020). We focus on such ‘superstars’ picked from sectors that have been identified as systemically significant for their disproportionate direct and indirect contribution to inflation (Hockett and Omarova, 2016, Weber et al. 2022). Thus, while our sample of firms is small, we focus on important cases.

Our analysis cuts across the binary of ‘transitory’ versus ‘persistent’ inflation that has emerged in recent debates. Based on the heuristic of a three-stage process we develop, the persistence of inflation depends on how firms react to the initial impulse and how labor reacts to the loss in real wages. As inflation eases towards the end of 2022, propagation seems to be dominating over amplification, and given the weakness of organized labor, the current inflation is broad-based but thus likely to fade in the absence of further supply shocks. However, despite this ‘transitory’ nature in the current US context, our analysis also suggests that sellers’ inflation can persist for a significant amount of time before dissipating, fueling economic instability and a cost-of-living-

crisis in its wake. Furthermore, under different concrete conditions, sellers' inflation has the *potential* to develop into persistent inflation. The trajectory of price-setting is not set by universal laws, but is path- and context-dependent. In an age of the overlapping emergencies of climate change, the pandemic and geopolitical tensions, shocks are likely to reoccur (Weber et al., 2022), which can propel an already prevalent inflation dynamic. Together with the serious harm such transitory inflation can cause while it lasts, this points to the necessity to develop policy tools to deal with impulse shocks as they emerge in real time.

This paper proceeds as follows: In the next section, we lay out our understanding of pricing principles in concentrated markets. The third section develops our argument on the stages of the inflationary process grounded in firm-level and aggregate findings. The final section draws policy conclusions.

2. Principles of pricing in a concentrated market: avoid price wars and stick to the pack when hiking prices

To derive our theoretical argument, we start from some basic considerations of how firms with market power set prices. To this end we draw both on insights from our study of earnings calls and on a long-standing literature that tries to understand pricing by observing concrete firm behavior. Some classic contributions include, for example, Means (1935, 1972) and Blair (1959, 1974) on administrative pricing, Hall and Hitch (1939) on full cost pricing, Sraffa (1926), Robinson (1969 [1933], 1953) and Chamberlin (1933) on imperfect competition, Galbraith (1952a, b, 1957) and strands of post-Keynesian economics (Lee, 1999).⁴ Interestingly, early studies on pricing behavior revert to qualitative methods such as interviews with business managers, even though prices may be the most clearly quantitative and formally theorized phenomenon in economics (e.g. Kaplan et al., 1958).

All of these literatures on pricing share the common perspective that prices in concentrated industries do not follow the simple logic of supply and demand – with one important exception: commodities. As Kaldor (1985, 22) put it in *Economics without Equilibrium*, the ‘big commodity markets in “staples” are undoubtedly the nearest real-world equivalent of the purely competitive and whole price-flexible auction markets of the textbook’. Commodity-producing firms, even if they are large, are price takers. Nevertheless, commodity prices are not market clearing – market participants usually hold inventories which implies that supply and demand are not equated – and prices are not in equilibrium but fluctuate more frequently and violently than in other parts of the economy (ibid., 18-19, 22). Commodity prices show large fluctuations in ‘response to changes in the growth rate of world industrial production (which governs the demand for them)’ (ibid. 22).

In contrast to commodities, in all other concentrated markets firms with market power are *price makers* and adjust supply primarily in response to quantity signals, such as an increase in orders or a decrease in inventories, rather than in response to prices (ibid., 23-24). We can think of the pre-pandemic just-in-time production networks as a perfected version of such quantity adjustments. This does not imply, however, that firms in concentrated markets set prices without considering competition. Nonetheless, prices here are ‘list prices’ that move slower than commodity prices, and competition follows the logic of strategic interaction between large players.

The following broad principles emerge in the literature on strategic price setting:

⁴ Price setting by firms with monopoly power and the divergence of marginal costs and prices has also been modeled in a neoclassical set-up building on the seminal work by Phelps and Winter (1970).

Firms do not lower prices, as doing so may spark a price war. Firms compete over market shares, but if they lower prices to gain territory from other firms, they must expect their competitors to respond by lowering their prices in turn.⁵ This can result in a race to the bottom which destroys profitability in the industry.⁶ Price wars are very risky for firms that are already in the market and are therefore typically launched by new entrants. The assumption that large firms tend to avoid lowering their prices also informed many of the questions of analysts in recent earnings calls. Trying to understand whether recent price hikes would be permanent, some analysts inquired whether, contrary to historical trends, firms might now have to ‘give back’ some of the recent price increases. For example, an analyst at Wells Fargo Securities asked the Chairman and CEO of PepsiCo, Ramon Laguarta, whether, in the event of a recession or general slowdown in demand, ‘price rollbacks are not entirely out of the question, even if they’re not historically a consistent practice’ (PepsiCo, 2022b). Laguarta responded by assuring that PepsiCo’s philosophy is ‘to create brands that can stand for higher value to consumers’ so that ‘consumers are willing to pay more for our brands’ and thus withstand the price hikes. Simply put, lowering prices is at best a means of last resort. Even in response to falling demand, firms respond with increased advertisement and product innovation, not price cuts. This stance is by no means unique to PepsiCo but is manifested in statements in earnings calls across different sectors.

Firms only raise prices when they are confident that their market shares will not be harmed. On the one hand, firms can set higher prices in relation to costs for new innovative products which temporarily give them exclusive control over a market segment. This practice is particularly salient in product segments that have fast innovation cycles. Edward Breen, Chairman and CEO of DuPont de Nemours, for example, explained this pricing practice on an earnings call: ‘where we really are able to capture price is on the next-generation products, and they tend to be fairly fast-cycle launches of new technology. So, we typically get price on new technology. And then, that technology pricing will erode over time, constantly replaced with the next generation of products where we get price’ (DuPont, 2021a). On the other hand, without monopoly-like control over product markets granted by innovation and strong branding, firms only raise prices if they expect other firms to do the same. A widely acknowledged form this can take is through price leadership. This amounts to an established norm that other firms follow the leadership of the most powerful firm in a market. Tyson, the largest US meat processor, is an example for price leadership. President and CEO Donnie King explained on an earnings call: ‘Additionally, we took various degrees of pricing in our key categories earlier this fiscal year ... Recently, we have seen competitors followed by increasing their prices, nearing Tyson’s price gap relative to our competitors’ (Tyson, 2022b). Beyond price leadership, there can be other forms of coordination to enable price hikes, the most formal one being a cartel.

But coordination can also take more implicit forms based on firms’ mutual knowledge of typical pricing goals that guide how firms react to sector-wide events. One clear rule that emerges from earnings calls across the board – and that has previously been noted in the literature on administered prices – is that firms pursue target profit margins and hence increase prices in response to cost increases (Blair, 1977). When these cost increases are not unique to individual firms but experienced by all competitors, firms can safely increase prices since they have a mutual expectation that all market players will do the same. Recessions can be an example of

⁵ One can think of this as a simple game that can be explained by the Folk Theorem (see Korinek and Stiglitz, 2022).

⁶ The problem of a price war is also indicated by the solution of the Bertrand oligopoly, where oligopolists compete on prices – as opposed to quantities in the Cournot oligopoly – and the only stable equilibrium is the perfect competition price, which is the worst possible outcome from the point of view of the oligopolist as it erodes all profits.

sector-wide unit cost increases, as capacity utilization falls with a decline in demand which results in higher per-unit fixed costs. Means (1935) observed stable or rising prices in concentrated sectors during downswings as a recurring empirical phenomenon since the rise of big business. Kalecki (1954, 17) rationalizes this counterintuitive pricing pattern as follows: ‘If the level of overheads should rise considerably in relation to prime costs, there will necessarily follow a “squeeze of profits” unless the ratio of proceeds to prime costs is permitted to rise. As a result, there may arise a tacit agreement among firms of an industry to “protect” profits, and consequently to increase prices in relation to unit prime costs.’ Kalecki goes on to suggest that the ‘factor of “protection” of profits is especially apt to appear during periods of depression.’ Galbraith (1957) argues for a similar kind of implicit coordination when he suggests that wage increases negotiated by sectoral unions serve to coordinate price increases across competitors.

By the same logic, tacit agreements to protect profits by raising prices can emerge due to a sector-wide input cost shock, for example in the case of a large upswing in commodity prices. In response to such a cost shock all firms try to restore their profit margins by increasing prices. They might overshoot or undershoot, thereby expanding or contracting margins and thus exacerbating or restraining price hikes further downstream, but the primary goal is (at bare minimum) the protection of profit margins. This logic is present in earnings calls across sectors. As an example, when asked about ‘historically high price’ by one of the analysts, PepsiCo Chief Financial Officer Hugh Johnston replied that ‘the environment is well set up for pricing to be positive going forward’ despite these high levels thanks to ‘the right way to compete, which is primarily around innovation and brand building and execution’ (PepsiCo, 2021a). CEO Laguarda added ‘obviously with the set of inflation trends that we’ve seen in some of the commodities and so on, there’s probably going to be very little incentive for anybody to break what is a very rational environment that we see today’ – where rational environment refers to firms increasing prices in response to cost increases (ibid.). A bottleneck that drives down capacity utilization can also increase unit costs across a sector and function in a similar way. Note that capacity utilization for an individual firm can decline both in the case of a bottleneck in an upstream sector that provides inputs to the firm, or in the case of a bottleneck affecting a downstream industrial customer who responds by reducing their demand for the firm’s output.⁷

While unit costs can increase in both cases of upstream and downstream bottlenecks – or, in a third case, directly in the industry in question – the outcomes might not be symmetrical. Compared to the case of a decline in demand for outputs from downstream sectors or an increase in input costs due to rising commodity prices, firms facing input shortages due to a supply-side bottleneck can be more aggressive about raising prices and thus may not only protect profit margins but expand them. If we think of a firm’s market as a territory surrounded by barriers created by brand identity, commercial infrastructure, customer relations etc., then a supply constraint means being unable to service the totality of one’s own territory. If this is the case for all firms in a sector, the ability of competitors to intrude into the territory of other firms in the short-run radically declines. Sraffa (1926, 545) observed in his seminal article (which in many ways established imperfect competition economics): ‘within its own market and under the protection of its own barrier each [firm] enjoys a privileged position whereby it obtains advantages which - if not in extent, at least in their nature - are equal to those enjoyed by the ordinary monopolist.’ When there are temporary supply bottlenecks that force existing firms to only service parts of their territory, the force of competition from other firms in the sector, as well as the danger of new entrants, is drastically reduced during this period, since nobody can

⁷ An example of the less intuitive case of a bottleneck impacting a downstream customer is DuPont’s Mobility and Materials segment, which caters to automobile companies. When automobile producers were forced to reduce production due to a shortage in semiconductor chips, DuPont saw their capacity utilization in the Mobility and Materials segment decline.

gain access to the lacking input. This can allow firms to gain temporary monopoly power. Demand so far outstrips supply that it is perceived as basically inelastic. The outcome is the same if there is a large unanticipated demand shock, only in this case it is as if every company's potential territory vastly expanded overnight, leaving them far within the boundaries of their larger kingdom.

Beyond these implicit agreements there are also explicit sanctioning mechanisms in the form of sell-offs of shares that can discipline firms that diverge from a strategy of increasing prices to protect or advance margins in response to cost increases. Two prominent examples in this regard are the discounters Target and Walmart. In 2021 both companies initially announced a strategy of absorbing some cost increases to keep prices low in pursuit of customer loyalty. But despite a strong earnings performance the reaction of investors was a sell-off of shares, penalizing their pricing strategy that deviated from other retailers and prioritized long-run market shares over short-run profitability via price hikes (Mabud, 2022b, Repko 2021, 2022). In light of this danger of a sell-off, frequent questions on earnings calls by analysts of companies' major investors about plans to raise prices can be read as a form of looming threat. Firms that refuse to exercise pricing power to enhance or protect short-run profitability risk being sanctioned by financial markets.

We can summarize this discussion in terms of three key points: First, firms typically do not lower prices and, aside from the case of new innovative product lines, raise prices only if they expect other firms to do the same – in other words, they stick to the pack. Second, besides a formal cartel and norms of price leadership, sector-wide cost increases can function as a coordinating mechanism for price hikes within the industry, since all firms want to protect their profit margins and know that the other firms pursue the same goal. Firms that do not follow this rule can be penalized by financial investors. Third, if demand outstrips existing capacity by a wide margin – either because of a supply or a demand shock or both – firms can gain temporary monopoly power which allows them to hike prices in ways that increase profit margins. Absent such a temporary monopoly, firms can increase profit margins by lowering costs.

As regards demand constraints, the earnings calls illustrate that, even though many firms model demand elasticities, they navigate demand not as a given entity – as elementary economic models tend to suggest – but as something that needs to be captured by a variety of strategic tools that can be used depending on the situation, where the pursuit of target profit margins is the overarching goal. The Vice Chairman and CFO of PepsiCo, Hugh Johnston, described this as follows on an earnings call: 'elasticities to me are basically a portfolio of risks that we try to manage rather than kind of zeroing in on a single number' (Pepsico, 2022c), indicating that elasticities are not exogenous, fixed entities internal to consumers but dynamic and moldable. From this perspective, the cash transfers in the form of stimulus checks and other measures during the pandemic are one of the factors in this portfolio of risks and opportunities. Among the tools that firms use to manage demand are, for example, package sizing, entry price points and advertising. There are also factors on the part of the customer that render demand inelastic. This is the case for essential consumer goods or specific inputs to established production processes with low short-run substitution possibilities, but also for goods to which customers have developed an emotional attachment thanks to branding.

Demand elasticity is ultimately part of a social relation between a firm and its customers. The earnings calls reflect that firms find customers are more willing to pay higher prices when price hikes are perceived as legitimate. This legitimacy for price increases can be created by media reporting and public discourse. A narrative of broken supply chains and exploding energy prices can develop understanding for rising prices on the part of customers, who would otherwise feel betrayed by the firms they are used to buying from if the price increase occurred without such

legitimation. Corporate leaders are very explicit on earnings calls that pricing involves navigating a relationship with customers and thus requires the cultivation of understanding. When asked by a Barclay's analyst about his price negotiations with customers, the Chief Operating Officer of Tyson, Donnie King, stated, for example: 'Remember, our relationships with our customers; it is a relationship, it is not a transactional event for us, and we've vested as they have through the years. And so they've been very supportive. They certainly understand the inflationary need. And I think we will be quite successful in this endeavor [i.e. increasing prices]' (Tyson, 2021a). This relationship is more tangible in the business-to-business case, but it extends to final consumers. The Chief Executive Officer of Pepsi, Ramon Laguarta, for example, referred to this multi-layered relationship when he commented on the company's approach to price increases: 'So we do that in full coordination with our partners [i.e. retail businesses], trying to make sure that we keep the consumer with us, we keep the shopper coming to the stores' (PepsiCo, 2022a).

Prices set by large firms are thus not optimal or market clearing but the outcome of path-dependent strategic interactions. Nonetheless, they are still constrained by competition. If prices in a sector are so high as to yield profit margins that are far above other sectors, in the long-run they tend to invite new entrants and possibly a price war launched by an outsider. If prices are stuck at too low a level in a sector, there will be a tendency for capital to be withdrawn, ruining the weakest firms and increasing concentrations which in turn makes the coordination of price hikes easier.

Overall, this discussion suggests that, absent coordinating mechanisms for price hikes, prices tend to be relatively stable in concentrated markets with the exception of commodity markets. Both insights are confirmed by long-standing empirical regularities. The important role attributed to costs in coordinating pricing also implies that prices across sectors are interdependent and linked through input-output relationships.

3. Sellers' inflation: Impulse, propagation, amplification and conflict

In this section, we use the principles of pricing laid out above to develop our interpretation of price setting, inflation and profits in the context of the COVID-19 pandemic.

3.1 The theoretical argument

To conceptualize why large firms in concentrated industries could hike prices during the pandemic after a long period of price stability and how this resulted in a generalized inflationary process, we develop a three-stage heuristic of the inflation process following a period of prolonged price stability (see Figure 3 for illustration):

1. The *impulse* stage of initial price increases in systemically significant sectors;
2. The *propagation* and *amplification* of the cost shock stage; and
3. The *conflict* stage when labor tries to regain real wage losses.

These stages are to some extent overlapping; price stability still prevails in many sectors while initial price increases emerge in others during the impulse stage; new impulses can occur in the propagation and amplification stage, and amplifications can create new impulses; and labor in some segments of the economy might manage to fend off declines in real wages before others. Nevertheless, distinguishing these stages can help us gain a clearer understanding of the processes underpinning the inflation dynamic. We spell this out stage-by-stage. Overall, the inflationary process we describe amounts to a 'sellers' inflation' in Lerner's sense (1958). This builds on the insight that '(p)rices may rise not because of the pressure of buyers who are finding it difficult to buy all they want to buy at the current prices' but 'because of pressures by sellers who insist on raising their prices' (Lerner 1958, 258).

Before the onset of the inflationary process, there was a prolonged period of low inflation in the economy as a whole. In the context of the pre-pandemic period, several decades of near- or below-target inflation prevailed, while profit margins increased (see Introduction). The question then emerges of why firms did not hike prices across the board before the pandemic and how they could still achieve such profit margin gains. Note that this is hard to explain from a Neoclassical perspective. An increase in market concentration could account for an increase in margins, but from this perspective we would also expect to see an increase in prices as an expression of enhanced monopoly power. An alternative explanation for rising profit margins within the Neoclassical framework could be a reduction in costs, but in this case it would be optimal to lower prices. By contrast, based on the principles laid out in the previous section, the period of prolonged price stability is not at all puzzling. Since firms tend to avoid lowering prices to preclude the dangers of price wars, falling costs can account for an increase in margins. The decades before the pandemic saw the rise of a new regime of globalized production designed to reduce costs, and furthermore saw real wages remain stagnant while productivity rose. This was the period of peak globalization, of outsourcing production to low wage countries, and of the creation of ultimately fragile but, while they worked, highly efficient ‘just-in-time’ global production networks. Furthermore, from the perspective laid out above, we would also expect the absence of major economy-wide price hikes even in the context of rising market concentration, so long as industry-wide coordinating mechanisms fail to emerge. The emergence of such coordinating mechanisms is what enables the inflationary process.

At the *impulse stage*, prices in some sectors increase for reasons other than an increase in input costs and alternate relative prices. Broadly speaking there are three possible drivers in the context of the pandemic: first and most importantly, the sharp increase in commodity prices that started in the third quarter of 2020 after a decline during the initial COVID-19 shutdowns in the first and second quarter. As Kaldor would have predicted and as Goldman Sachs argued (Currie et al. 2022), this was driven by the recovery of world production after the first half of the year saw lockdowns and declines in production. The result is an increase in profitability in the commodity sector. Second, supply bottlenecks in critical inputs such as computer chips and ocean freight transportation granted both the companies in those sectors with the bottlenecks, as well as firms in immediate downstream sectors that depend on critical inputs from those sectors, a form of temporary monopoly power, which allowed them to drive up prices as much as their demand could sustain. This price increase results in an increase in profitability so long as it is not offset by higher costs due to lower capacity utilization or substitution efforts – the latter of which being challenging for firms to enact in the short-run. Third, the decline in production that resulted from the 2020 recession could also have given a smaller but more broad-based impulse to increase prices if lower rates of capacity utilization increased unit costs, bringing down profit margins.⁸ To protect against this decrease in profitability, firms can react by increasing prices. If these price increases are in sectors that produce inputs, they can create cost shocks in addition to the first two drivers that act as an impulse for price hikes throughout the value chain. If such impulses originate in upstream systemically significant sectors that produce ubiquitous inputs, they are particularly potent in unleashing domino effects across sectors and across different stages of the value chain (Weber et al. 2022).

In the *propagation stage* sector-wide cost shocks resulting from the price increases in the impulse stage function as coordinating mechanisms for price hikes. Firms can safely increase their prices to protect profit margins thanks to an implicit agreement among competitors that passing on costs is the way to react to cost shocks. Daily news reports on supply chain issues and high

⁸ A decline in capacity utilization can result in increased unit costs where firms face economies of scale (Blair 1977).

commodity costs in this stage not only aid in the emergence of an implicit pricing agreement among firms, but can also develop understanding on the part of customers for higher prices and thus render demand less elastic. To protect profit margins firms must increase prices by more than costs.⁹ If firms do manage to increase prices to protect margins, the next firm in the chain will do the same but now starts from a cost increase that incorporates both the initial upstream cost hike and the higher markup for the second firm in the chain. If all firms behave like this, there is a cumulative effect that increases the nominal value of profits even while profit margins stay constant. Therefore, even with an increase in nominal profits, firms with constant profit margins will have just managed to protect themselves from the cost push. In cases where a sector furthermore experiences a supply-side bottleneck or a demand shock – granting firms within the sector temporary augmented monopoly power – profit margins may even be enhanced, thereby not only *propagating* but also *amplifying* the initial cost shocks down the supply chain.

Across these stages inflation has thus far been driven by cost shocks which have primarily resulted in increased nominal profit flows. Labor, on the other hand, sees living standards decline as real wages fall with rising prices. Workers will thus eventually try to restore their living standards and reclaim lost real wages. This corresponds to the *conflict stage* in this inflationary process and is an expression of the distributional conflict inherent in inflation (Rowthorn 1977). However, workers are very much on the defensive in this stage, attempting to fight back and regain lost territory. Even if labor manages to restore its share in national income, the timeframe in which profit flows absorbed the increase in national income due to price hikes would have functioned as a temporary transfer of income from labor to capital.

Within our framework, such inflationary dynamics have the potential to result in either a transitory or a persistent form of inflation under different institutional and macroeconomic environments. If the initial impulses which triggered propagation, amplification and conflict subside, it is possible for the propagation and amplification stage to run its course and for labor to just manage to restore its share in national income. This will have resulted in a ‘one-time’ broad-based increase in the price level. But even such ‘transitory’ bouts of inflation can last for significant amounts of time, create economic instability and cause a cost-of-living crisis. The potentially transitory nature of inflation does not mean that no policy response is required. In our analysis, the trajectory of price-setting throughout the economy is not set by universal laws of market-clearing optimality but is path- and context-dependent. Given the nature of the economy as a network of input-output relations, once an environment of price-raising has been established throughout firms along the value chain, all firms have continual justification for further price hikes to offset costs. If firms with sufficient market power in systemically significant sectors continue not only to propagate but to amplify cost increases, one can imagine a self-sustaining ‘price-price’ spiral persisting. Furthermore, if labor manages to overcompensate for its losses and increase its share in national income in response to price hikes during the conflict stage, this can create another impulse in the form of a new cost shock that restarts the propagation process, as firms react again by protecting profit margins through price increases.

⁹ Consider a firm that produces good x at a selling price of \$100 and maintains a profit margin of 10 percent, or a nominal markup above total costs of \$10. Suppose an upstream shock pushes costs up by \$10. If the cost increase is simply passed on, maintaining a nominal markup above total costs of \$10, the price of good x would be raised to \$110. But while the entirety of the cost increase was passed on, the profit margin has fallen to 9.09%. The firm therefore increases the nominal markup above total costs to \$11, raising the price of good x to \$111. Talking about the ‘impact of the pickup in raw material escalation’ in one product segment of Dupont, CFO Lori Koch referenced this phenomenon to analysts: ‘We are getting it [the cost increase] all in price. But as you know, it will hurt margin percent’ (DuPont, 2021a).

This can in theory result in spiraling conflict inflation that initially originated from price shocks in upstream sectors, which is, however, an unlikely scenario in the current US context (Galbraith, 2022). Yet, given that we are living in a time of overlapping emergencies with the looming pandemic, geopolitical tensions and climate change, a future of more frequent shocks in upstream systemically significant sectors – the 2022 shocks following the war in Ukraine being a foreboding example – appears to be on the horizon. As firms in commodity sectors have not reacted to record price levels with sufficient supply increases (Wallace 2022), this important cost impulse is likely to reoccur.

3.2 The aggregate view

We argue that the dynamics of *stability*, *impulse*, *propagation* and *amplification*, and *conflict* can play out at varying overlapping levels among different sectors over time. Nonetheless, the combined effects of simultaneous shocks and propagations is visible in a macroeconomic analysis of the stages of inflation. Broadly speaking these stages are an era of *price stability* in the years before the pandemic; an *initial impulse* that is constituted of price and profit increases up to the first quarter of 2021; the second quarter of 2021 and onwards reflects a period of *propagation* and *amplification* of initial price shocks as firms protect their profit margins, while labor managed to regain only parts of the ground lost due to rising prices; there is a *renewed impulse* of profit and price increases in the wake of the war in Ukraine in the first and second quarter of 2022; and, finally, 2022-Q3 is the only quarter in which labor captured a larger share of the increase in nominal income due to inflation – a moment of *conflict* inflation in which labor recuperated some of its prior losses but with relatively little quarterly inflation to speak of.

Using aggregate national income data on non-financial corporate business (NFCB) from the Bureau of Economic Analysis – which accounts for roughly 65 percent of gross value added (GVA) of the private sector – Figure 2a shows the distribution of the increase in nominal GVA attributable to inflation between profits and wages over time.¹⁰ The black line represents annual inflation measured as year-over-year percent changes in the NFCB GVA deflator, while the blue and red bars show the amount of the change in nominal GVA attributable to inflation ‘captured’ by labor and capital in terms of changes in wage income and profit flows.¹¹ Note that if nominal wages and profits increased by the same percentage over a period so that neither gained relative to the other, the percentage capture of each factor would simply equal its share of nominal GVA, which is about 56 percent for wages and 44 percent for profits in the 35 years prior to the pandemic. Therefore, time periods which show a deviation from a 56:44 split between wages and profits represent a period in which one factor captured the increase in nominal GVA attributable to inflation more than its typical share in GVA. In Figure 2a, the black crosses indicate what would be an ‘even’ split between wages and profits; red bars which rise above the black cross indicate time periods in which profits captured more than 44 percent of nominal GVA attributable to inflation, while red bars which fail to reach the black cross indicate time periods in which profits captured less than 44 percent.

Figure 2a shows that, before the pandemic, there was a long period of relative macroeconomic price *stability*, with low inflation and generally shared growth in nominal GVA between wages

¹⁰ Profits are before taxes and before deductions for consumption of fixed capital, taxes on production and imports less subsidies plus business current transfer payments (net), and net interest and miscellaneous payments. This aggregate measure of profits is close to the firm-level measure of earnings before interest, taxes, depreciation, and amortization (EBITDA), a common indicator used to reflect firms’ ability to generate cash profits. Wages refers to compensation of employees, which includes wages and salaries as well as supplements to wages and salaries – also before-tax measurements.

¹¹ See the appendix for details.

and profits.¹² This pattern of roughly shared growth in GVA changes dramatically with the onset of the pandemic beginning in 2020-Q1. Since year-over-year changes can obscure rapidly changing dynamics occurring on a shorter timescale, Figure 2b zooms into the period since 2020-Q1 and displays quarterly changes in inflation and its shares captured by profits and inflation. Table 1 presents annual and quarterly data together, with the amount of inflation captured by profits and wages presented in percentage terms. The first two quarters of 2020 are unique, as they are the only two quarters where real and nominal GVA contract. The fact that the GVA deflator is negative in Q1 but positive in Q2 signifies that nominal GVA contracted by more than real GVA in Q1 – indicating a quarter of price deflation – while nominal GVA contracted by less than real GVA in Q2. That the quarters in Figure 2b show positive blue bars and negative red bars does not mean that nominal wages increased – they in fact substantially decreased in Q2 – but instead indicates that aggregate nominal wages were less affected by the contraction in output than profits. This is consistent with the idea expounded in Sections 2 and 3.1 that unit costs can rise with declining capacity utilization. Still, quarterly and year-over-year inflation remained relatively low for the first two quarters of 2020.

Within our framework, the period since the start of the pandemic up to 2021-Q1 functions as an *impulse* stage in which initial supply chain snarls and rising commodity prices drive up prices and provide windfall profits in some sectors. Contrary to the first two quarters of 2020, the last two quarters of 2020 and the first quarter of 2021 show profits overwhelmingly capturing increases in nominal GVA attributable to inflation. Figure 4 shows that this is a reflection of both nominal wages and profits returning to their pre-pandemic levels after declining in early 2020 due to shutdowns in production and a decrease in employment, but with profits rising at a faster rate than wages. That nominal profits declined more rapidly than wages during the downturn in early 2020, and subsequently rose more rapidly than wages in the following quarters in returning to pre-pandemic levels, might not be notable in itself. What is interesting, however, is that the period in which nominal increases in profits led the return of GVA to pre-pandemic levels coincides with the onset of accelerating inflation, particularly in 2021-Q1. These quarters saw the beginning of supply chain bottlenecks and rising commodity prices and shipping freight rates, with the producer price index (PPI) for all commodities rising at an annual rate of 7 percent by 2021-Q1. Commodity producing sectors such as wood products, industrial chemicals, and primary metals began to see their profits swell rapidly as their output prices rose sharply (Figure 5). This impulse stage thus saw profits driving inflation. Note, however, that there has been a large degree of variance in profitability during this inflationary period across sectors, even when only considering the largest firms (Figure 6). It is particularly the explosion of profits in systemically significant upstream sectors that are most important in providing impulses for systemic inflation.

The second quarter of 2021 and onwards reflects a period of *propagation* and *amplification*, in which initial price increases in upstream industries during the *impulse* stage are passed on. In this stage, firms in downstream sectors achieve varying levels of success while attempting to protect their profit margins from rising costs, depending on the specific market conditions of individual sectors and firms.¹³ While some firms barely maintained pre-pandemic levels of profit margins, others were able to inflate margins by increasing prices more than enough to offset costs, thereby amplifying price pressures (see section 3.3). In addition, labor was able to temporarily

¹² Notable exceptions to the shared growth in nominal GVA between wages and profits occurred during the commodity price boom in 2010, when wages lost out and profits won, and when inflation fell below zero and stayed below target in 2015 to 2016, and profits declined.

¹³ Micro-level anecdotal evidence is provided in the following section.

return to its pre-pandemic share in GVA. Figure 2b and Table 1 show that the last three quarters of 2021 saw labor and capital capturing just about their historical average levels of increases in nominal GVA attributable to inflation. This does not mean, however, that labor recovered the losses due to inflation which it faced in the previous three quarters. The initial stages of sellers' inflation essentially functioned as an upward transfer of income that has not been reversed. Wages have consistently failed to keep pace with inflation and most workers have faced declining real wages (Rich, Tracy, and Krohn, 2022). Furthermore, the first two quarters of 2022 saw profits once again disproportionately capture the increase in nominal national income at historically high levels of inflation, as the War in Ukraine provided a renewed *impulse* for further price hikes. 2022-Q3 saw labor manage to regain some of its share in rising nominal GVA, albeit for a quarter with a much lower inflation rate. This period therefore corresponds to the *conflict* stage but at a moment when inflation is easing. Conflict inflation is thus here a response to several quarters of profit-led inflation in which workers lost ground in the share of national income.

While aggregate data on wages and profits for the fourth quarter of 2022 is unavailable at the time of writing, the most recent price data indicates that inflation inertia slowed considerably, with monthly changes in the CPI at their lowest levels since the beginning of the pandemic. This comes with the alleviation of supply chain snarls and easing in global commodity prices. If the slowing of inflation continues, this indicates that the propagation and amplification stage may have run its course, and that labor's recent restoration of its share in national income thus far has not functioned as an impulse for further rounds of price hikes.¹⁴ While this provides evidence of the ultimately 'transitory' nature of the COVID-19 inflation, its unexpectedly significant duration and magnitude – helped in part by the second shock of the War in Ukraine – evinces the need to develop tools to halt inflation in its tracks when impulses inevitably arrive in this future of global emergencies. We further caution that future impulse-propagation-amplification-conflict processes may not always come to a relatively short end.

3.3 The firm-level view

Against the background of the aggregate manifestation of the different stages in the inflationary process, this section presents firm-level small-sample evidence to illustrate our understanding of the changes in prices and profits. This is an exploration bringing together quantitative firm-level data (see figures in the Appendix) and insights gleaned from earnings calls that delivers preliminary findings meant to stimulate future research rather than to offer definitive conclusions. Earnings calls are held quarterly by publicly listed companies. Chief officers report to investors and analysts on a company's record and strategies. Since the fourth quarter of 2020 there has been increasing discussions of pricing practices which we draw on in this analysis.

We focus our analysis on some of the largest firms with disproportionate importance in sectors that have been identified as systemically significant for inflation by Weber et al. (2022). Therefore, although our sample is not representative of the whole economy, the firms we consider are of disproportionate importance for the overall inflationary dynamic. Table 1 in the appendix lists all firms for which we have consulted earnings calls and profit and price movements. Firms have been divided into two main groups, depending on whether they were mainly part of the initial price and profit explosions at the impulse stage or whether they functioned to propagate or amplify these initial price increases. Note that there is a spectrum between propagation and amplification.

¹⁴ As this process is still unfolding at the time of writing, future research is required to distinguish the effects from the 'spontaneous' easing of the supply-side causes of inflation and from the Fed's aggressive interest rate hikes.

To provide an impulse for price increases in other sectors in ways that can become significant for the economy as a whole, a company must be an important provider of inputs for other firms. Put differently, price explosions in upstream sectors have greater potential to unleash ripple effects throughout the economy. The firms we consider for the impulse stage are all large publicly listed companies that have seen large price and profit increases and are in upstream sectors.

Clearly, the most important impulse came from the enormous increase in fossil fuel prices. The analysis of Weber et al. (2022) illustrates that fossil fuels is by far the most systemically significant sector for inflation, and a recent study finds significant direct and indirect effects of increases in energy prices on inflation in the UK (Saunders, 2023). The case of Exxon Mobil, the largest non-government owned oil company in the world, can illustrate what the pandemic has meant for profits.¹⁵ Profits turned negative in 2020 – with significant losses in Q4 – as a result of the decline in oil prices and volumes due to falling demand (Appendix Figure 4). In response to the decline in volumes, the earnings reports reveal that the least productive production facilities were shut down. As oil prices began to rise in 2021-Q1, profit magnitudes and margins immediately turned positive and rose through to 2022-Q3 despite relatively little volume growth. The higher cost production facilities were not fully reopened despite the high prices.¹⁶ On earnings calls, the CEOs of both Chevron and ExxonMobil list low production costs as one of the factors that has raised margins (Weber 2022).¹⁷ Historically high profit magnitudes and margins were achieved with the second impulse following the war in Ukraine in early 2022 as oil prices spiked even higher. In the words of Exxon Chief Executive Officer, Darren Woods: ‘we’ve created this hole with a lot more capacity coming off-line without a whole lot of new capacity.... That capacity is not coming on. So we've got this gap, demand recovers, and we don't have the capacity to meet that, which has led to a record, record-high refining margins’ (ExxonMobil, 2022). The case of Chevron tells a similar story, but with a relatively larger increase in total profits compared to the change in margins. Chevron’s CEO, Mike Wirth, informed his shareholders in the fourth quarter earnings call of 2021 that ‘the last two quarters have been the best two quarters the company has ever seen. And last year was 25% higher than the best year in our history’ (Chevron, 2022b). Chevron prioritized paying out record earnings to shareholders rather than using them for capital investments and ‘focused on generating returns’ rather than expanding production (Chevron, 2022a). While oil companies are price takers, the pandemic has enabled a coordinated reduction in volumes that would not have occurred otherwise. Since all oil companies profit off the low cost, high price constellation, incentives to invest and restore production capacities are low.

Chemicals is an important example for a sector that is both systemically significant for inflation and closely linked to fossil fuels due to its high energy intensity, and represents an example of a sector which saw price increases and functioned as an impulse for further price pressures. Dow and DuPont – the largest US chemical companies – merged in 2015, creating the largest chemical company in the world, and subsequently split again, combining specialized segments of the prior companies. Dow saw a sharp increase in profit margins and profits in large part due to large price increases starting in the fourth quarter of 2020 (Appendix Figure 2). DuPont saw an increase in profit margins at the same time, but with a smaller contribution from price increases

¹⁵ See Figure 4d for the sectoral development of profits and prices for ‘Petroleum and Coal Products’.

¹⁶ The case of a decline in unit costs resulting from diminished capacity utilization is opposite to that of increasing unit costs described earlier in this paper. The fact that the oil and gas sector exhibited declining unit costs by shutting down low-productivity sites may be unique to the structure of the industry, for example in the variation of productiveness of extraction facilities due to geological factors.

¹⁷ Also see Galbraith (2023) in this volume on the role of private equity in encouraging investment discipline in the oil sector.

(Appendix Figure 2). Yet, even for the less obvious case of Dupont, the earnings calls highlight the importance of price actions for margins and the strategic nature of price setting. In the fourth quarter of 2020 as supply chain issues began to manifest, DuPont reassured analysts that they were not losing business due to raw material constraints, since all competitors faced the same issue, instead pointing to the benefits of a ‘constructive market for pricing’ (Dupont, 2021b). CFO Lori Koch explained how bottlenecks enhance pricing power: ‘a couple of recent force majeure in the industry ...[are] making the price environment even more conducive’ (ibid.). In subsequent quarters the company consistently expressed confidence in recouping all costs in pricing. As hope for an easing of commodity prices emerged in 2022, the new theme became whether the enormous price increases – described as unprecedented in the career of one of the Chief Officers – would have to be returned to customers when costs start falling. The company representatives were confident that they would be able to keep prices up, thus sustainably improving margins. They explained, ‘every price increase we did, we put it into the product cost. We did not do it as surcharges that would fluctuate off an index, so customers would have to negotiate with us when there’s any price changes’ (Dupont, 2022b). In other words, the price increases have been strategically baked into the ‘normal’ price to disguise falling costs. In the words of Dupont Executive Chairman & Chief Executive Officer Edward D. Breen: ‘obviously, our goal if a recession hits, and commodity costs come down, would be to then get a gap, maintain a gap going forward where obviously, we’re maintaining more price than the decrease on the commodity’ (DuPont, 2022a).¹⁸ This strategy is by no means unique to DuPont and confirms the principle that firms with market power tend not to lower prices in a downturn. This also means that the initial impulse in upstream industries is sustained beyond the events that unleashed it, making it likely that the companies that use these high-priced inputs will also not lower their prices.

The sector ‘Iron and steel mills and ferroalloy manufacturing’ is the sixth most upstream sector in the US economy based on its numbers of forward linkages,¹⁹ And provides another example of an important sector which provided an impulse for price increases further downstream. After a decline at the beginning of the pandemic, prices of ‘Iron and Steel’ increased by over 100% from the beginning of 2020 to the end of 2021, with profits for the industry increasing by a similar magnitude (Figure 6). Profit declines for Nucor and losses for US Steel, for example, were swiftly regained by 2021-Q1, right at the takeoff of inflation (Appendix Figures 6 and 7). For each quarter beginning with 2021-Q2, profit volumes and magnitudes were significantly larger (in some quarters by a factor of two to three) than pre-pandemic averages. Volumes rose throughout 2021 and to a lesser degree in 2022, contributing to the rise in profits, but generally by a smaller percentage than prices. Nucor explained this as resurgent demand reflecting the pick-up in global production activity: ‘Virtually all the steel end-use markets that we monitor are growing. Some of this growth may simply be catch-up from the pandemic-induced economic lull we experienced here in the U.S., but we think it goes beyond a temporary rebound’ (Nucor, 2022). But they also acknowledged benefitting from windfalls, as they maintained lower inventory costs and forward contracts while prices rose: ‘in 2021, when raw material prices were rising, we had inventory in the supply chain where we captured value. And so we made money ...because of low iron ore prices that we had on the ground and in our contracts. We

¹⁸ Korinek and Stiglitz (2022) have analyzed this price-keeping behavior of firms using a Cournot model.

¹⁹ In a Leontief input-output framework, forward linkages are defined as the row sum of the Leontief inverse matrix of direct and indirect requirements. Forward linkages can be interpreted as the impact of an increase in the final demand of all sectors by one unit on the production of industry i . In other words, it is the amount by which the production of industry i would need to increase in order to allow for a unitary increase in total final demand. The higher the forward linkages of a sector, the more dependent the productive structure of the entire economy is on the good supplied by that sector. The ranking of ‘iron and steel mills and ferroalloy manufacturing’ was calculated via the 405-sector 2012 input-output tables from the BEA.

made money in scrap because we had scrap in our scrap yards that was being priced higher every month and every quarter, as prices were rising' (Nucor, 2021). For Nucor, volumes declined in 2022, but the abnormally large profit magnitudes and margins were sustained thanks to continued price increases. By 2022-Q3 there were simultaneous declines in some prices and volumes for US Steel, leading to smaller yet still larger than average profit magnitudes and margins. The segments of both companies include both products that are commodities as well as more specialized steel types and processed metal goods, thus indicating that they are price takers for parts of their products and have pricing power for others. The large upward swings in prices and profits are therefore partially driven by global commodity market dynamics and partially by price increases in response to bottlenecks, as becomes apparent from the earnings calls discussions.

Two examples that illustrate salient bottleneck dynamics are the wood manufacturer Boise Cascade and the Danish shipping giant Maersk.²⁰ Maersk provides a clear example of windfall profits thanks to the bottleneck of all bottlenecks, the gigantic backlogs in container shipping that emerged during the pandemic. After several years of low and even negative profits, profit margins immediately began to rise at the start of the pandemic, quickly reaching historic highs. This coincided with price increases despite initial declines in volumes (Appendix Figure 5). Freight rates skyrocketed in 2021 as volume kicked back up. Large price increases were sustained throughout the entire post-pandemic period, although volumes began declining in 2021-Q4. Throughout the entire pandemic, including the post-shutdown period, Maersk saw enormous and rising profit magnitudes and margins. The sector 'Sawmills and Wood Preservation' is less upstream than steel (ranking 71 out of 405 in forward linkages) but can still be considered as part of the initial inflation impulse due to the extraordinary price increases of wood products by nearly 600 percent between 2020-Q1 and 2021-Q2. Sawmills shut down in the early phase of the pandemic, but when demand shot up with the housing and 'DIY' boom, a bottleneck emerged. After two modest quarters of profits in early 2020, Boise Cascade's profits jumped to long-time highs in 2020-Q3 (Appendix Figure 1). Resurgent demand in 2021 combined with continuing price hikes, leading to tremendous profit magnitudes and margins. Volumes began to decline in 2022, but historically high profits were maintained with sufficient price hikes.

The sectors and companies we have discussed for the impulse stage are merely examples, but they illustrate how windfall profits were reaped following specific price hikes. Exploding prices became exploding costs for other companies across the economy. Since the economy is a network of input-output relationships, there is no clear beginning or end to price hikes – e.g. steel matters for oil and oil for steel. Nevertheless, some companies matter more for inflation than others, and we grouped them in the impulse stage insofar as they have seen large margin, profit and price increases, and rank highly in terms of the number of forward linkages.

There are also examples of upstream industries that acquired systemic significance during the period of inflation but displayed more of a propagation rather than an impulse pattern. One case in place is trucking. CH Robinson is a Fortune 200 company that offers freight transportation and related services. They did increase prices, but for the most part just managed to protect profit margins against escalating costs, rather than enhancing them (Appendix Figure 9). Yet, profit volumes went up substantially due to the increase in revenues. In the second quarter of 2022 they reached record profits thanks to windfalls as costs fell and prices failed to decrease. Another example with a similar kind of pattern of price increases, stable margins and rising

²⁰ While Maersk is a non-US company, the global nature of shipping makes it nonetheless relevant for our discussion. A recent study finds global shipping prices have significant and persistent effects on inflation (Carrière-Swallow et al., 2023).

profits is Home Depot (Appendix Figure 14), for which the wholesale part of its business also falls into a systemically significant upstream sector. Similar to the steel companies, part of their pricing powers follow commodities – as in the case of lumber – while more processed goods have list prices. In contrast to Home Depot, their direct competitor Lowe’s did increase its profit margins (Appendix Figure 15). Price hikes on the part of all competitors presented Lowes an opportunity to catch up with Home Depot’s margins. In both cases we see large price increases even when demand began falling as the pandemic boom ceased. This is consistent with the principle we laid out above: firms with market power price primarily to protect profits, not to induce demand (with the exception of promotions). An even more extreme example of price increases in response to declining demand is Starbucks (Appendix Figure 18).

Two downstream examples of propagation are the giants PepsiCo and Coca Cola. They both used pricing to protect their margins from cost pressures, especially when volume growth declined (Appendix Figures 10 and 16). Their dominance in different product markets – ranging from grocery stores, to restaurants and gas stations – allowed them to keep volumes relatively stable despite the large shifts in consumption patterns during the pandemic.²¹ Their market is global per capita consumption of drinks and snacks. PepsiCo’s CEO Laguarda summarized the general pricing practice on an earnings call: ‘When you come to our pricing and our – how we’re going to deal with pricing in the coming months, I would say obviously same as everybody else, we’re seeing inflation in our business across many of our raw ingredients and some of our inputs in labor and freight and everything else. ... We’re working with our partners in the retail space and in the away-from-home space to make the right decisions in pricing to [keep] the consumers with us whilst we improve our margin, yeah’ (Pepsico, 2021b). In addition to the implicit agreement among competitors on hiking prices, Laguarda also pointed to a change in consumer attitudes in the pandemic context: ‘What we’re seeing across the world is much lower elasticity on the pricing that we’ve seen historically and that applies to the developing markets, Western Europe and the US. So, across the world, consumer seems to be looking at pricing a little bit differently than before.’ As explanations he cites that ‘consumers are shopping faster in-store and they might be paying less attention to pricing’ (Pepsico, 2021c) – one might add as they fear contracting COVID-19 – and a special emotional attachment to familiar brands.

Some firms have managed to not only protect margins but increase them in varying degrees by raising prices, thus amplifying the overall inflation dynamic. Procter and Gamble, for example, a producer of hygiene and health care products that enjoyed strong demand during 2020, managed to increase margins and profit volumes somewhat above the pre-pandemic level and to keep them there due to price increases when volume growth declined (Appendix Figure 17). Procter and Gamble’s Chief Financial Officer explained to analysts: ‘we’re better positioned for dealing with an inflationary environment... than we’ve ever been before, starting with the portfolio that is focused on daily-use categories, health, hygiene, and cleaning, that are essential to the consumer versus discretionary categories which in these environments are the first ones to lose focus from the consumer’ (Q2 2022). Simply put, selling goods that people depend on gives Procter and Gamble space to raise prices. Furthermore, within these essentials (such as diapers) the company covers the whole price range from basic to luxury brands, which ensures that

²¹ PepsiCo Chairman and CEO Ramon Luis Laguarda explained this ubiquity of PepsiCo’s products as follows for the example of snacks: ‘And on the impact of the kind of the new mobility habits on snacks, I would say we’ve lost a lot of high-profit volume in both the convenience channel and the away-from-home channel. I mean, we always talk about beverages, but snacks had a pretty good impulse and away-from-home opportunity that we’ve lost, and that was high margin. On the opposite side, we’re obviously seeing more consumption at home, both on kind of indulgence in terms of kind of at the end of the day, there’s -- people need a break or during the day some breaks, and we’re seeing more solo consumption, so more multipack, small portion formats’ (Pepsico, 2021d).

customers stay with Procter and Gamble even if they switch to a relatively cheaper product in response to price hikes (ibid.).

The world's second largest meat processor, Tyson, more than doubled its margins and profits in the second half of 2021, in no small part due to price increases they pioneered for the industry, and then continued raising prices to protect margins against falling volumes and cost pressures, for example from grain prices. Tyson changed its pricing model from annual list prices to more flexible prices and quarterly changes to 'de-risk' from commodity price swings (Tyson, 2021b). They claimed 'there's flexibility both going up and there's flexibility going down' (Tyson, 2022a), yet goods that fall into the commodity category face more price swings than others. Tyson does not compete in the market for chicken or beef alone, but for all protein consumption, and they 'play across the spectrum from the most value-added products to the most commodity of commodity products and we meet the consumer wherever they are on the value chain' (ibid.). This implied that when people had more purchasing power and bought expensive beef cuts, they bought from Tyson, but as inflation put pressure on households and they switched to cheap chicken, they were still buying from Tyson. Offering such a portfolio of close substitutes adds to the range of possibilities in strategic pricing. Like most other giant companies we studied, they found that demand elasticities are low.

A somewhat similar pattern of amplification emerges for General Mills – a multinational company that sells branded processed food – but they realized a more sustained upward trend in profits and margins, first as a result of volume growth and later also due to price increases (Appendix Figure 12). General Mills emphasized its agility in adjusting pricing: 'And so in a volatile market, trying to be certain is not a good place to be. What you need to be is thoughtful and you need to be fast' (General Mills, 2021b). The example of General Mills, too, makes it clear that pricing actions are possible because of sector-wide cost changes:

We're seeing inflation, and it's broad based across commodities, across logistics, across things like aluminum and steel. And so, whenever you see this kind of broad-based inflation and it's global, that's an environment where you're going to realize net pricing. ... But in this kind of environment... – our retailers are seeing it, our competitors are seeing it, and we're seeing it. And so, we will realize pricing (General Mills, 2021a).

Companies in the automobile sector have also amplified price pressures enabled by a form of temporary monopoly granted by the computer chips shortages. This allowed car producers to focus on expensive models with higher margins and generally raise prices without having to fear a loss in market share. General Motors, for example, increased its profit margins and magnitudes in the second half of 2020 and in 2021 due to a combination of pricing and mix (Appendix Figure 13). The shortages in new automobiles in turn created a demand shock for used cars. The largest US used car retailer Carmax, for example, experienced a very large increase in volume and an uptick in prices in the second quarter of 2021 which it then translated into even higher price increases the next quarter (Appendix Figure 8). As a result, the company enjoyed record profits and margins, which dwindled as the shortages eased in 2022.

4 Conclusion

Lerner (1958) coined the term 'sellers' inflation' to disentangle aggregate excess demand from inflation. Excess demand is just one among several possible causes of inflation. If this is the case, we need additional policy tools focused on other causes, aside from merely ones aimed at bringing down aggregate demand by hiking interest rates or enacting fiscal austerity. Sellers' inflation is not possible in a perfectly competitive economy, but in a highly concentrated

economy in which large firms are price makers, it is a real possibility – as we are witnessing again today. If sellers’ inflation is tackled by inducing a recession using tools designed for aggregate excess demand, it can aggravate the institutional conditions that gave rise to it in the first place. The giant corporations we have surveyed in this paper express confidence on earnings calls that they are weathered against a recession. Their product portfolios are so versatile and their revenue management so perfected that they have a playbook to make sure customers stick to them through bad times. Their global reach, which makes them less dependent on any single national market, adds to their resilience. By contrast, a recent survey shows that, when expecting a recession, small business owners do not feel prepared to navigate it successfully (Shippy, 2022). Contractionary monetary policy in itself also tends to hit smaller businesses harder (Galbraith, 1957). Price takers, in contrast to price makers, cannot raise their prices when costs go up due to higher interest rate payments, and thus – unlike firms with market power – they see their profitability decline. This in turn undermines their creditworthiness and access to loans. Large firms also tend to have more financing options beyond bank loans, which can make them generally less dependent on bank rates. But the injustice of monetary policy does not stop at the discriminatory effect on small versus big businesses. Ultimately, hiking interest rates is meant to increase unemployment, which hurts workers who have already been in a defensive position in this inflation.

We are living in times of overlapping emergencies. The pandemic is not over, climate change is a reality and geopolitical tensions are mounting. It is likely that there will be more shocks to come. If shocks hit systemically significant upstream sectors, they can initiate price increases which provide an impulse for further price hikes and ultimately inflation following the dynamic discussed in this paper. The recent easing of price hikes may indicate that the current bout of inflation seems to be ‘transitory’ in nature pending further shocks. But our analysis suggests that seller’s inflation can also give way to more persistent inflation. Furthermore, within such ‘transient’ periods inflation undermines economic stability and causes financial harm while real wages fall. The mere fact that a second impulse shock landed in 2022 and exacerbated already-high levels of inflation – leading to the relatively long duration and significant magnitude of the COVID-19 inflation – evinces the need for states to develop tools and take effective action early on in such inflationary processes, rather than adapt the ‘wait-and-see’ approach initially advocated by many of those on ‘team transitory’ (e.g. Krugman, 2021) until inflation becomes broad-based.

For commodity markets, Keynes, Kaldor and others have long argued for buffer stock systems that can dampen the violent price fluctuations inherent in these markets by inducing prices to stay within a certain corridor (Ussher, 2016). The use of the Strategic Petroleum Reserves by the US administration, which contributed to the recent reduction in fossil fuel prices, follows this logic. The maintenance of lower fossil fuel prices may be seen as a contradiction to the goal of a ‘green transition’. But non-linear pricing – as has been implemented for example in Germany with the so-called “gas price brake” – can create price stability for the inelastic basic demand while preserving price incentives at the margins to encourage saving (Weber, Beckmann, Thie, 2023). Such a price policy can not only be important for preventing inflation – as fossil fuels currently remain systemically significant upstream resources – but also for the goal of a *just* transition, since the same communities who are hit hardest by climate change and the pollution from fossil fuels are also among the prime victims of oil price shocks (Weber, 2022). Stable fossil fuel prices can prevent profit explosions which increase the power of big oil and vested fossil fuel interests.

To be prepared for future emergencies, buffer stock systems are needed for a wider range of commodities. Limiting financial speculation on commodities is another useful tool to reduce the

potential for impulses that can help trigger inflation. To prevent companies from exercising temporary monopoly power in response to a bottleneck, price gouging laws in many US states prohibit excessive pricing in emergencies. For the most part, these laws focus on consumer essentials. Similar national or even international regulations that limit the degree of legal price increases in times of emergencies for systemically significant upstream sectors could play an important role in preventing impulses that then propagate through the whole economy, creating inflation on the way. To be effective, price gouging laws need to be backed up with monitoring capacity. Windfall profit taxes can be a complementary tool that can make it less attractive for firms to hike prices in ways that increase profit margins and thus make initial price impulses and amplifications of price hikes less likely. Finally, if all these measures fail, strategic price controls for systemically significant sectors can be a means of last resort. Where prices are administered by a handful of firms, they are easier to implement than in competitive markets.

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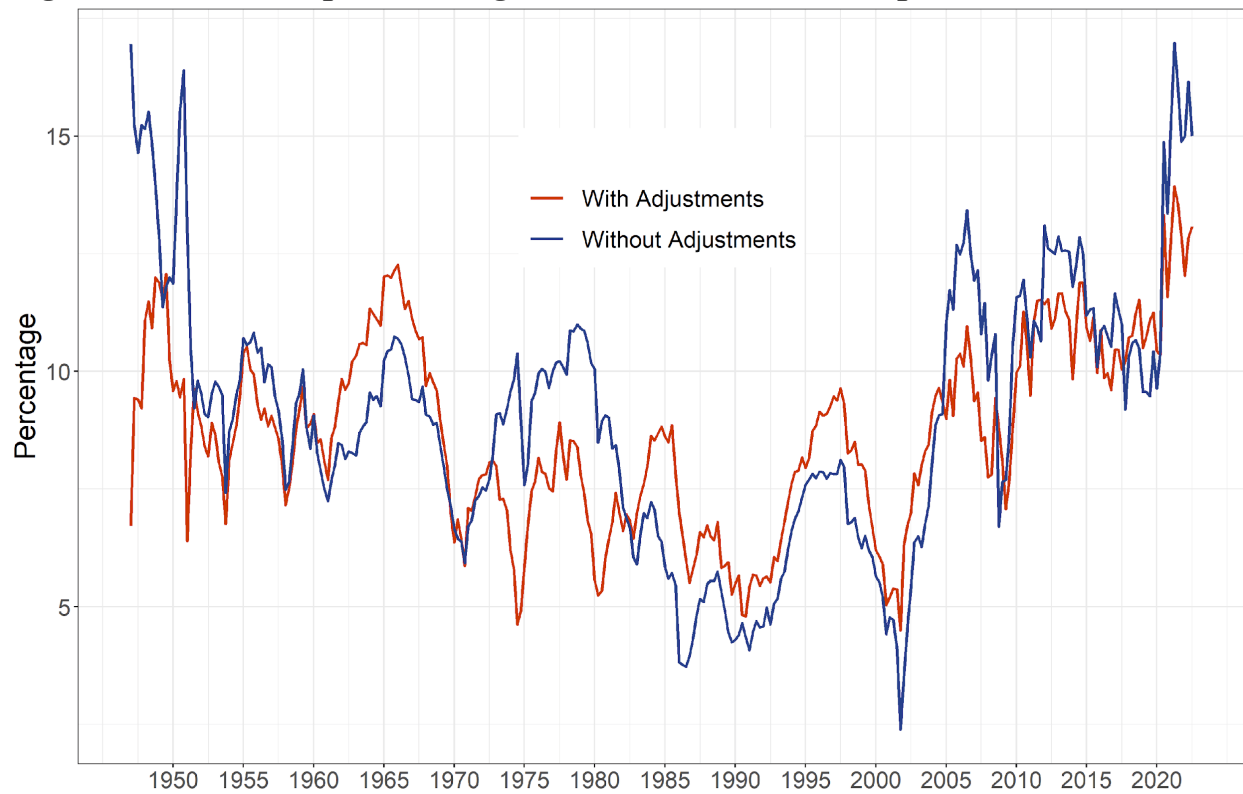
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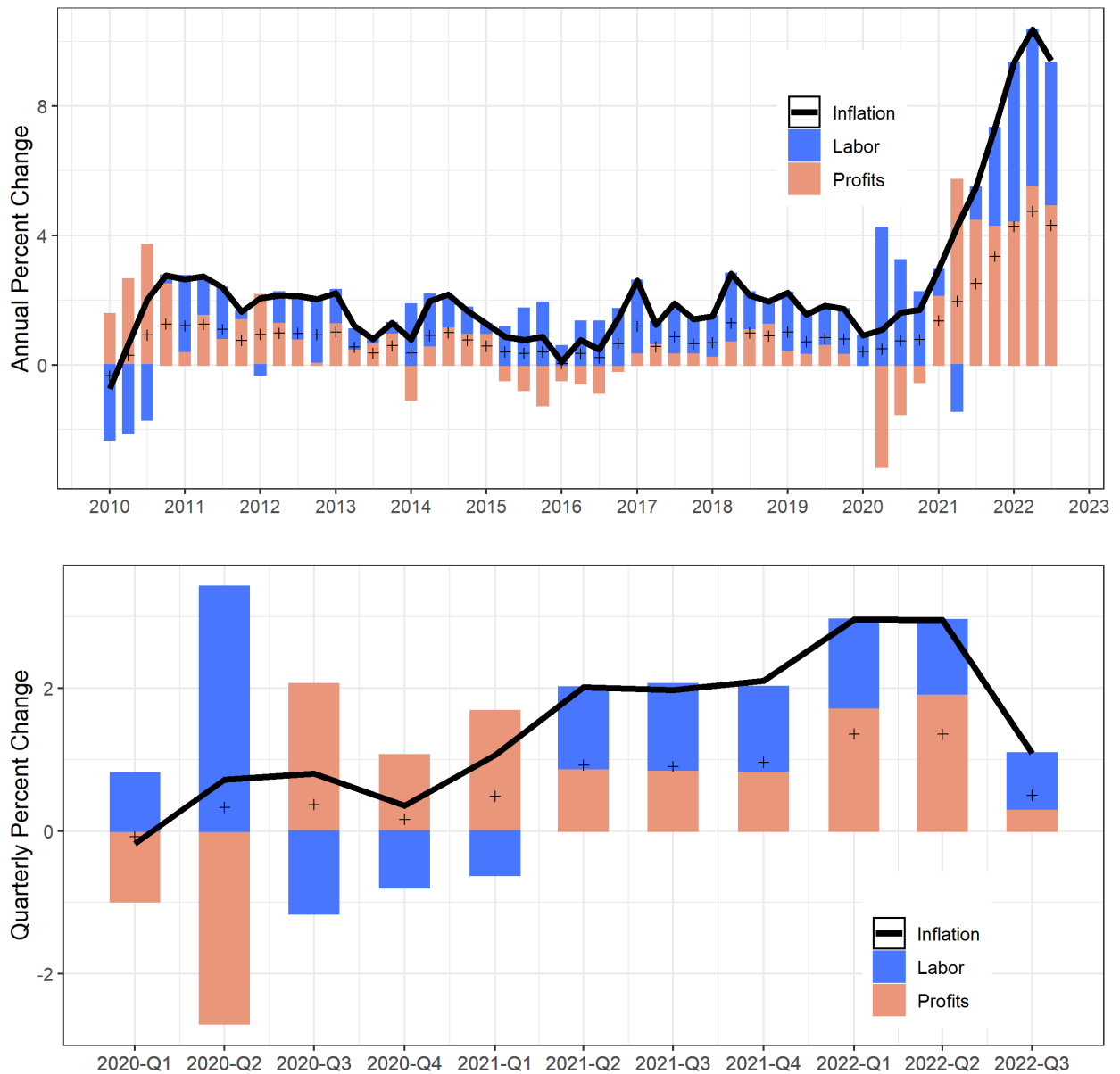
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Figure 1: After-tax profit margins of non-financial corporate business



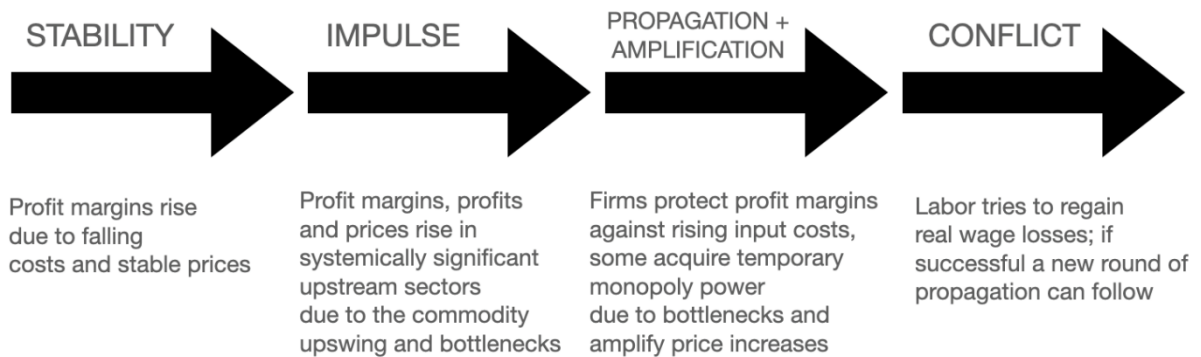
Note: Quarterly after-tax corporate profit margins are defined as after-tax corporate profits as a percentage of gross value added. Data pertains to the US domestic non-financial corporate business sector, 1947-Q1 to 2022-Q3. Red indicates corporate profits with inventory valuation adjustments (IVA) and capital consumption adjustments (CCadj) provided by the BEA, while blue shows corporate profits without adjustments. The purpose of IVA and CCadj are to adjust estimations of profit incomes for changes in the prices of inventories and replacement costs of capital stocks due to inflation. In attempting to understand how inflation impacts profits and visa versa, however, profits without adjustments – which include the benefits of realized gains on inventories and depreciation allowances – may be a more meaningful measure than profits with adjustments. *Source:* BEA.

Figure 2: Capture of Annual and Quarterly Inflation by Profits and Wages



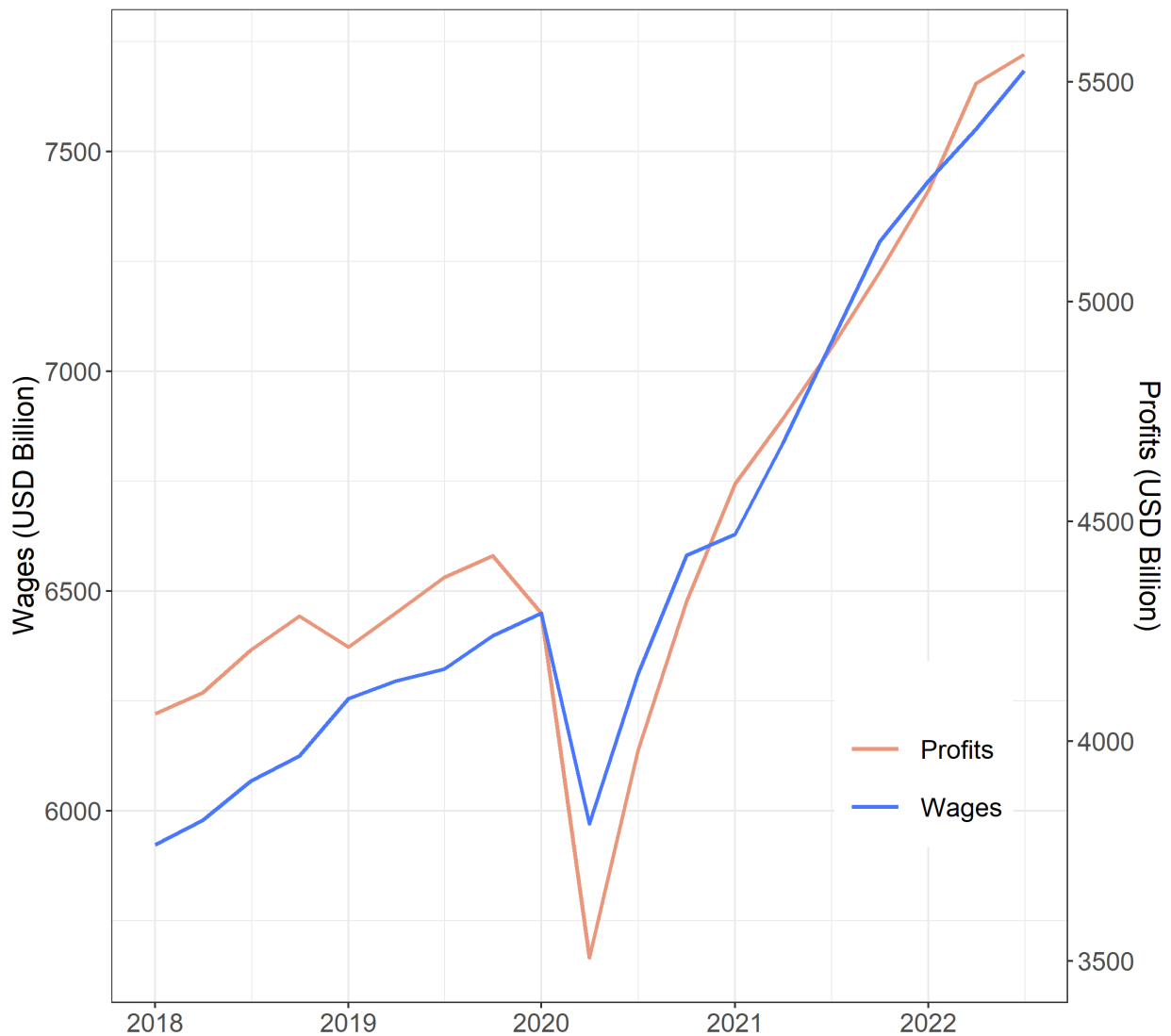
Note: Inflation is measured as changes in the gross value added (GVA) deflator (black) for the non-financial corporate business sector. The capture of nominal changes in GVA attributable to inflation by profits (red) and wages (blue) is depicted by stacked columns which sum to the level of inflation. (a) reflects annual inflation and (b) reflects quarterly inflation. Black crosses indicate levels at which profits and wages would capture their historical averages of GVA – 46 percent for profits and 54 percent for wages. A similar graph appears in Kühnlénz (2022). *Source:* BEA. See Appendix for details.

Figure 3: Stages in the inflation process



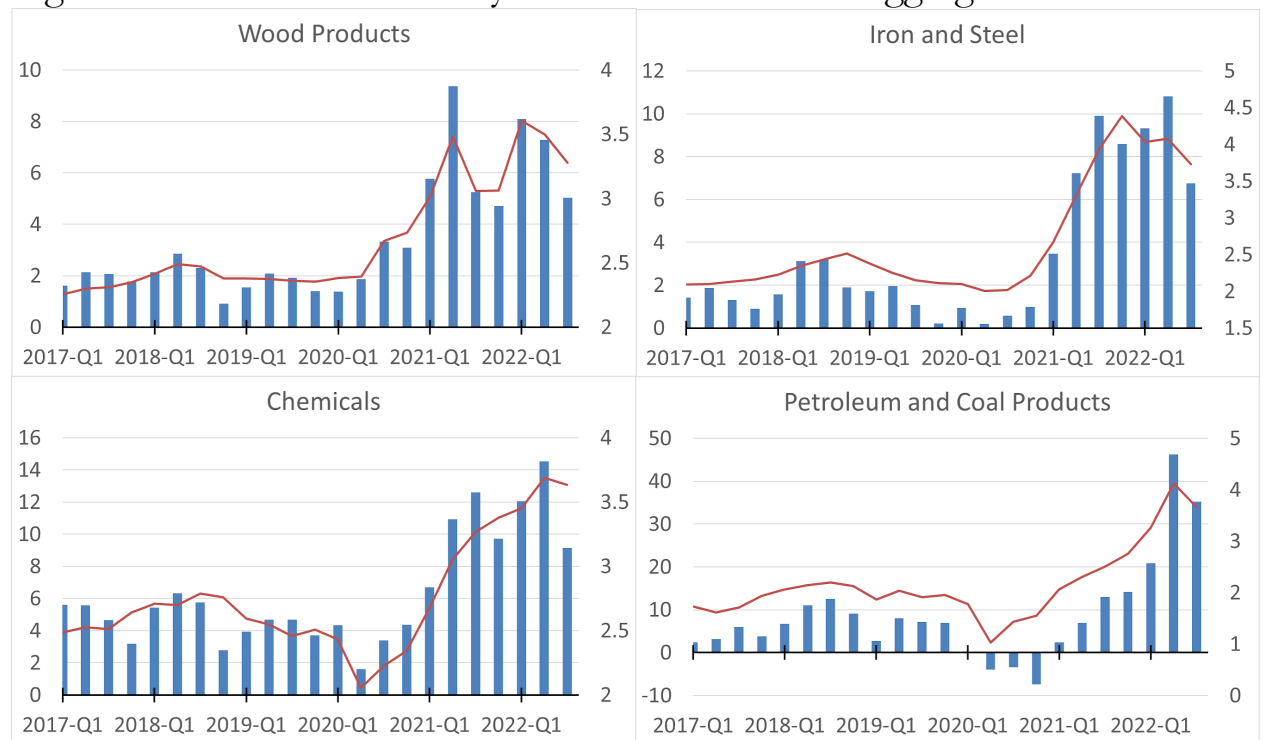
Note: An illustration of the three stages of inflation following a period of price stability outlined in Section 3. The inflation process does not necessarily end at the conflict stage, as the conflict stage can provide an impulse for further propagation and amplification. Other new impulses can emerge at any point in the inflation process – an example being the sharp increases in oil and grain prices following the Russian invasion of Ukraine in early 2022. Multiple stages of the process can thus overlap and exist simultaneously across different sectors.

Figure 4: Nominal Aggregate Wages and Profits



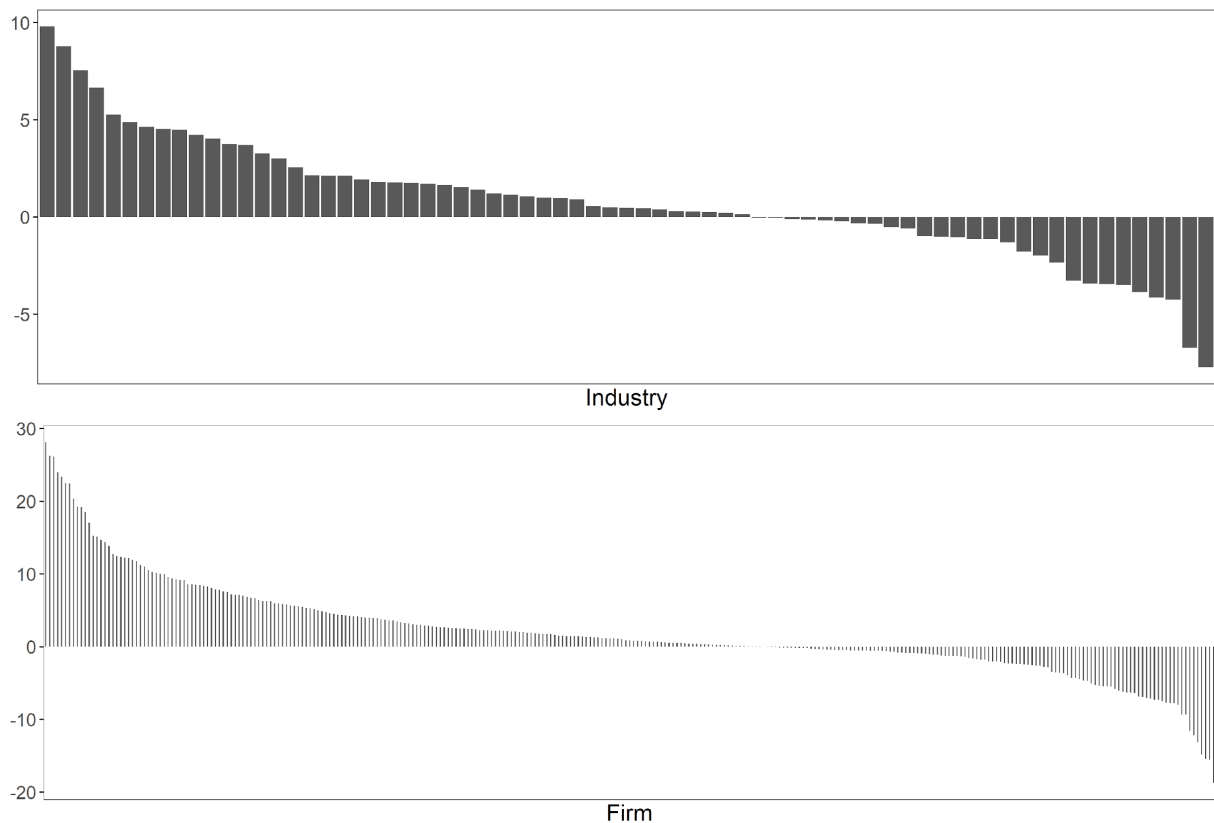
Note: Nominal profit income (red, right y-axis) and wage income (blue, left y-axis) data pertain to the non-financial corporate business sector. Profit income is defined as before-tax corporate profits without deductions for consumption of fixed capital, taxes on production and imports less subsidies plus business current transfer payments (net), and net interest and miscellaneous payments. Wages refers to compensation of employees, which includes wages and salaries as well as supplements to wages and salaries. *Source:* BEA.

Figure 5: Sectoral Commodity Prices and Nominal Aggregate Profits



Note: Quarterly nominal aggregate profits (blue columns, left y-axis, USD Billion) and producer price index (PPI) levels (red lines, right y-axis, PPI in base year = 1) are provided for four sectors identified as systemically significant for inflation in Weber et al. (2022). The profit data pertains to industry classifications, while the PPI data pertains to commodity classifications, both according to the North American Industry Classification System (NAICS). (a) Industry: wood products. PPI: lumber and wood products. (b) Industry: iron, steel, and ferroalloys. PPI: iron and steel. (c) Industry: basic chemicals, resins, and synthetics. PPI: industrial chemicals. (d) Industry: petroleum and coal products. PPI: petroleum products, refined. *Source:* Industry nominal profit data comes from the Quarterly Financial Report survey of the US Census Bureau. PPI data comes from the BLS.

Figure 6: Distribution of changes in profit margins among industries and firms



Note: (a) Columns represent changes in aggregate profit margins between 2021 and average annual profit margins for the pre-pandemic period 2017-2019 for 71 industries defined in the GDP-by-industry accounts of the BEA. Profit margins are defined as gross operating surplus divided by gross output (y-axis shows nominal change in profit margin percentage). (b) Columns represent changes in profit margins between the four quarter period 2021-Q3 to 2022-Q2 and average annual profit margins for the pre-pandemic period 2017-2019 for 300 US firms in the Compustat database with the highest pre-pandemic revenues. Profit margins are defined as net income before extraordinary items divided by revenues. A similar graph for the UK appears in Hayes and Jung (2022). *Source:* BEA and Compustat.

Table 1: Capture of Annual and Quarterly Inflation by Profits and Wages

| Quarter | Annual: | | | Quarterly: | | |
|------------------|-----------------------------|---------------------------------|-------------------------------|-----------------------------|---------------------------------|-------------------------------|
| | Total Inflation Over Period | Capture of Inflation by Profits | Capture of Inflation by Labor | Total Inflation Over Period | Capture of Inflation by Profits | Capture of Inflation by Labor |
| Long Run Average | NA | 45.8 | 54.0 | NA | 45.8 | 54.0 |
| 2020-Q1 | 0.9 | 0.0 | 100.0 | -0.2 | 550.0 | -450.0 |
| 2020-Q2 | 1.1 | -291.7 | 391.7 | 0.7 | -375.0 | 475.0 |
| 2020-Q3 | 1.6 | -94.4 | 200.0 | 0.8 | 255.6 | -144.4 |
| 2020-Q4 | 1.7 | -31.6 | 131.6 | 0.4 | 300.0 | -225.0 |
| 2021-Q1 | 3.0 | 72.7 | 27.3 | 1.1 | 158.3 | -58.3 |
| 2021-Q2 | 4.3 | 133.3 | -33.3 | 2.0 | 43.5 | 56.5 |
| 2021-Q3 | 5.5 | 82.3 | 17.7 | 2.0 | 43.5 | 60.9 |
| 2021-Q4 | 7.3 | 59.0 | 41.0 | 2.1 | 40.0 | 56.0 |
| 2022-Q1 | 9.3 | 47.7 | 52.3 | 3.0 | 58.3 | 41.7 |
| 2022-Q2 | 10.4 | 53.7 | 46.3 | 3.0 | 64.9 | 35.1 |
| 2022-Q3 | 9.4 | 52.7 | 46.4 | 1.1 | 28.6 | 71.4 |

Note: Inflation is measured as changes in the gross value added (GVA) deflator for the non-financial corporate business sector. The capture of nominal changes in GVA attributable to inflation by profits and wages is given in percentage terms which sum to 100 percent. The top row shows the long-run average captures of inflation by profits and wages for the period 1983-Q1 to 2019-Q4, which reflects the average profit and wage shares of GVA. *Source:* BEA.

Appendix A: Calculating the capture of inflation by profits and wages

Calling GVA^D_i , $Profit^D_i$ and $Labor^D_i$ the GVA deflator, unit profit deflator and unit labor cost deflator, respectively, for period i , each deflator is calculated by dividing the nominal values of GVA, profits and compensation of employees by real GVA in period i .²² Since nominal profits and compensation of employees sum to the nominal value of GVA, the unit profit and unit labor cost deflators sum to the value of the GVA deflator in each period. By tracking the change in, say, the unit profit deflator relative to the change in the GVA deflator over time, we can determine the relative amount of changes in nominal GVA attributable to price changes – that is, changes in nominal GVA above or below changes in real GVA – which flow to capital as profits, or, in other words, how much of the nominal change in GVA attributable to inflation is ‘captured’ by capital in the form of a nominal increase in profit flows.²³ This percentage ‘capture of inflation by profits’ between periods t_0 and t_1 is calculated as follows:

$$Profits\ Capture = 100 \times \frac{Profit^D_{t_1} - Profit^D_{t_0}}{GVA^D_{t_1} - GVA^D_{t_0}}$$

In Figure 2, the profits capture and labor capture percentage is multiplied by the annual or quarterly inflation rate to determine the height of each bar. The profits and labor captures of inflation sum to 100 percent, since changes in the unit profit and unit labor cost deflators sum to the change in the GVA deflator. Note that if nominal profits and wages increased by the same percentage over a period so that neither gained relative to the other, the percentage capture of each factor would simply equal its share of

²² Profits are before taxes and before deductions for consumption of fixed capital, taxes on production and imports less subsidies plus business current transfer payments (net), and net interest and miscellaneous payments. This aggregate measure of profits is close to the firm-level measure of earnings before interest, taxes, depreciation, and amortization (EBITDA), a common indicator used to reflect firms’ ability to generate cash profits. Wages refers to compensation of employees, which includes wages and salaries as well as supplements to wages and salaries – also before-tax measurements.

²³ Similar calculations are performed in Bivens (2022a) and Bivens (2022b).

nominal GVA. Therefore, a period in which profits capture a relatively high portion of the increase in nominal GVA attributable to inflation would be reflected by a profits capture of inflation of more than 44 percent. Also note, however, that this calculation of course does not provide a causal explanation for inflation. An above average capture of inflation by either profits or labor simply reflects the fact that the factor was able to benefit from inflation in the form of increased nominal income flows relatively more than the other; it does not necessarily mean that the reason for price increases were conscious efforts to increase or compensate for these income flows.

Appendix B: Firm-level profits, volume, and price data

Notes on the data

Various data on pricing and sales volumes were compiled for our selection of firms. The data differs among firms in terms of public availability, comprehensiveness, meanings of terms, units of measurements, and more. The data presented is thus in no way systematic, nor standardized. The data is meant to provide a snapshot of how pricing and sales volumes fluctuated over the course of the pandemic for a handful of large firms in systemically significant sectors, and how this impacted profit magnitudes and margins. For each company, one graph is provided with pricing and volume data (top) and one graph with quarterly nominal profit magnitudes and margins.

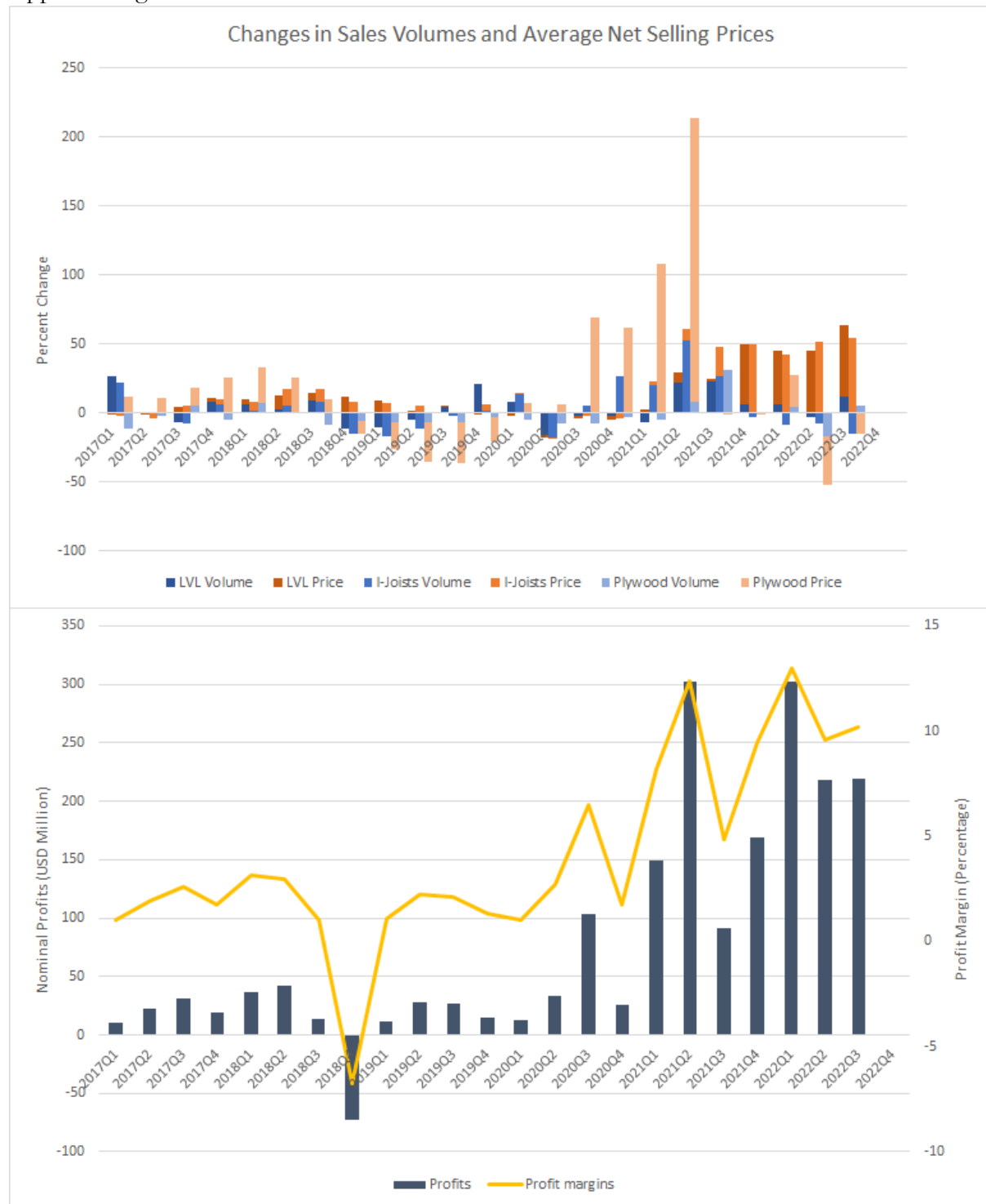
The profit data comes from Compustat. Profits are here defined as net income before extraordinary items. Profit margins are profit magnitudes divided by revenues. The data on pricing and volumes comes directly from publicly available quarterly earnings press releases, supplementals to press releases, and investor presentations. It generally reflects annual changes in average sales prices and volumes. In some cases, the numbers represent firm estimates of the contributions of changes in prices and volumes to annual changes in profits. In others, the numbers represent percent changes in average sales prices and volumes. Many firms provide more factors other than prices and volumes in their estimations of contributions to changes in profits, such as costs, in which cases we provide them. Some firms lump product ‘mix’ in with their category on pricing, obfuscating the interpretation of fluctuations as ones strictly of prices. For example, a large annual increase in a ‘local mix and price’ category could occur either due to price hikes or due to sales shifting to higher margin product lines. A similar issue arises with firms who provide data on average tickets. An increase in average tickets may arise either from an increase in prices or an increase in customers’ average purchasing bundles. Further note that these figures are non-GAAP estimates coming from the firms themselves, and are thus not recognized as standard accounting practices. Readers are therefore advised to take caution when interpreting these graphs. Nonetheless, the small-sample firm-level data provides an interesting robustness check for our arguments.

The firms are roughly divided into two groups. The Impulse Group corresponds to firms situated within upstream industries that saw large early price hikes, contributing to the *impulse* stage of inflation. These firms generally benefited from increases in commodity prices and supply bottlenecks in the form of enhanced profit magnitudes and margins. The Propagation and Amplification Group corresponds to firms that experienced cost shocks and raised prices to protect profit margins, thereby *propagating* and sometimes *amplifying* price pressures. Firms in this group saw varying levels of success in protecting and enhancing profit margins in the face of these cost shocks.

Appendix Table 1 provides a list of firms for which the data was compiled along with general summaries of the movements of prices, volumes and profits, comments on how the firm relates to our interpretation of the COVID-19 inflation, and notes on the data itself. For questions on specific sources, terms, methodology, etc., reach out to the authors.

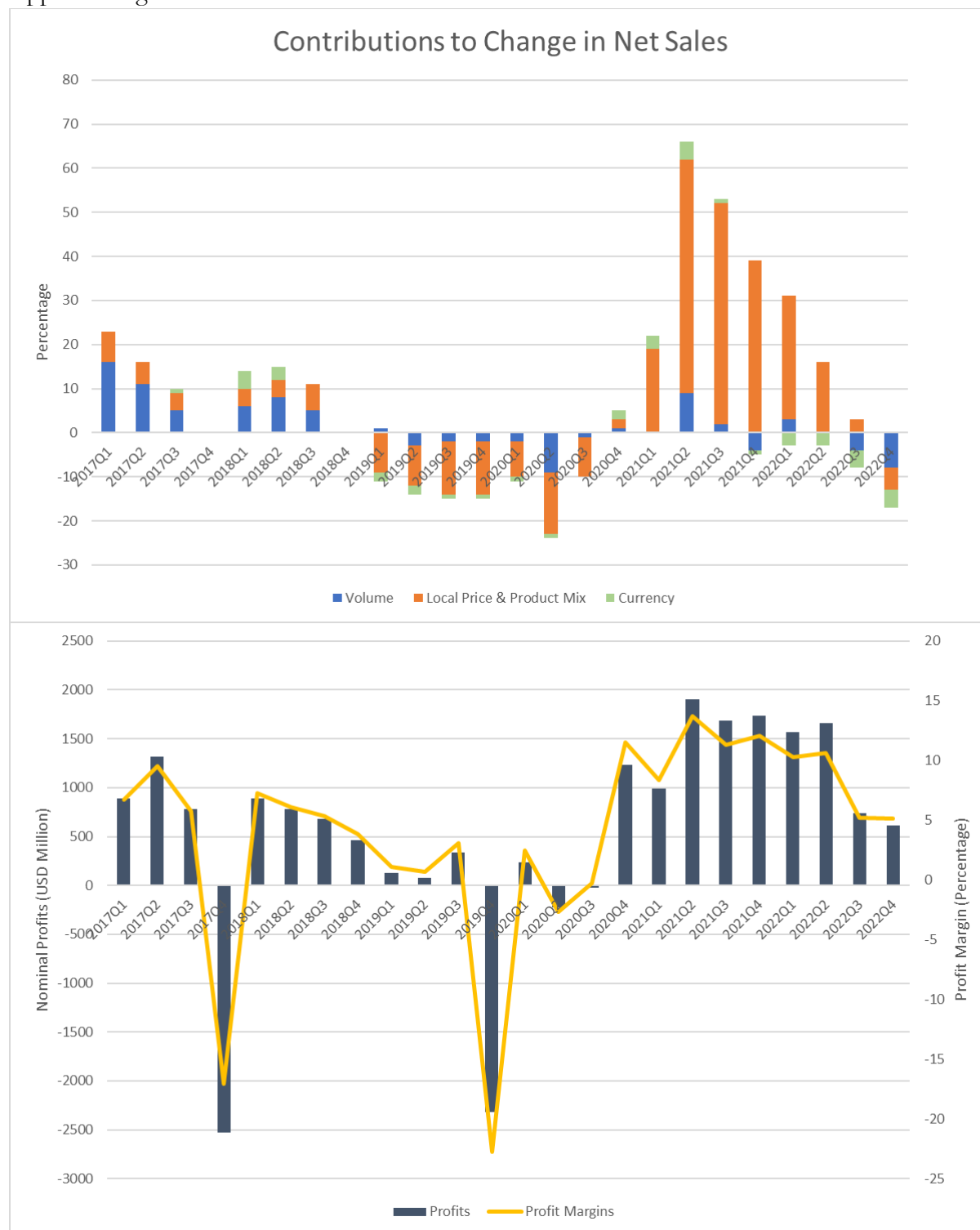
Impulse Group

Appendix Figure 1: Boise Cascade Co.



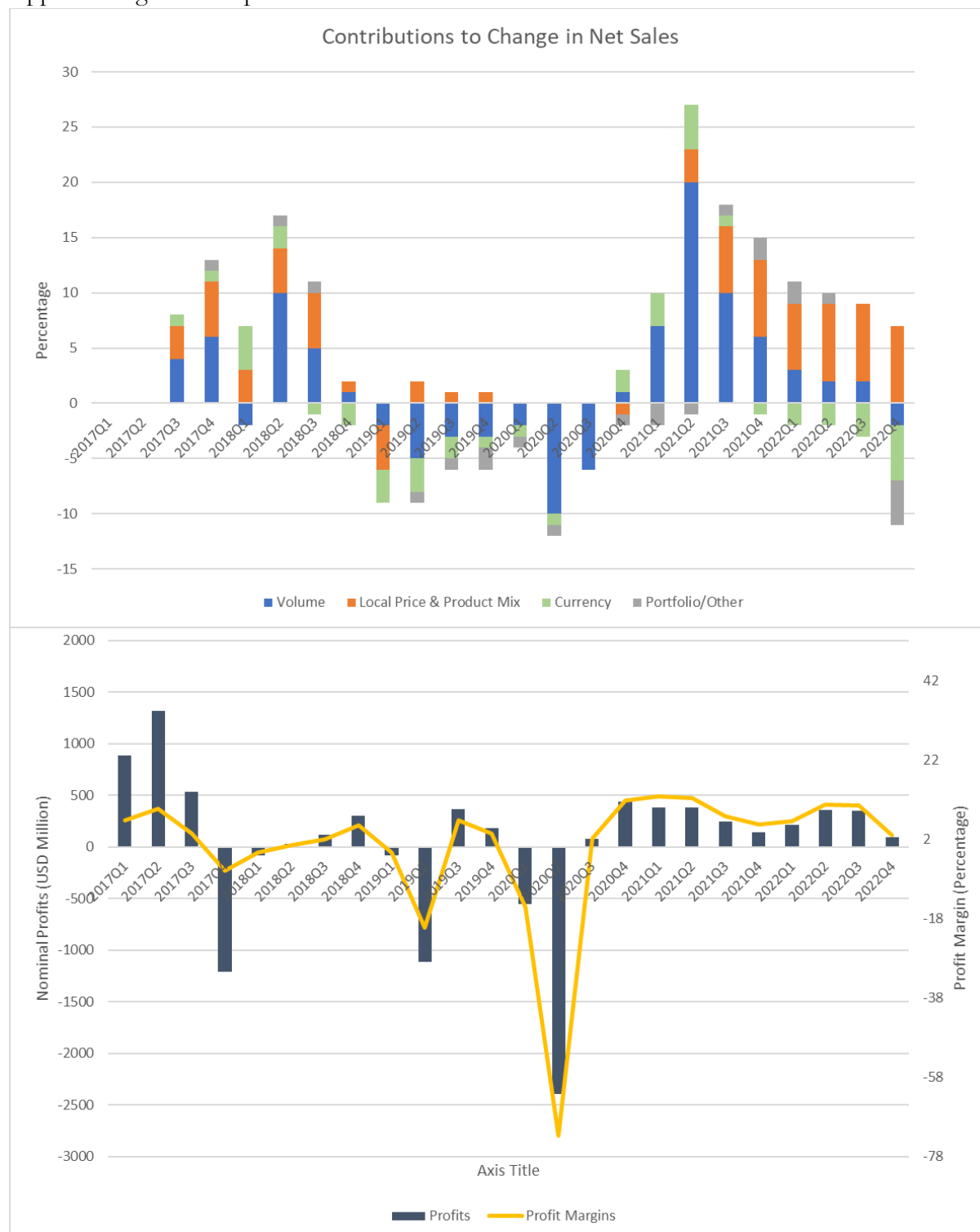
Note: (Top) Firm estimates of year-over-year percentage changes in average net selling prices and sales volumes for three different wood products. (Bottom) Quarterly profit magnitudes and margins. Profit magnitudes are defined as net income before extraordinary items, and margins are defined as profit magnitudes divided by revenue. *Source:* Price/volume data comes from quarterly earnings press releases. Profit data comes from Compustat. See 'Notes on the Data' for further comments on the data.

Appendix Figure 2: Dow Inc



Note: (Top) Firm estimates of percentage point contributions of changes in sales volumes, price and mix, and foreign exchange gains/losses to year-over-year changes in net sales. (Bottom) Quarterly profit magnitudes and margins. Profit magnitudes are defined as net income before extraordinary items, and margins are defined as profit magnitudes divided by revenue. *Source:* Price/volume data comes from quarterly earnings press releases and SEC filings. Pre-2019 data corresponds to The Dow Chemical Company, and subsequent data to Dow Inc. Profit data comes from Compustat. See 'Notes on the Data' for further comments on the data.

Appendix Figure 3: Dupont de Nemours Inc.

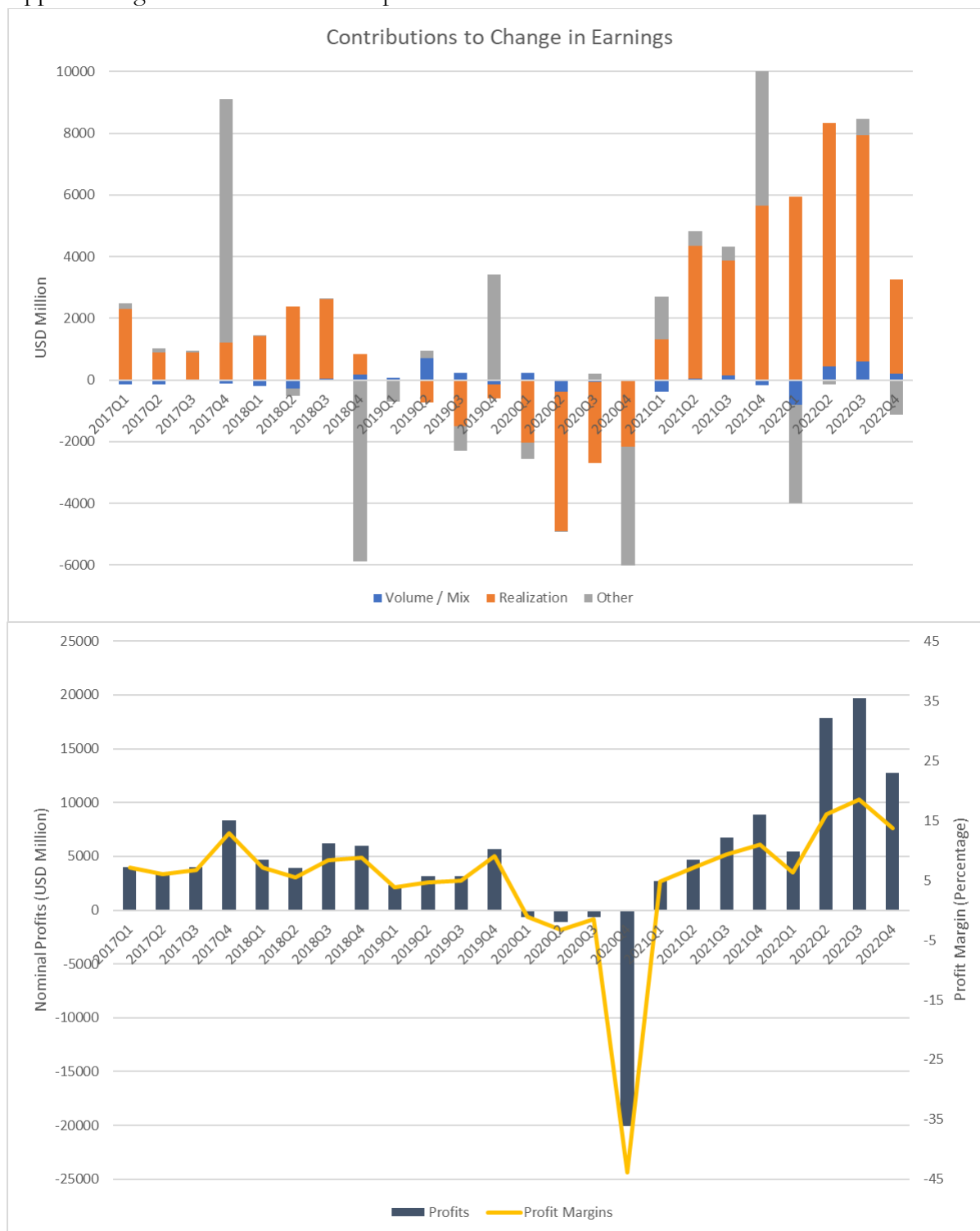


Note: (Top) Firm estimates of percentage point contributions of changes in sales volumes, price and mix, foreign exchange gains/losses, and 'other' to year-over-year changes in net sales.

(Bottom) Quarterly profit magnitudes and margins. Profit magnitudes are defined as net income before extraordinary items, and margins are defined as profit magnitudes divided by revenue.

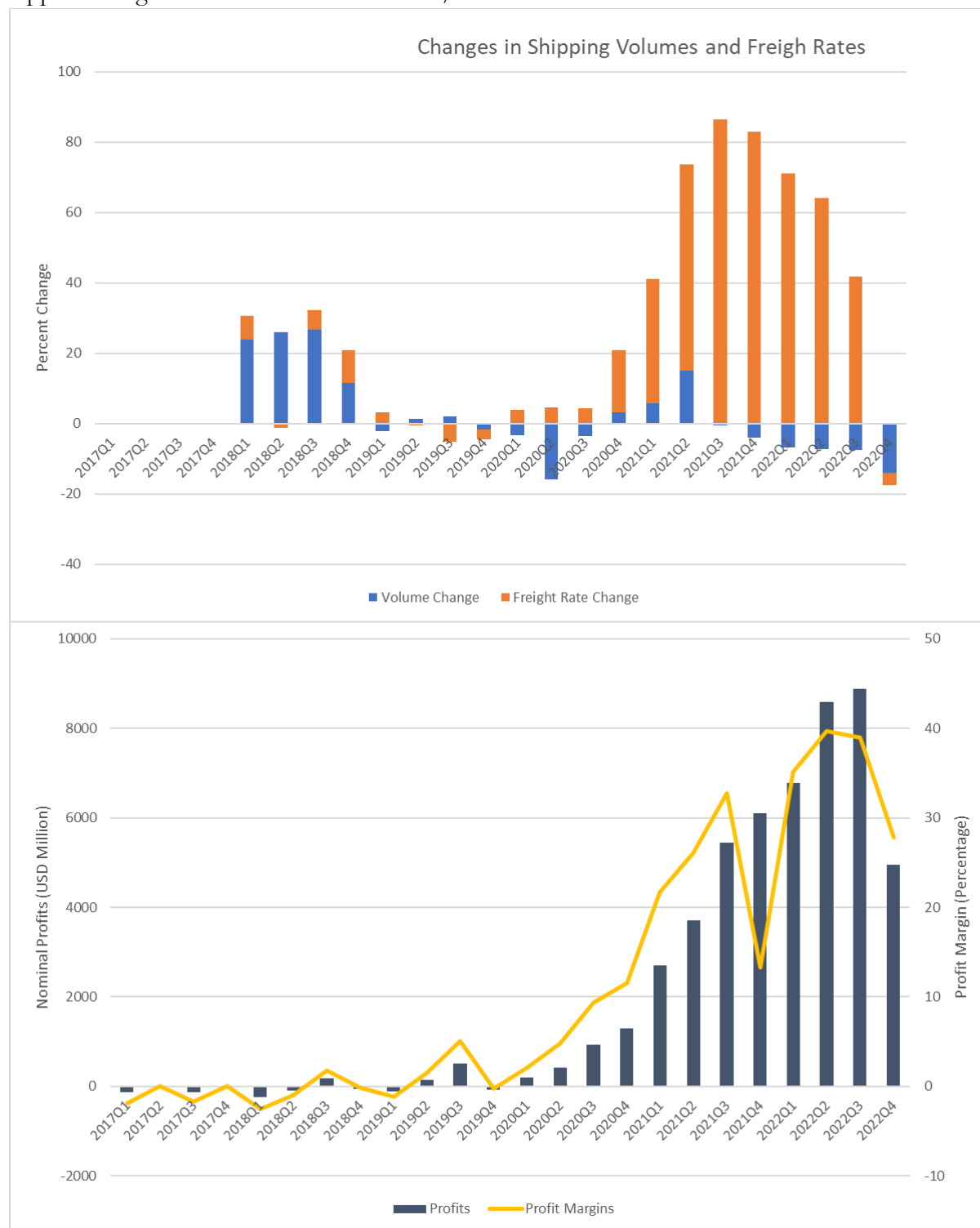
Source: Price/volume data comes from quarterly earnings press releases. Profit data comes from Compustat. See 'Notes on the Data' for further comments on the data.

Appendix Figure 4: ExxonMobil Corporation



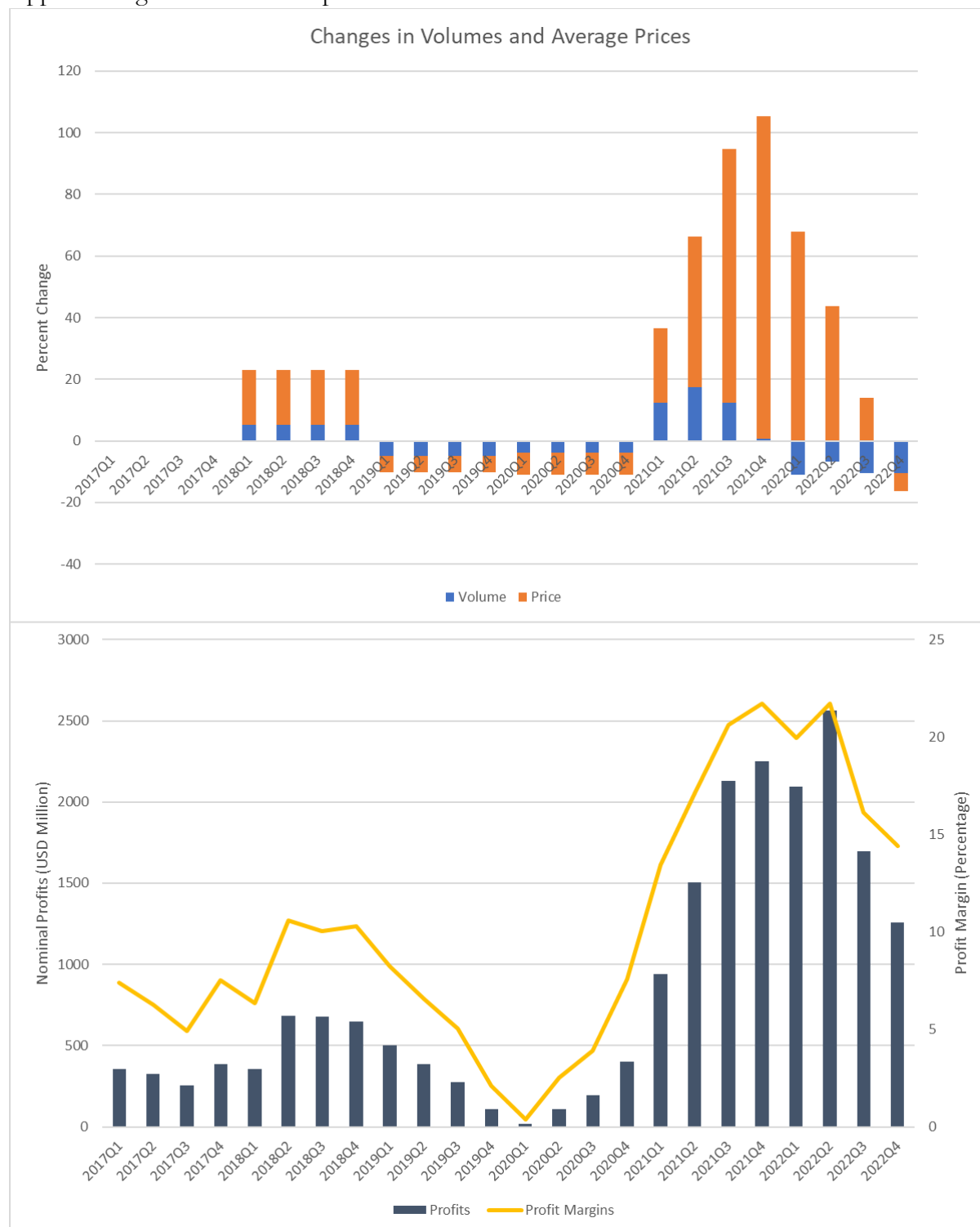
Note: (Top) Firm estimates of nominal contributions of changes in volume/mix, price ‘realization’, and ‘other’ to year-over-year changes in net income for Exxon Mobil’s upstream business segment. (Bottom) Quarterly profit magnitudes and margins. Profit magnitudes are defined as net income before extraordinary items, and margins are defined as profit magnitudes divided by revenue. *Source:* Price/volume data comes from quarterly earnings supplemental data. Profit data comes from Compustat. See ‘Notes on the Data’ for further comments on the data.

Appendix Figure 5: A.P. Møller – Mærsk A/S



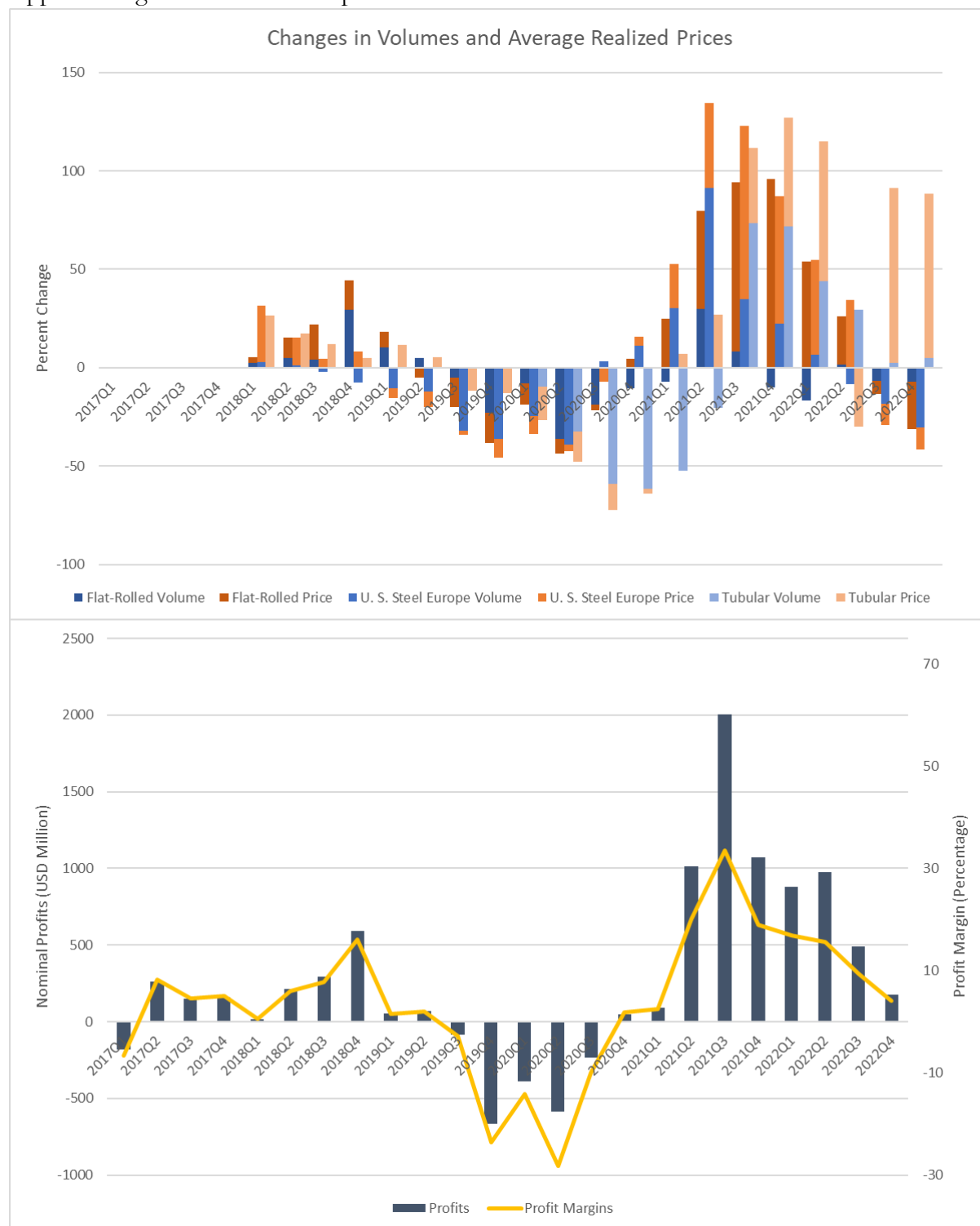
Note: (Top) Year-over-year percentage changes in loaded volumes and average loaded freight rates. (Bottom) Quarterly profit magnitudes and margins. Profit magnitudes are defined as net income before extraordinary items, and margins are defined as profit magnitudes divided by revenue. *Source:* Price/volume data comes from supplemental data to quarterly earnings releases and pertains to Maersk’s ocean business segment, which provides the bulk of total quarterly revenue. Profit data comes from Compustat. See ‘Notes on the Data’ for further comments on the data.

Appendix Figure 6: Nucor Corp



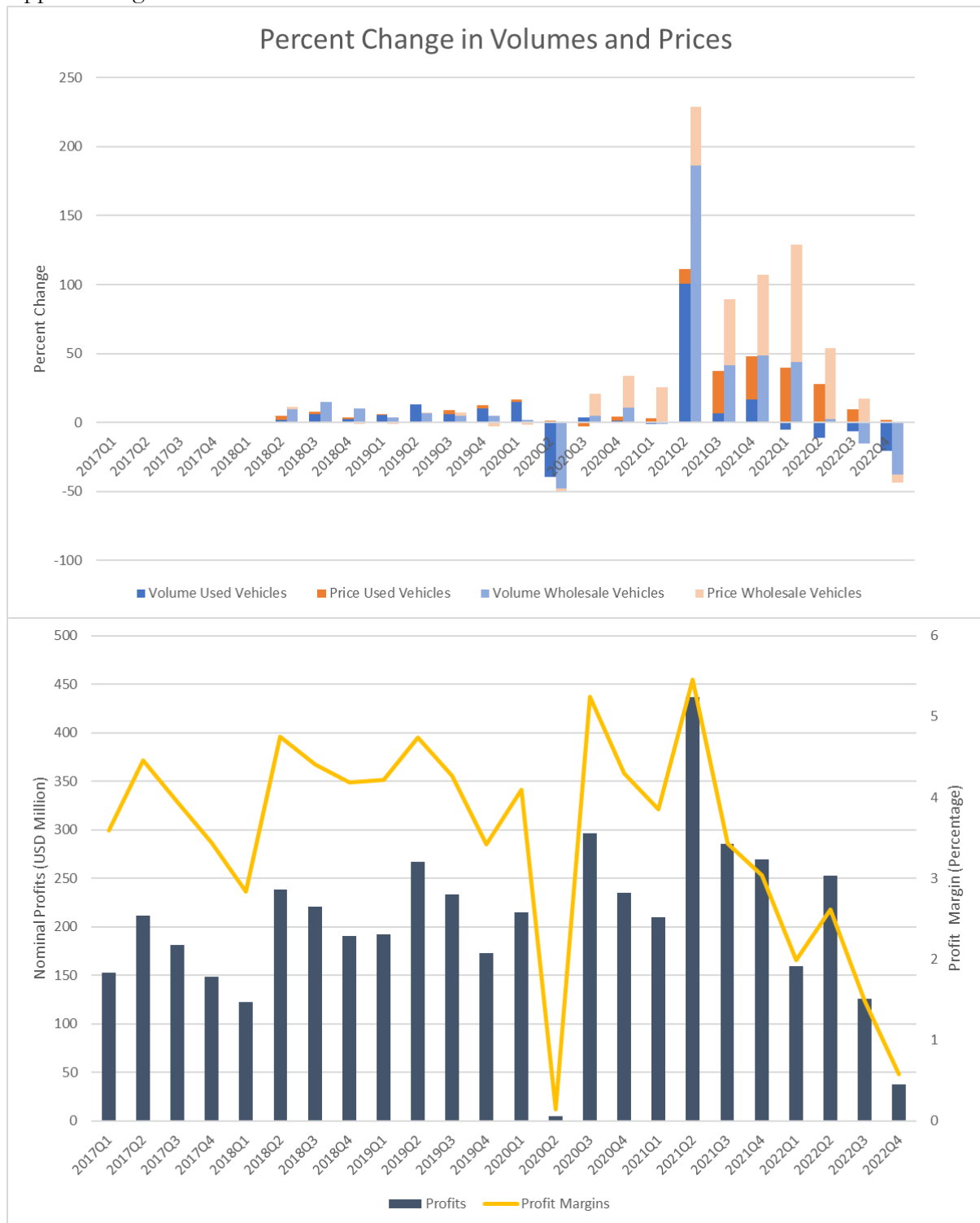
Note: (Top) year-over-year percent changes in total tons of all products sold and composite sales prices per ton. Before 2021 only annual data is publicly available, therefore quarterly results in the graph reflect annual numbers divided by 4 (hence why price/volume changes display as constant for four consecutive quarters). (Bottom) Quarterly profit magnitudes and margins. Profit magnitudes are defined as net income before extraordinary items, and margins are defined as profit magnitudes divided by revenue. *Source:* Price/volume data comes from quarterly sales and earnings data on steel tonnage. Profit data comes from Compustat. See 'Notes on the Data' for further comments on the data.

Appendix Figure 7: US Steel Corp.



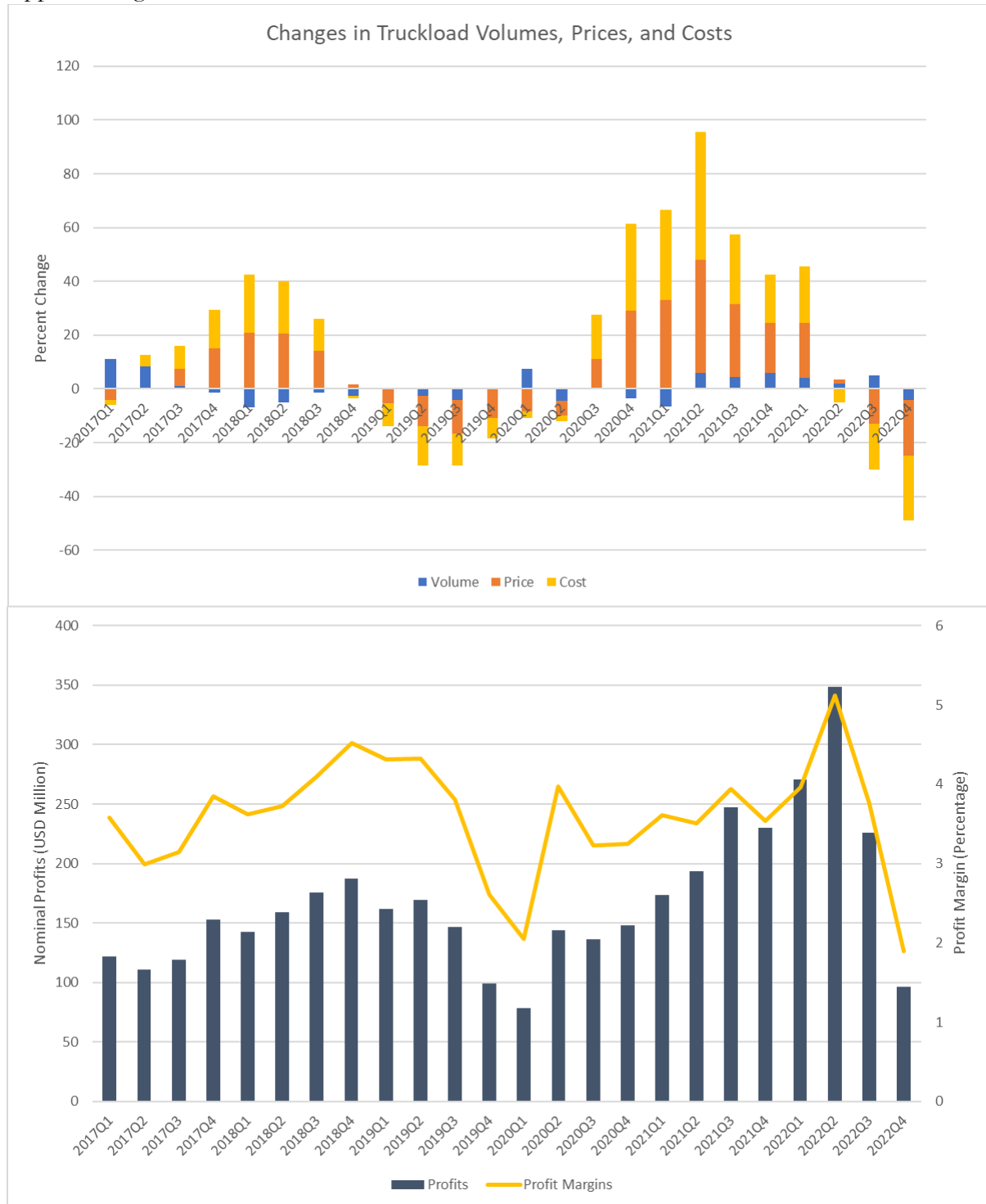
Note: (Top) Year-over-year percent changes in total tons of steel shipped and average realized prices for three business segments: Flat-Rolled, US Steel Europe and Tubular. (Bottom) Quarterly profit magnitudes and margins. Profit magnitudes are defined as net income before extraordinary items, and margins are defined as profit magnitudes divided by revenue. *Source:* Price/volume data comes from quarterly earnings press releases. Profit data comes from Compustat. See 'Notes on the Data' for further comments on the data.

Propagation and Amplification Group
 Appendix Figure 8: Carmax Inc.



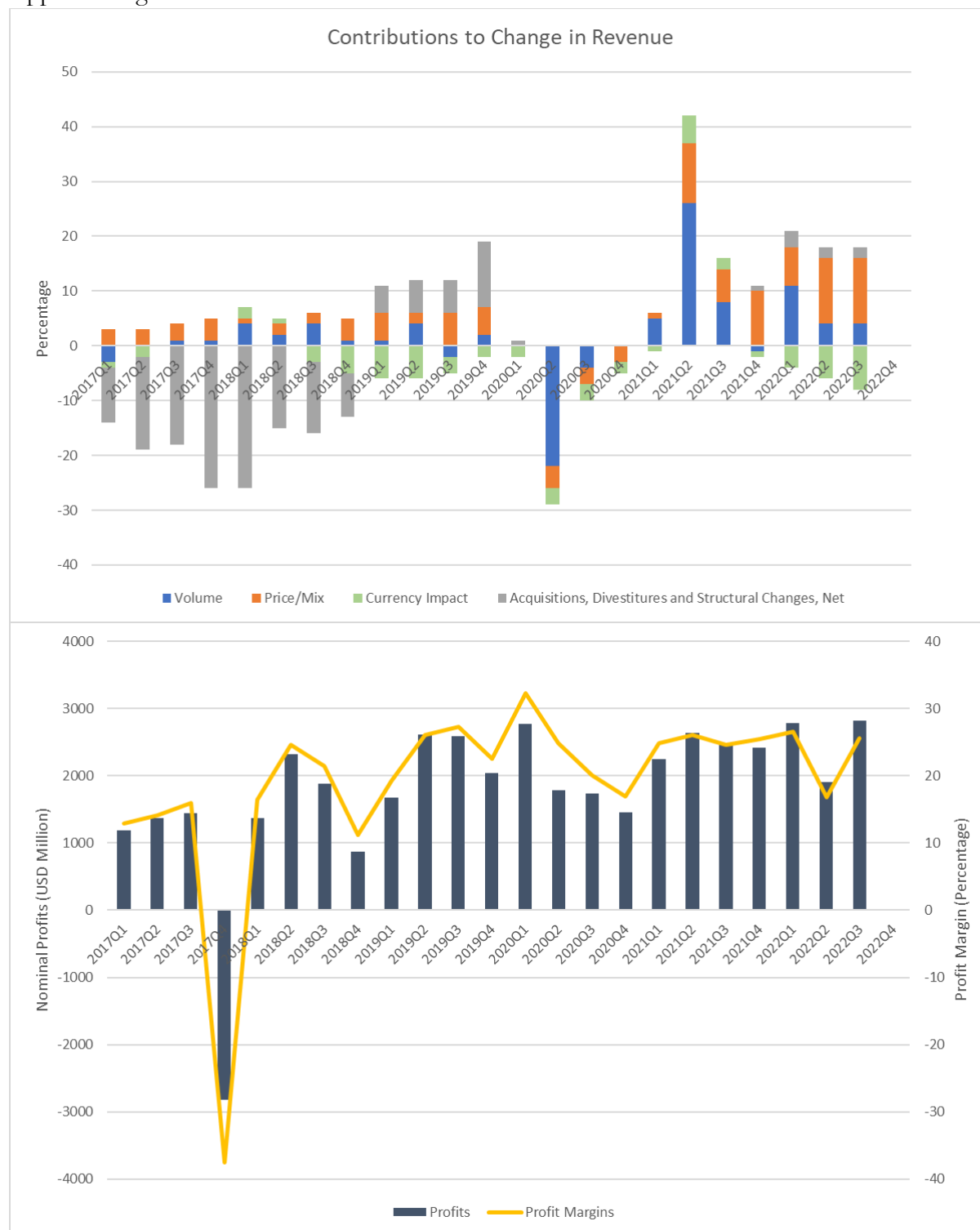
Note: (Top) Firm estimates of year-over-year percentage changes in average selling prices and sales volumes for used and wholesale vehicles. (Bottom) Quarterly profit magnitudes and margins. Profit magnitudes are defined as net income before extraordinary items, and margins are defined as profit magnitudes divided by revenue. *Source:* Price/volume data comes from quarterly earnings press releases. Profit data comes from Compustat. See 'Notes on the Data' for further comments on the data.

Appendix Figure 9: C.H. Robinson



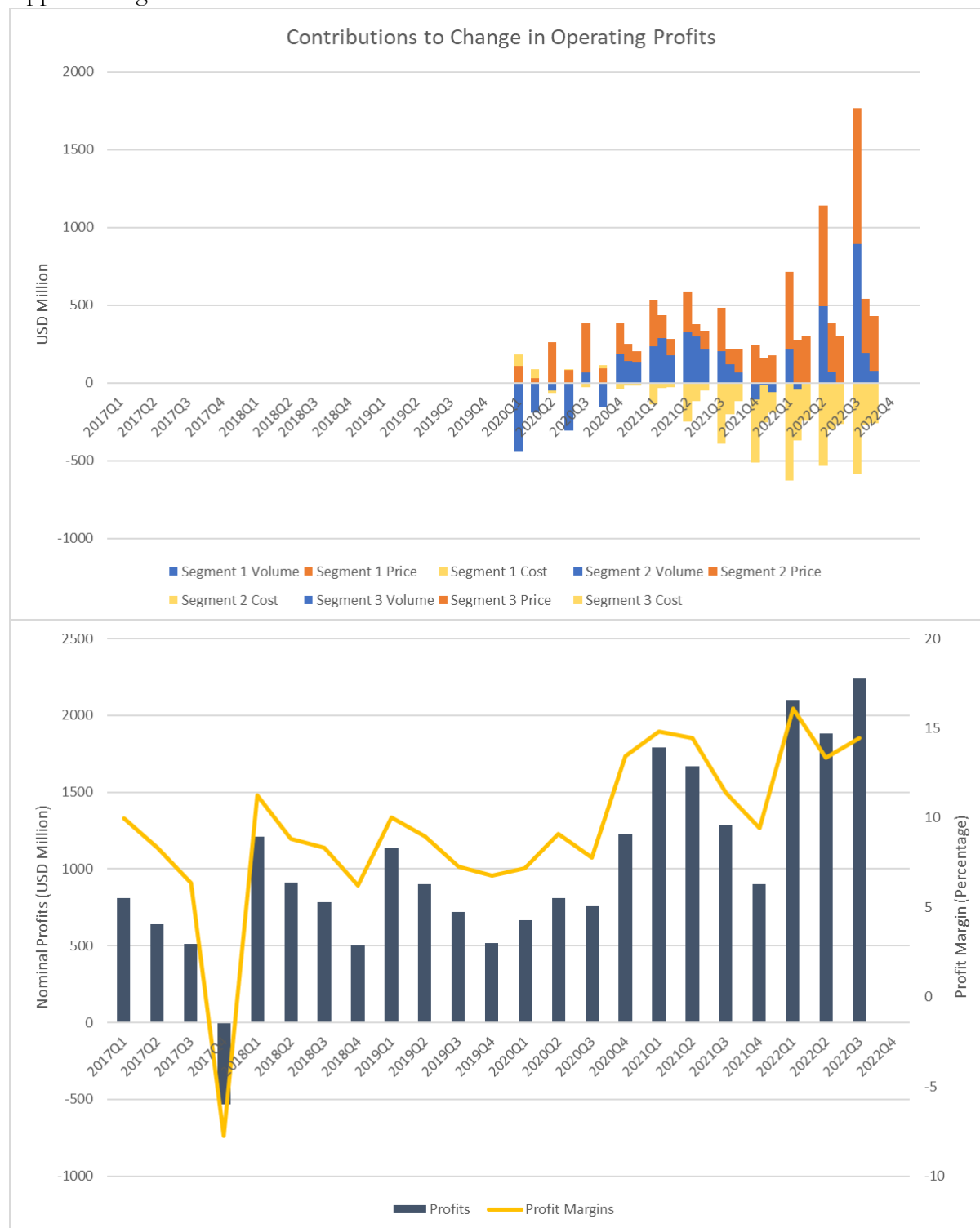
Note: (Top) Firm estimates of year-over-year percent changes in truckload volumes, average prices and average costs. (Bottom) Quarterly profit magnitudes and margins. Profit magnitudes are defined as net income before extraordinary items, and margins are defined as profit magnitudes divided by revenue. *Source:* Price/volume data comes from quarterly earnings call presentations. Profit data comes from Compustat. See ‘Notes on the Data’ for further comments on the data.

Appendix Figure 10: Coca-Cola Co.



Note: (Top) Firm estimates of percentage point contributions of changes in sales volumes, price/mix, foreign exchange gains/losses, and ‘acquisitions, divestitures, and structural changes’ to year-over-year changes in net revenue. (Bottom) Quarterly profit magnitudes and margins. Profit magnitudes are defined as net income before extraordinary items, and margins are defined as profit magnitudes divided by revenue. *Source:* Price/volume data comes from quarterly earnings press releases. Profit data comes from Compustat. See ‘Notes on the Data’ for further comments on the data.

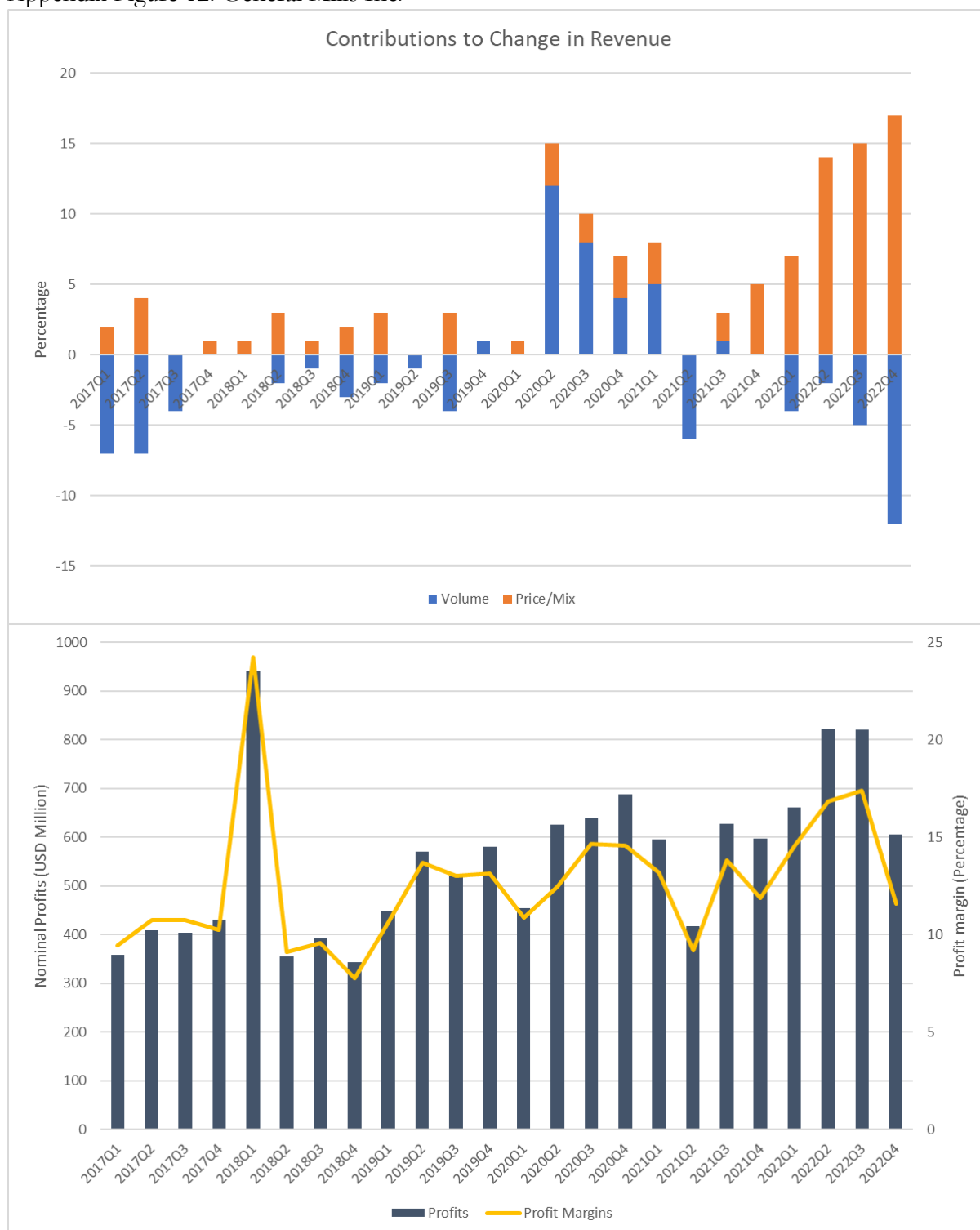
Appendix Figure 11: Deere & Co.



Note: (Top) Firm estimates of nominal contributions of changes in sales volumes, prices and costs to year-over-year changes in operating profits for three business segments: production and precision agriculture, small agriculture and turf, and construction and forestry. Before 2020-Q4 there were only two business segments: agriculture and turf, and construction and forestry. Negative cost changes (yellow bars below the x axis) signify an increase in costs from the previous year, contributing to a decline in profits over the previous year. (Bottom) Quarterly profit magnitudes and margins. Profit magnitudes are defined as net income before extraordinary items, and margins are defined as profit magnitudes divided by revenue. *Source:* Price/volume

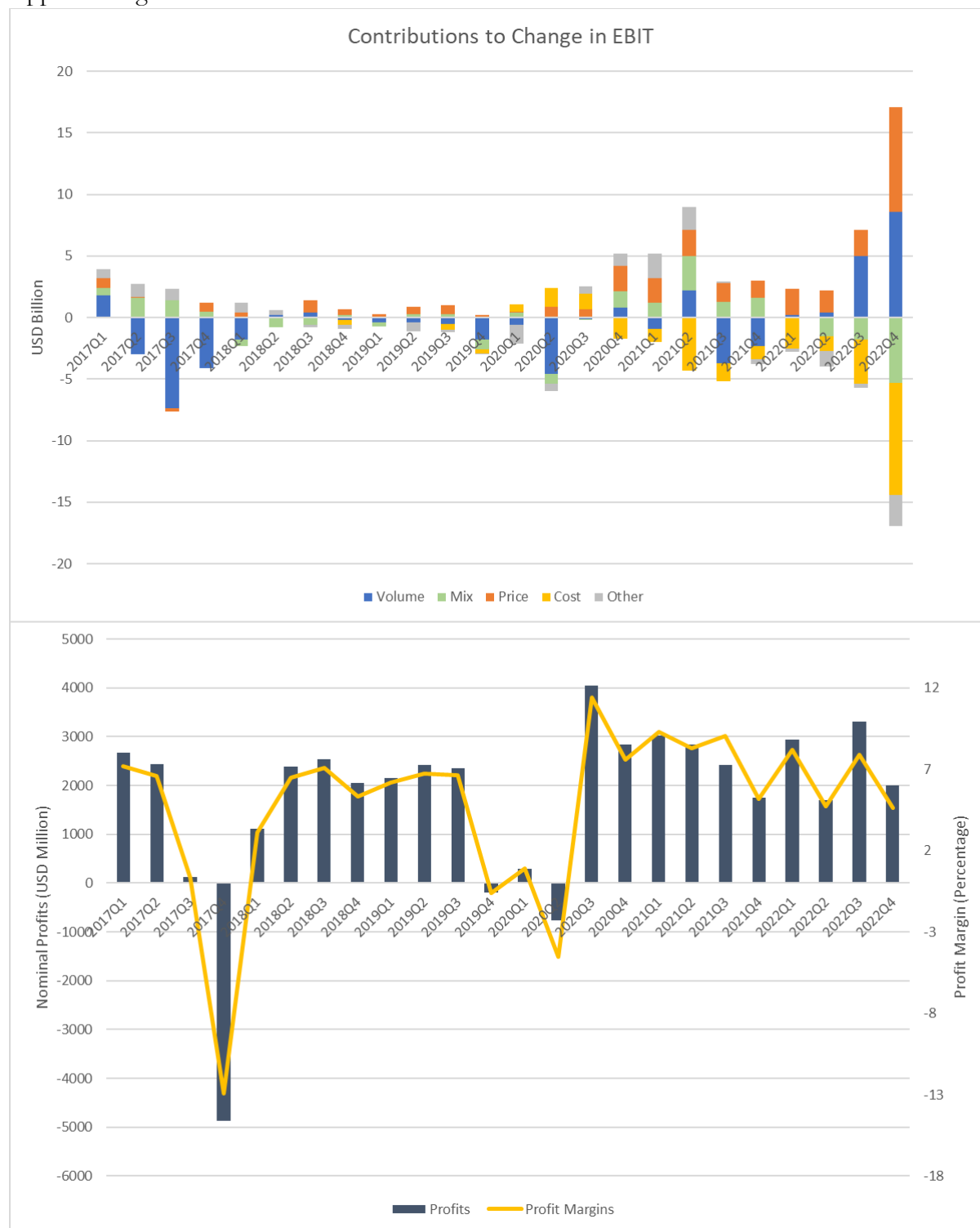
data comes from quarterly earnings press releases. Profit data comes from Compustat. See 'Notes on the Data' for further comments on the data.

Appendix Figure 12: General Mills Inc.



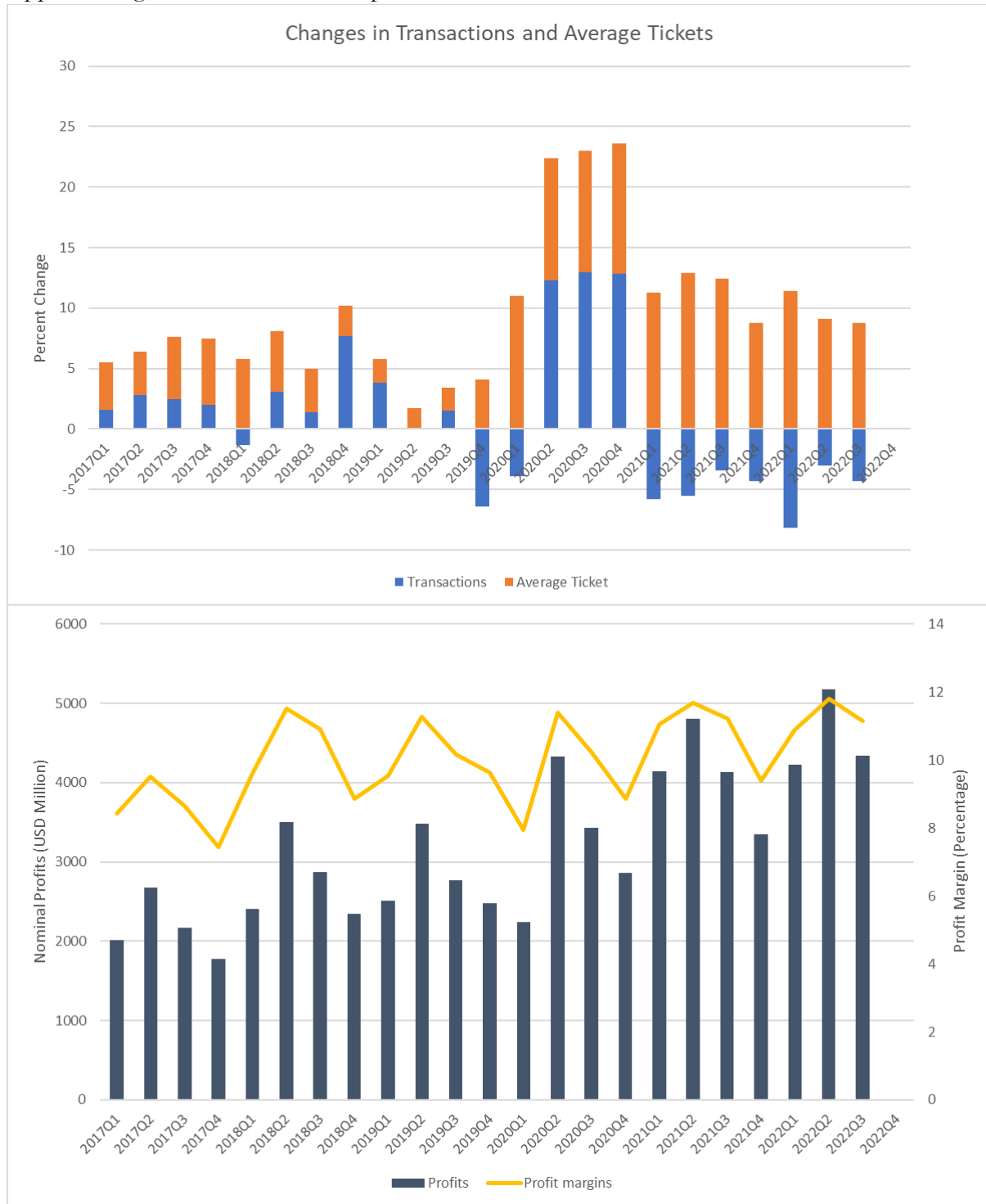
Note: (Top) Firm estimates of percentage point contributions of changes in sales volumes and price/mix to year-over-year changes in organic net sales. (Bottom) Quarterly profit magnitudes and margins. Profit magnitudes are defined as net income before extraordinary items, and margins are defined as profit magnitudes divided by revenue. *Source:* Price/volume data comes from quarterly earnings press releases. Profit data comes from Compustat. See 'Notes on the Data' for further comments on the data.

Appendix Figure 13: General Motors Co.



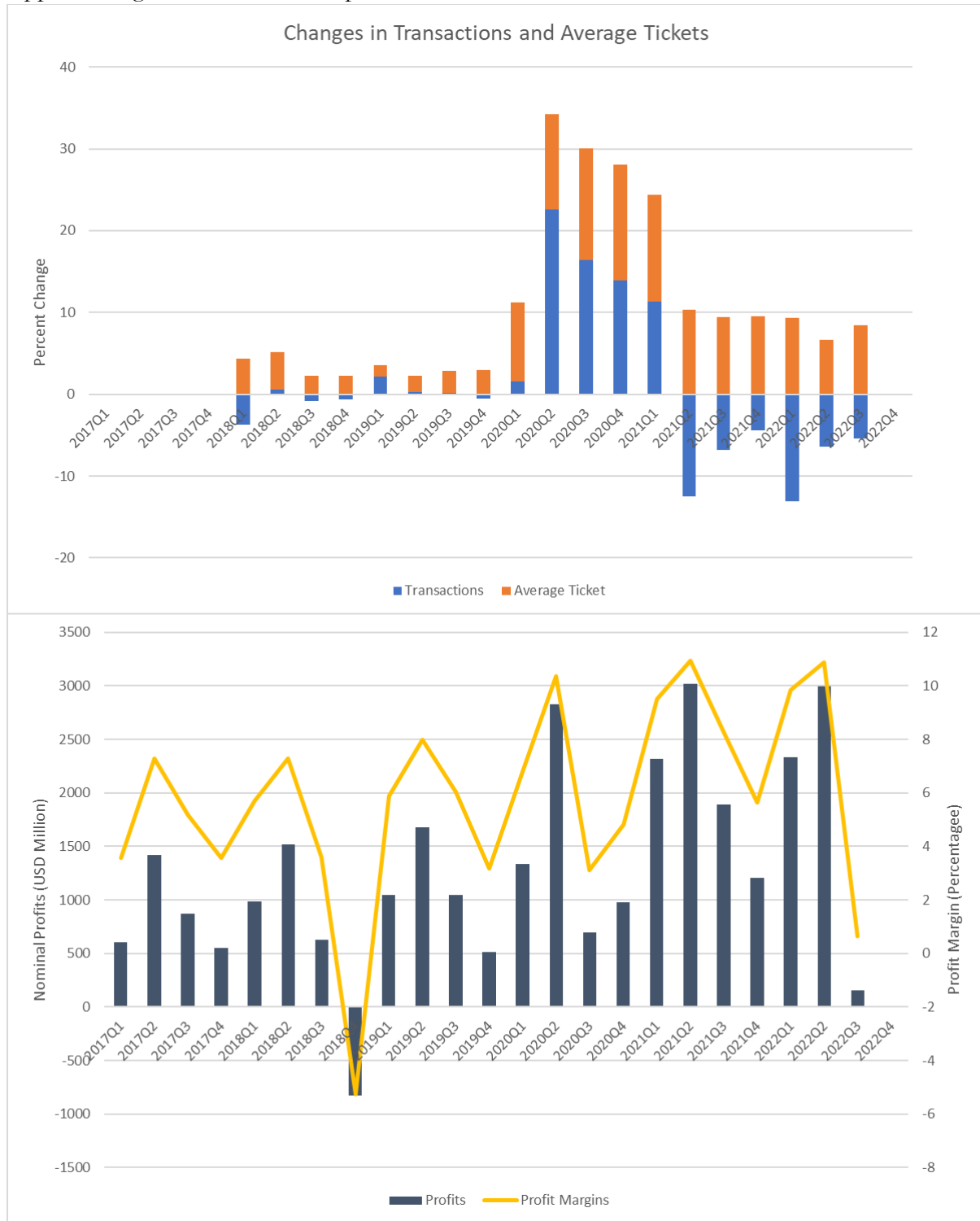
Note: (Top) Firm estimates of nominal contributions of changes in sales volumes, mix, prices, costs and 'other' to year-over-year changes in EBIT. In some quarters the category 'GM Financial' was added to the category 'other'. Negative cost changes (yellow bars below the x axis) signify an increase in costs from the previous year, contributing to a decline in profits over the previous year. (Bottom) Quarterly profit magnitudes and margins. Profit magnitudes are defined as net income before extraordinary items, and margins are defined as profit magnitudes divided by revenue. *Source:* Price/volume data comes from quarterly earnings call presentations. Profit data comes from Compustat. See 'Notes on the Data' for further comments on the data.

Appendix Figure 14: The Home Depot Inc.



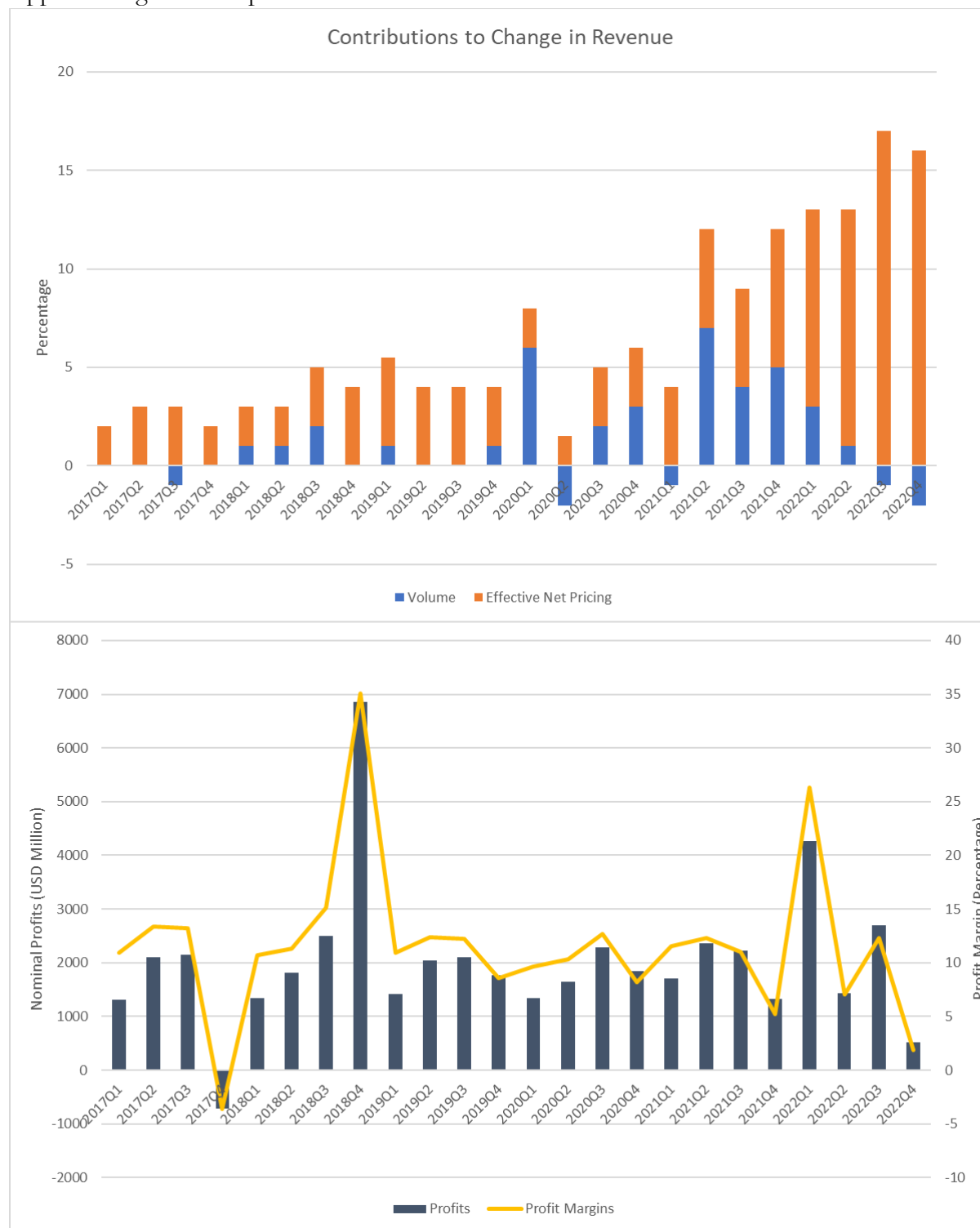
Note: (Top) Firm estimates of year-over-year percentage changes in transactions and average tickets. (Bottom) Quarterly profit magnitudes and margins. Profit magnitudes are defined as net income before extraordinary items, and margins are defined as profit magnitudes divided by revenue. *Source:* Price/volume data comes from quarterly earnings press releases. Profit data comes from Compustat. See 'Notes on the Data' for further comments on the data.

Appendix Figure 15: Lowe's Companies Inc.



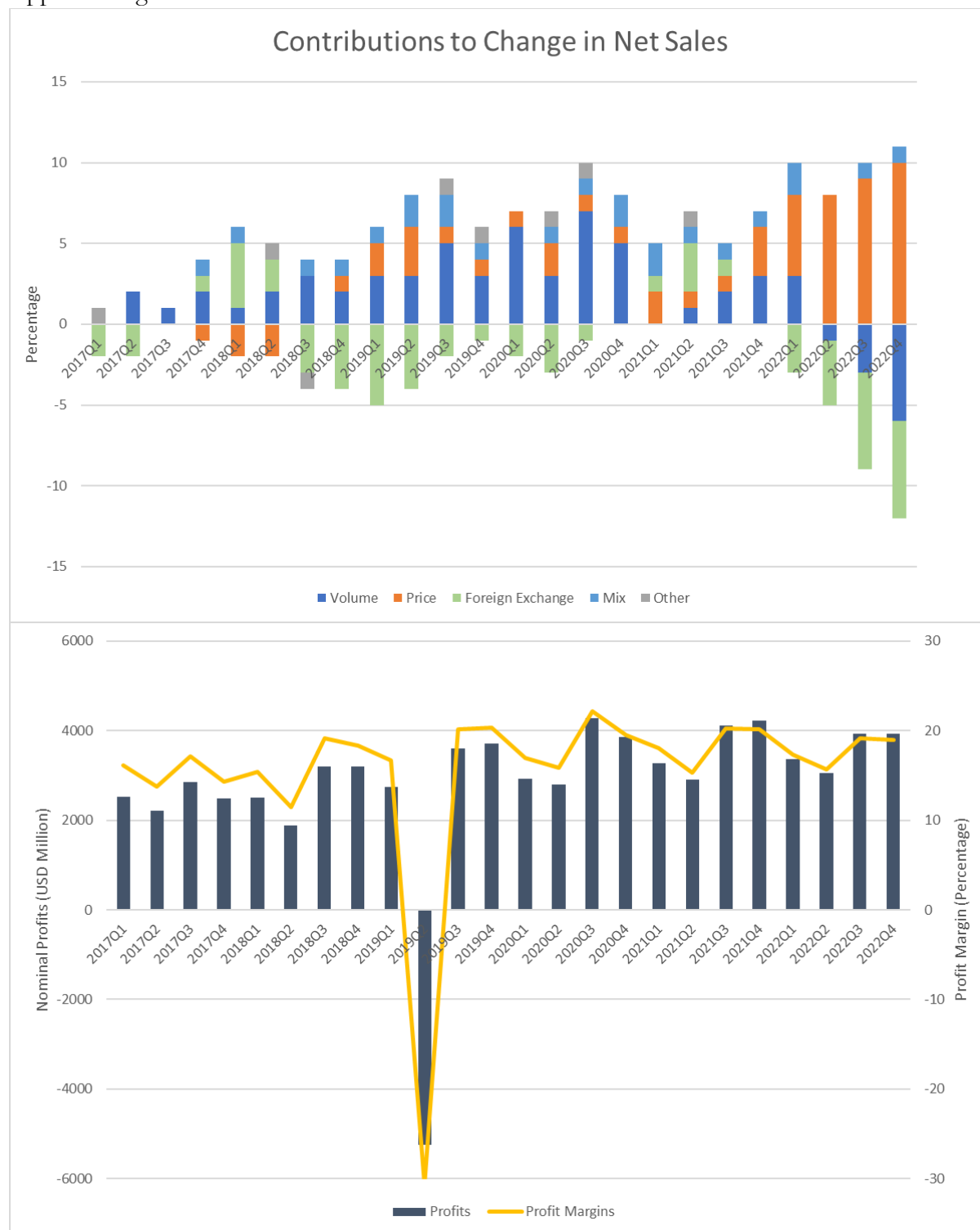
Note: (Top) Firm estimates of year-over-year percentage changes in transactions and average tickets. (Bottom) Quarterly profit magnitudes and margins. Profit magnitudes are defined as net income before extraordinary items, and margins are defined as profit magnitudes divided by revenue. *Source:* Price/volume data comes from quarterly earnings press releases. Profit data comes from Compustat. See 'Notes on the Data' for further comments on the data.

Appendix Figure 16: PepsiCo Inc.



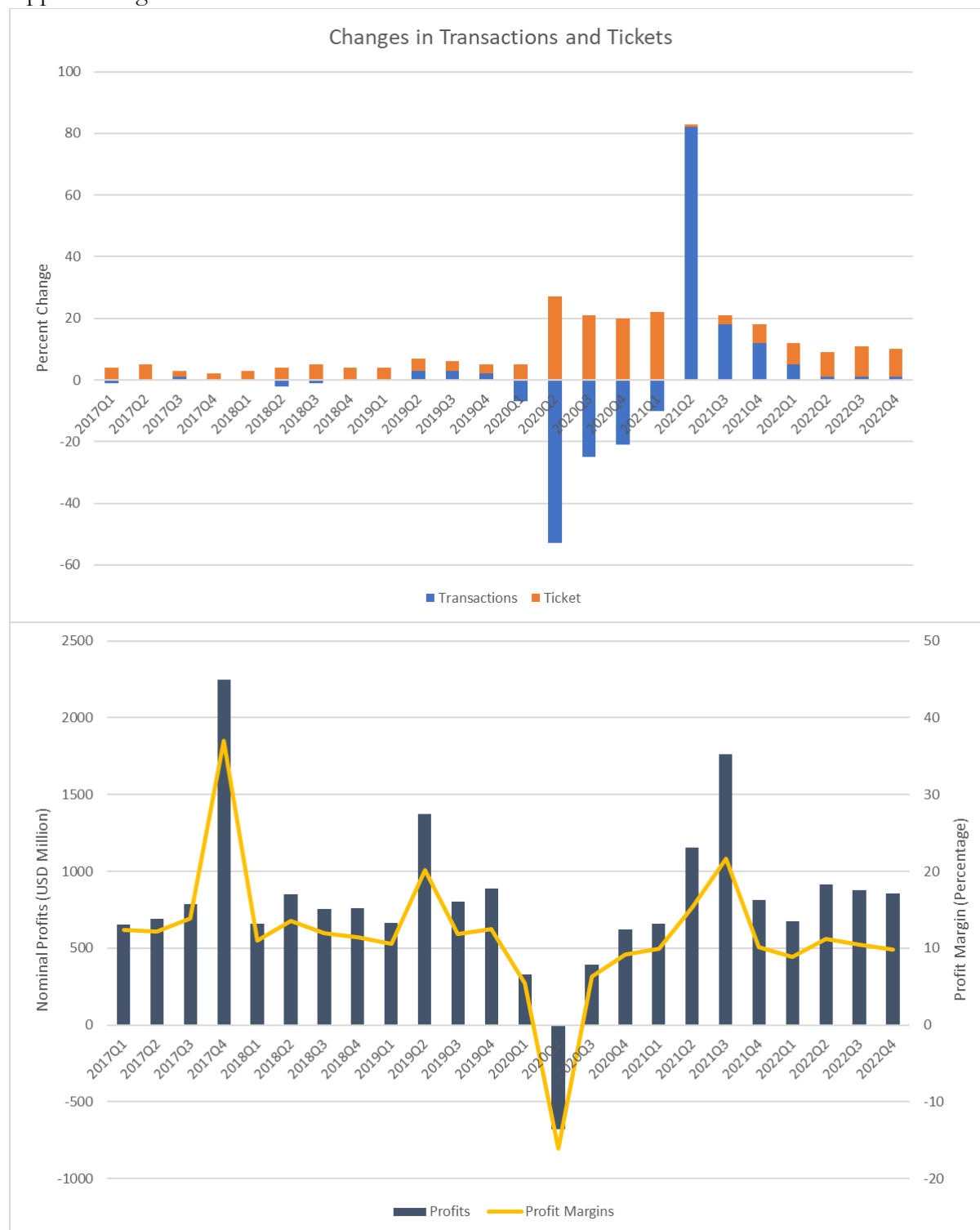
Note: (Top) Firm estimates of percentage point contributions of changes in sales volumes and effective net pricing to year-over-year changes in net revenue. Effective net pricing reflects the year-over-year impact of discrete pricing actions, sales incentive activities and mix resulting from selling varying products in different package sizes and in different countries. (Bottom) Quarterly profit magnitudes and margins. Profit magnitudes are defined as net income before extraordinary items, and margins are defined as profit magnitudes divided by revenue. *Source:* Price/volume data comes from quarterly earnings press releases. Profit data comes from Compustat. See 'Notes on the Data' for further comments on the data.

Appendix Figure 17: Procter & Gamble Co.



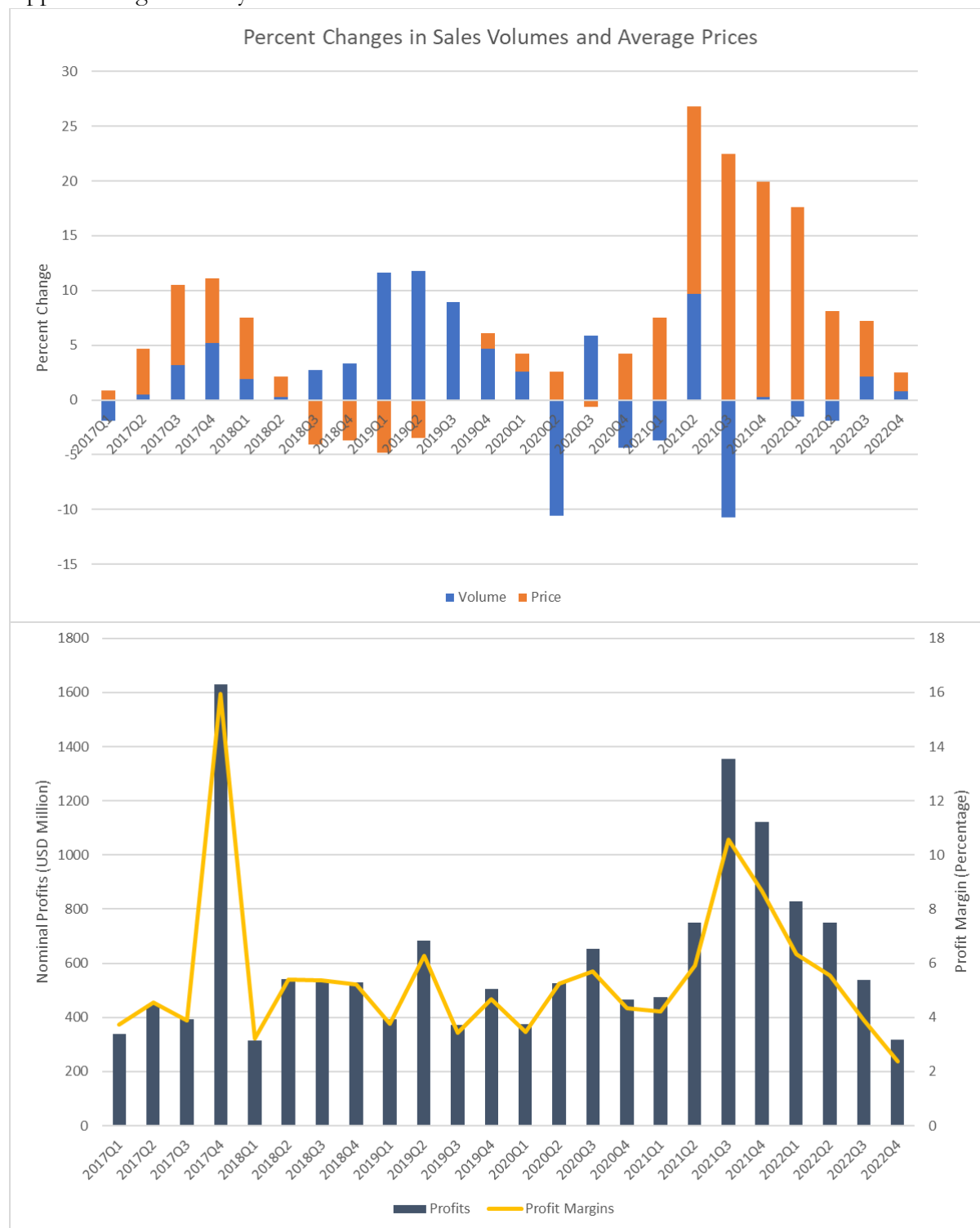
Note: (Top) Firm estimates of percentage point contributions of changes in sales volumes, prices, foreign exchange gains/losses, product mix, and ‘other’ to year-over-year changes in net sales. (Bottom) Quarterly profit magnitudes and margins. Profit magnitudes are defined as net income before extraordinary items, and margins are defined as profit magnitudes divided by revenue. *Source:* Price/volume data comes from quarterly earnings press releases. Profit data comes from Compustat. See ‘Notes on the Data’ for further comments on the data.

Appendix Figure 18: Starbucks Co.



Note: (Top) Firm estimates of year-over-year percentage changes in transactions and average tickets. (Bottom) Quarterly profit magnitudes and margins. Profit magnitudes are defined as net income before extraordinary items, and margins are defined as profit magnitudes divided by revenue. *Source:* Price/volume data comes from quarterly earnings press releases and pertains to Starbucks' Americas business segment before 2021-Q3 and the North America business segment afterwards, as Starbucks made changes to its business segmentation. Profit data comes from Compustat. See 'Notes on the Data' for further comments on the data.

Appendix Figure 19: Tyson Foods Inc.



Note: (Top) Firm estimates of year-over-year percent changes in total sales volumes and average sales prices. (Bottom) Quarterly profit magnitudes and margins. Profit magnitudes are defined as net income before extraordinary items, and margins are defined as profit magnitudes divided by revenue. *Source:* Price/volume data comes from quarterly earnings press releases and SEC filings. Profit data comes from Compustat. See ‘Notes on the Data’ for further comments on the data.