Inflationary Pressures Surrounding COVID – Are Price Increases Consistent With Changes in Costs

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Evidence suggests that companies are more eager to raise prices than to cut them (Karaian et al., 2023). Profit margins remain high even as inflation drops. This is accomplished by raising or holding prices steady as inflation shrinks. We examine the changes in selling prices and underlying costs between pre and post COVID periods. We expect that the shift in the relation between selling price and underlying costs prior to COVID would be less than the shift post-COVID. We investigate grocery food items because food inflation has been a main driver of inflation in the United States and other countries (Cavallo, 2022). Focusing on this specific cost behavior between the pre- and post-COVID periods allows us to measure the relationship between raising selling prices and related underlying increases in cost of goods sold and selling, as well as general and administrative expenses. The inference from our analyses suggests that food companies may have taken advantage of COVID-driven inflation to justify and increase their profit margins.

Keywords: profit margins, COVID effects on pricing, food costs, company pricing behavior

INTRODUCTION

The coronavirus disease (COVID-19) pandemic was announced by the World Health Organization (WHO) on March 11, 2020. The pandemic resulted in unexpected economic shocks that affected a wide range of industries worldwide, leading to supply-chain disruptions, increased unemployment, and shifting demand, which taken together, resulted in price volatility.

Food prices are skyrocketing around the world. In January 2022, according to the Food and Agriculture Organization's (FAO) food price index of the United States (Vos et al., 2022; Figure 1), international prices for major food items climbed to a level near the heights of the global food price crises of 2007-08 and 2010-11. Astonishingly, world food prices jumped nearly 13% in March 2022 to a new record high as the war in Ukraine caused turmoil in markets for staple grains and edible oils (Trompiz, 2022).

Costs to produce and distribute companies' products play a key role in pricing. Companies deal with inflation by raising prices, accepting smaller margins, or reducing product costs (and often quality). Faced with this trilemma, most managers ultimately raise their prices, then look for clever ways to mitigate the subsequent crisis (Koenigsberg, 2022). If production costs continue to increase, companies will need to raise prices to accommodate the added costs and expenses. Similar to production costs, the operating cost

of selling, general and administrative (SGA) expenses can also go up and negatively affect companies' bottom line unless they can raise their selling prices.

FIGURE 1
FAO MONTHLY FOOD PRICE INDEX IN NOMINAL TERMS

Chart: IFPRI Source: Vos et al. 2022

Prior research studies on asymmetric cost behavior, also referred to as cost stickiness, have shown that SGA costs are asymmetrically and significantly associated with changes in sales revenues (Anderson et al., 2003; Balakrishnan et al., 2004; Banker and Chen, 2006). Particularly, the results of these studies suggest that selling, general, and administrative costs (SGA) rise more for sales increases than they fall for equivalent decreases. Asymmetric cost-sales behavior is explained by managerial decisions to increase selling prices due to the need to recover increased costs (Anderson et al., 2003).

Typically, products increase in price to match higher operating costs, increases in hires, or increases in prices of needed materials. To ensure the same high quality level, sometimes the company must raise the price. For instance, as some raw materials become increasingly scarce and expensive, companies that utilize these materials are forced to increase the prices for products that use them rather than face a potential reduction in quality.

In this study, we are interested in whether there is a difference in observations before and after an intervention, which will suggest whether the intervention had a causal effect or not. Focusing on the relation between changes in selling prices and changes in underlying cost, the intervention in our study is the COVID-19 pandemic occurring in 2020. We expect that the shift in the relation between selling price and underlying costs prior to COVID would be less than the shift post-COVID (regression coefficient on change of cost of goods sold (COGS) and selling, general and administrative expenses (SGA) would be greater across the pre COVID to post COVID period). We base our investigation on popular grocery food items because food inflation has been one of the main drivers of inflation in the United States and other countries (Cavallo, 2022). Focusing on this specific cost behavior enables us to establish a relatively strong link between the pre and post COVID periods where we can measure the relation between raising selling prices and related underlying increases in cost of goods sold and selling, general and administrative expenses.

We investigate if the changes in sales prices exceed the changes in cost of goods sold and selling, general, and administrative expenses. Specifically, we examine if companies are increasing revenues faster than the changes in costs justify. We expect the coefficient on change in cost of goods sold (Δ COGS) and selling, general and administrative expenses (Δ SGA) will be greater post COVID than pre COVID. A comparison of the estimated coefficients in a regression linking changes in sales revenue to changes in underlying costs will provide evidence regarding our hypotheses that companies were taking advantage of the COVID situation to raise prices above the changes in underlying costs.

Using a sample of 25 and 24 food oligopolies or monopolies for the top four companies that, when combined, their sales exceed 60% of sales in each food category established in the study by Lakhani et al. (2021), we explore the price-to-cost linkages. Our analysis is a comprehensive study in a particular industry across the pre-COVID period of 2018-2019 and the post COVID period of 2021-2022. We provide evidence that supports our expectations outlined above.

Our comparisons indicate that the positive relation between the cost of goods sold and the change of sale revenue is larger for the post period. Specifically, in pre COVID, every 1% increase in the cost of goods sold is associated with a 0.6103 increase in sales revenue while in post COVID, every 1% increase in the cost of goods sold is associated with a 1.0640 increase in sales revenue. In addition, the positive relation between the change of selling, general, and administrative expenses and change of sales revenue is larger for the post-COVID period. Specifically, in pre-COVID, every 1% increase in selling, general, and administrative expenses is associated with a 0.6501 increase in sales revenue, while in post COVID, every 1% increase in selling, general, and administrative expenses is associated with a 1.0510 increase in sales revenue.

It is very important to note that the coefficients on Δ COGS and on Δ SGA are not only greater post COVID than pre COVID but exceed 1.00 post-COVID while they are less than 1.00 pre COVID. This result is consistent with the prediction of our hypothesis that companies are using COVID and other factors causing inflation to justify raising selling prices more than is justified by the increases in cost of goods sold and selling, general, and administrative expenses. The inference is that increased cost of goods sold combined with increased selling, general, and administrative expenses post-COVID leads to a larger change of sales revenue than is justified by the cost increase.

Our study contributes to the financial and management accounting literature in several ways. First, to the best of our knowledge, our study provides the first empirical evidence of the cost effect on sales revenues due to COVID-19, using data from food companies expected to have oligopoly or monopoly power in their popular food category. We provide empirical evidence for the conjecture that some companies are taking advantage of the COVID situation to justify increasing sales prices more than is justified by the changes in costs. Our results are informative to standard setters, regulators, and auditors interested in understanding some aspects of real earnings management. Our results may imply that a company's ability to pass on cost increases greater than is justified by cost increases may impact customers' price and quality sensitivity.

The remainder of this paper is organized as follows. Section two contains a review of the pertinent literature and hypotheses development. Section three describes our methodology and models. The results are presented in section four. The fifth section provides a summary and discusses the implications of our results.

PRIOR LITERATURE AND HYPOTHESIS DEVELOPMENT

Food Prices Inflation

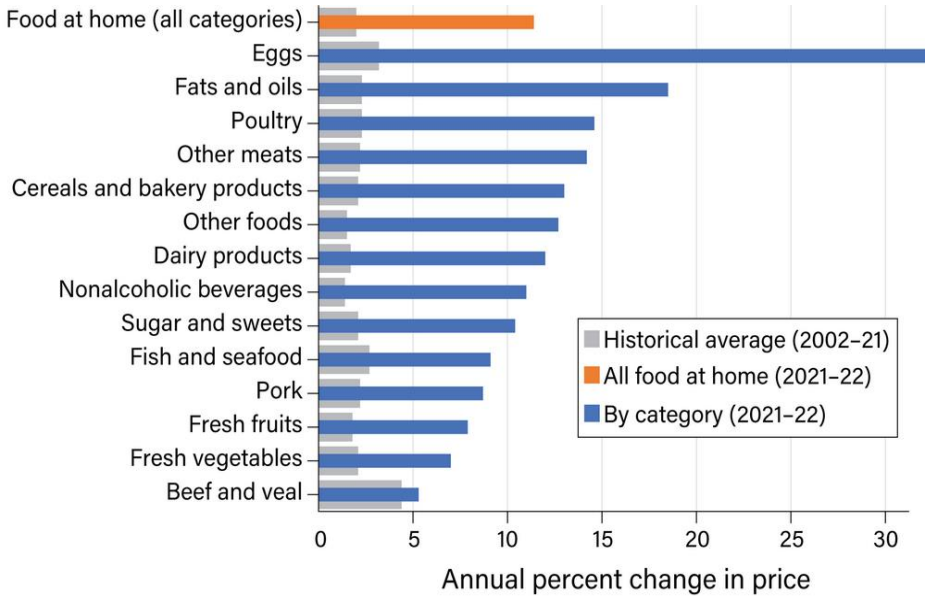
Global food prices started to rise in mid-2020 when businesses shut down due to the COVID-19 pandemic, straining supply chains. Farmers dumped milk and let fruits and vegetables rot due to a lack of available truckers to transport goods to supermarkets, where prices spiked as consumers stockpiled food. A shortage of migrant labor as lockdowns restricted movement impacted crops worldwide.

Russia's invasion of Ukraine in late February 2022 dramatically worsened the outlook for food prices. The U.N. food agency stated prices hit a record in February 2022 and again in March 2023. Russia and Ukraine account for nearly a third of global wheat and barley and two-thirds of the world's export of sunflower oil used for cooking. Ukraine is the world's No. 4 corn exporter. The conflict has damaged Ukraine's ports and agricultural infrastructure, and that is likely to limit the country's agricultural production for years.

"According to U.S. Department of Agriculture, average annual food-at-home prices were 11.4 percent higher in 2022 than in 2021. For context, the 20-year historical retail food price inflation is 2.0 percent per year. In 2022, prices for all food categories increased faster than their historical averages from 2002–21. Prices for nine food categories increased by more than 10 percent in 2022. Egg prices rose by 32.2 percent,

primarily because of the highly pathogenic avian influenza outbreak. Prices for fats and oils increased by 18.5 percent, poultry increased by 14.6 percent, other meats increased by 14.2 percent, and cereals and bakery products increased by 13.0 percent. Beef and veal prices rose the slowest, at 5.3 percent, following large price increases in 2020 and 2021. The 2022 price increase for beef and veal was close to its historical average of 4.4 percent" (Figure 2).

FIGURE 2
PRICE CHANGES FOR CPI FOOD-AT-HOME CATEGORIES, 2021-2022



Note: CPI= Consumer Price Index
Source: USDA= U.S. Department of Agriculture

Sales Growth

Companies often celebrate increases in total revenue—a simple metric universally considered the go-to measure of success. Conversely, decreases in revenue are negatively perceived by the top management, so extensive effort is invested into avoiding such decreases at any cost, usually at the expense of profitability. Likewise, increases in total revenue are also prioritized in the media and academic research, implying their paramount importance and making them a favorite key performance indicator in the business world.

Comparison of the current year's total sales revenue with the prior year's total sales revenue is a known simple measure of sales growth (Jategaonkar, 2023). Sales growth indicates firm value (Kodongo et al., 2014) and is usually used as a proxy for firm performance (Cai and Szeidl, 2018). Sales growth reflects the firm's ability over time (Widarjo and Setiawan, 2009) to improve profits. A higher level of sales growth for a firm indicates the successful execution of the company's marketing and sales strategy. Positive sales growth likely increases firm value. From an investor's point of view, sales growth shows a positive signal where a firm can increase profits through its sales and positively impact firm value.

Cost Behavior

Costs are fundamental to accounting earnings (Hartlieb and Loy, 2022). Financial reporting decisions can potentially influence cost behavior and vice versa (Hartlieb and Loy, 2022). A stream of literature identifies the asymmetric cost behavior termed "cost stickiness", i.e., costs decrease less when sales fall than when sales rise (Anderson et al., 2003; Kallapur and Eldenburg, 2005; Banker et al., 2011). This may occur because managers deliberately retain excess capacity during periods of weak demand with the

expectation of future sales rebound (Anderson et al., 2003) or be driven by their empire-building incentives to maintain slack resources for personal consumption (Chen et al., 2012).

The Relationship Between Sales Growth and Cost of Goods Sold and Selling, General, and Administrative Expenses

Prior research has studied the relationship between the stickiness of costs (cost of goods sold, and SGA costs) and sales level and determining the stickiness of costs considering factors of sales reduction in the past year. Moreover, managers are more likely to change costs for activity increases than for activity decreases (Cooper and Kaplan, 1998).

Anderson et al. (2003) invented the term stickiness of costs to represent the asymmetric reaction of costs, and their analysis of selling, general, and administrative costs supported it. They studied differential slopes of costs and found that selling, general, and administrative costs (SGA) rise more for sales increases than they fall for equivalent decreases, using a large sample of firms from multiple industries. Specifically, they found that for 7,629 firms over 20 years, selling, general, and administrative (SGA) costs increase on average 0.55% per 1% increase in sales but decrease only 0.35% per 1% decrease in sales.

Using multiple regression, Medeiro and Costa (2004) studied the relationship between selling, general, and administrative costs and sales revenue. Based on data from 198 Brazilian companies in a 7-year period (1986-2003), the results supported the expectation that companies' selling, general, and administrative costs are sticky. Their results also indicate that a 10% increase in sales revenue may be linked to an increase in selling, general, and administrative costs of 5.90%. However, a 10% reduction in sales revenue is only linked to a 3.20% decline in selling, general, and administrative costs.

Subraamaniam and Weidenmier (2003) found that when there are little changes in sales revenue, costs (cost of goods sold, and selling, general, and administrative costs) are not sticky. However, cost stickiness is observed when changes are more than 10%. They consider the stickiness of costs result from management decisions and consideration of tradeoffs. Their assumption is that stickiness of costs appears because managers have obligations that may hold in the future and decide to reserve resources for future use. Thus, while a company may report decreased income, costs wouldn't decrease in proportion to income reduction.

Ghaemi and Nematolahi (2006) studied costs in detail and found that the cost of goods sold and selling, general, and administrative costs have stickiness separate to changes in sales revenues. Farzaneh et al. (2013) indicate that the cost of goods sales is not sticky to changes in sales. However, they find general, administrative, and selling costs (SGA costs) increase by 0.443% when there is 1% increase in sales revenues. They also find that a 1% decrease in sales revenue is associated with a 0.261% reduction in general, administrative, and selling costs. Their results also indicate the ratio of total assets to sales (an indicator of a company's size does not affect cost stickiness.

Big Food Corporations' Market Dominance

Less competition among agribusinesses means higher prices and fewer choices for consumers – including where they can shop for food. Until the 1990s, most people shopped in local or regional grocery stores. Now, just four companies – Walmart, Costco, Kroger, and Ahold Delhaize – control 65% of the retail market. "Corporate consolidation can drive up food prices and reduce access to food" (Lakhani et al., 2021). "Supermarket mergers drive out smaller, mom-and-pop grocers and regional chains. We have roughly one-third fewer grocery stores today than we did 25 years ago, according to the US Census Bureau" (Lakhani et al., 2021). As countless mom-and-pop stores struggled to stay afloat during the pandemic lockdowns, revenue for Walmart US hit $341bn - almost 3% higher than the previous year.

Market Share

Market share is the most important metric companies can use to judge the effectiveness of any possible revenue-generating effort. A growing market share corresponds to growing revenue. An increase in market share also helps boost a company's total sales.

As the total market for a product or service grows, a company maintaining its market share is growing revenues at the same rate as the total market. A company growing its market share will grow its revenues

faster than its competitors. The higher the market share, the more sales a company has than its competitors in their given industry.

Lakhani et al. (2021) examined the extent of America's food monopolies and found that four firms or fewer controlled at least 50% of the market for 79% of groceries. The top firms controlled at least 75% of the market share for almost a third of shopping items. For instance, Grupo Bimbo owns 64% of the bagel market, which includes several well-known brands like Sara Lee and Thomas'. A whopping 92.9% of Americans' sodas are owned by just three companies, Coca-Cola, PepsiCo, and Keurig Dr Pepper. PepsiCo owns five of the most popular dip brands for a total of 87.5% of the market. Conagra owns the huge majority of prepared foods, including sloppy joe sauce (93.9%) and dinner mixed (59.3%). 85.4% of the canned tuna we eat is owned by just four companies: Dongwon Industries (45.6%), FCF Fishing Company (26.4%), Thai Union (12.3%), and Wild Planet (1%). Breakfast cereals are owned by the four huge companies that dominate the market, General Mills (27.9%), Kellogg Company (26.8%), and Post Holdings (18.1%).

Hypothesis Development

We aim to provide direct evidence concerning the impact of costs of food oligopolies or monopolies for the four companies where their combined total sales exceeded 60% of sales in each popular food category during the pre-COVID period of 2018-2019. We posit that increases in costs should yield increases in prices (sales) unless marginal cost changes offset them. In this study, we explore this empirically and assess whether the rising costs at the oligopolies or monopolies level correlate with excessive rising prices (sales) in the corresponding industry.

The question goes to the core of the price inflation surrounding COVID around the world. Rising prices are due to global food prices starting to rise in mid-2020 when businesses shut down due to the COVID-19 pandemic, straining supply chains. Shockingly, world food prices jumped nearly 13% in March 2022 to a new record high as the war in Ukraine caused turmoil in markets for staple grains and edible oils (the U.N. food agency).

Accordingly, we expect the coefficients on change in COGS and change in SGA to be positive and greater post COVID than pre-COVID. We hypothesize that companies are using COVID and other factors causing inflation to justify raising selling prices more than is justified by their increases in costs.

Asymmetric cost behavior is a well-documented property of corporate costs based on managerial resource adjustment decisions. On average, costs decrease less in response to reduced firm activity than they grow for an equivalent increase (e.g., Anderson et al., 2003). Prior research shows that managerial short-term incentives to increase reported earnings, such as avoiding losses or meeting analyst earnings targets, encourage asymmetric cost behavior. Opportunistic managers could discretionarily refrain from cutting costs in periods of downturn to their own benefit (Anderson et al., 2003; Chen et al., 2012). Managers are sometimes more inclined to cut costs to increase short-term profits (Dierynck et al., 2012; Kama and Weiss, 2013). It follows that during periods in which inflation is expected, companies may pad their sales revenue by increasing selling prices more than is justified by increased costs due to general inflation. Accordingly, the coefficient on the change in cost of goods sold (Δ COGS) in Model (1) should be positive, and the coefficient on the change of selling, general, and administrative expenses (Δ SGA) in Model (2) should be positive. Evidence regarding whether the coefficients are larger post-COVID than pre-COVID will allow us to provide inferences regarding our research hypothesis (below):

H: *Companies are using COVID and other factors causing inflation to justify raising selling prices more than is justified by the increases in costs*

METHODOLOGY

Sample Selection

We identify food oligopolies or monopolies by using the top four companies that, exceed 60% of sales revenue in each food category based on the study of Lakhani et al. (2021). Markets where the top four companies account for more than 40% of sales are generally considered consolidated; those exceeding 60%

are tight oligopolies or monopolies (Lakhani et al., 2021). This yielded 99 observations of oligopolies or monopolies. We eliminated 60 companies missing SEC 10K annual report filings. We also eliminated 8 companies where we could not obtain CUSIC on COMPUSTAT. Finally, we removed companies where we were unable to obtain the requisite data for our analyses on COMPUSTAT for Model (1) (6 observations), Model (2) (7 observations), and Model (3) (7 observations). Our final sample is comprised of 25 paired observations with all control variables built for our estimation on the pre-COVID and post COVID periods for Model (1), 24 paired observations on the pre-COVID and post-COVID periods for Model (2) and Model (3). Matching across the pre-COVID and post-COVID periods for a company is used to avoid confounding in our study. It allows the pre-COVID period to serve as the control, with COVID as the intervention.

How Do We Determine the Market Share for a Company

Lakhani et al. (2021) use the sales information from retail scanner data compiled by the market research firm IRI, a Chicago-based international company. Data obtained directly from IRI covers the majority of 2020. They also used IRI data published by Mintel Group reports (covering 2019) and the Market Share Reporter (covering 2017). They calculated the sales ratio of the top four – or fewer – companies in each food category compared with the rest. This calculation is a common yardstick to measure industry concentration. Brands and subsidiaries (including all mergers/acquisitions completed by June 2021) appear in the market share of their parent companies. For the meat, beef, and poultry processing categories, they used Ibis World's estimate of total revenue in 2021. The Guardian and Food and Water Watch selected a range of grocery categories to reflect everyday products Americans commonly buy.

Appendix A lists the combined market share of the top four companies on which we base our analyses.

Table 1 summarizes the steps employed in our data filtering process. We restrict our sample to American big food oligopolies or monopolies that scale to have market dominance and political power.

TABLE 1
SAMPLE SELECTION

	Observations		
Top four companies exceeding 60% of sales in each food category	99		
Companies missing SEC 10K annual report filing	(60)		
Companies missing CUSIC on COMPUSTA T	(8)		
Companies missing COMPUSTAT data between Pre and Post for Model (1)	(6)		
Companies missing COMPUSTAT data between Pre and Post for Model (2)		(7)	
Companies missing COMPUSTAT data between Pre and Post for Model (3)			(7)
Observations used in the final sample for regression estimation	25	24	24

Table 2 presents the oligopoly or monopoly companies that have market dominance in the food industry based upon our selection criteria.

TABLE 2
INDUSTRY COMOPISITION

Top Four Company	Food Dominance	Industry
ThreeHouse Foods	Pasta (dry plain)	Veggies, fruits and grains
Post Holdings	Breakfast cereals	Veggies, fruits and grains
Flowers Foods	Fresh bread	Veggies, fruits and grains
Keurig Dr. Pepper	Carbonated soy milk	Beverages
Danone S A	Refrigerated soy milk	Beverages
Anheuser-Busch InBev	Beer	Beverages
Molson Coors	Beer	Beverages

Top Four Company	Food Dominance	Industry
Heineken N.V.	Beer	Beverages
Constellation Brands	Wine makers	Beverages
Starbucks Corporation	Coffee	Beverages
Kraft Heinz	Dry mac & cheese mixes	Prepared foods
Abbott Laboratories	Baby formula	Prepared foods
Gruma, S.A.B.de C.V.	Hard/soft tortillas	Prepared foods
Campbell Soup Company	Prepared soup	Prepared foods
PepsiCo	Dip	Snacks and condiments
Hershey Company	Chocolate confectionary	Snacks and condiments
Simply Good Foods	Snack bars	Snacks and condiments
Hostess brands	Doughnuts	Snacks and condiments
Mondelez International	Biscuits	Snacks and condiments
Hain celestial group	Single serve yogurt/yogurt drinks	Animal products
Kellogg company	Frozen meat substitute	Animal products
Maple leaf foods	Frozen meat substitute	Animal products
Land O'lakes	Processed/imitation cheese slices	Animal products
Hormel foods	Turkey producers	Animal products

Table 3 presents descriptive statistics for our two samples on a pre- and post-period basis across several characteristics. The mean change of sales revenue (Δ Sales) is 0.0218 on the pre-COVID observations in Panel A, while the mean change of sales revenue (Δ Sales) is larger (0.0707) for the post-COVID period in Panel B. The mean change of cost of goods sold (Δ COGS) for the pre-COVID period is 0.0244. However, the mean change in cost of goods sold (Δ COGS) is much larger for the post-COVID period (0.1179). This is about 4.83 times higher than the cost of goods sold changed in the pre-COVID period. We assume that market share remains constant across both the pre- and post-COVID period since we measured market share using the pre-COVID observations.

TABLE 3
DESCRIPTIVE STATISTICES

Panel A: Pre-COVID 2018-2019

Variable	N	Mean	Std Dev	Lower Quartile	Median	Upper Quartile	Max
Δ Sale	24	0.0218	0.1319	-0.0455	0.0100	0.0511	0.4934
Δ COGS	24	0.0244	0.1329	-0.0312	0.0109	0.0466	0.3840
Δ SGA	24	0.0241	0.1549	-0.0412	0.0162	0.0468	0.6463
Market-Share	24	32.0666	22.8617	16.95	23.70	41.55	87.50

Panel B: Post-COVID 2021-2022

Variable	N	Mean	Std Dev	Lower Quartile	Median	Upper Quartile	Max
Δ Sale	24	0.0707	0.0942	0.0152	0.0835	0.1146	0.2172
Δ COGS	24	0.1179	0.0951	0.0884	0.1458	0.2126	0.2467
Δ SGA	24	0.0358	0.0847	-0.0224	0.0511	0.0768	0.1968
Market-Share	24	32.0666	22.8617	16.95	23.70	41.55	87.50

Regression Analyses

We estimate three models with the change in sales revenue as the dependent variable. In the regression analyses, the independent variables are the change in cost of goods sold and the change in selling, general,

and administrative expenses. We will also include the market share as an independent variable in further analyses.

Our main general hypothesis is that 'companies are using COVID and other factors causing inflation to justify raising selling prices more than is justified by the increases in costs. The following three regressions are used to determine if the changes in sales prices exceed the changes in cost of goods sold and selling, general, and administrative expenses. The estimated coefficients will provide evidence regarding our hypotheses that companies are increasing revenues faster than is justified by the changes in costs. The three models are as follows. Variables definitions are in Appendix B.

$$\Delta Sale = \alpha_0 + \alpha_1 \Delta COGS + \varepsilon \quad (1)$$

$$\Delta Sale = \alpha_0 + \alpha_1 \Delta SGA + \varepsilon \quad (2)$$

$$\Delta Sale = \alpha_0 + \alpha_1 \Delta COGS + \alpha_2 \Delta SGA + \varepsilon \quad (3)$$

To test our hypothesis that revenue rises faster than the increase in costs, we expect the coefficient on the change in COGS will be greater post COVID than the coefficient on the change in COGS pre COVID in Model (1). In Model (2), we expect the regression coefficient for the change in SGA will be greater post COVID than the regression coefficient for the change in SGA pre COVID. It is difficult to develop an expectation for the difference in the coefficients pre and post COVID when both COGS and SGA are included in the analysis due to the likelihood there is correlation across these two variables.

RESULTS

Univariate Analyses

In our hypothesis, we posit that the changes in sales prices exceed the costs of goods sold and selling, general, and administrative expenses between the pre and post-COVID periods. As a first stage, we perform univariate analyses to examine any association between change of sale revenue, cost of goods sold, and change of selling, general, and administrative expenses.

In Table 4, we provide the Pearson product moment correlations between the variables we use in our regression analyses for our pre and post COVID periods sample. As expected, consistent with our univariate analyses using the descriptive statistics previously discussed, we observe significant correlations between change of sale revenue (Δ Sale) and change of cost of goods sold (Δ COGS), and change of selling, general, and administrative expenses (Δ SGA) in the hypothesized direction. The change of sales revenue (Δ Sale) is highly correlated with the change of cost of goods sold (Δ COGS), and with the change of selling, general, and administrative expenses (Δ SGA). As expected, we find support that change of cost of goods sold and change of selling, general, and administrative expenses are linked to higher change of sale revenue. Our main test will be the change in the extent to which sales revenue increases more than is justified by the cost increases across the pre COVID and post COVID periods. While other variables may impact the link between the costs and sales revenue, the univariate analyses support our hypotheses.

TABLE 4
PEARSON CORRELATION STATISTICS

Panel A: Pre-COVID 2018-2019

	Δ Sale	Δ COGS	Δ SGA
Δ COGS	0.9478*** <0.0001		
Δ SGA	0.8463*** <0.0001	0.6613*** 0.0004	
Market-Share	-0.0498 0.9855	-0.0716 0.7392	0.0039 0.9855

Panel B: Post-COVID 2021-2022

	Δ Sale	Δ COGS	Δ SGA
Δ COGS	0.9379*** <0.0001		
Δ SGA	0.8441*** <0.0001	0.7714*** 0.0004	
Market-Share	0.0229 0.9151	-0.0524 0.8076	0.1754 0.4121

Multivariate Analyses

To better understand the interplay between changes in sales revenue and the changes in costs (costs of goods sold and selling, general, and administrative costs), we need to employ regression to estimate the linkage between the changes in sales revenue and the changes in costs across the pre COVID and post COVID periods.

In Table 5 and Table 6, we present our regression results where the change of sales revenue is the dependent variable. We are interested in whether there is a difference in observations before and after the COVID-19 intervention, which will suggest whether the intervention had an effect. The intervention in our study is the COVID-19 pandemic occurring in 2020.

Change of Sale Revenue (Δ Sale) and Changes in Costs

Our regression analyses are based upon the paired observations for the pre- and post-periods for the companies in our sample.

For Model (1) (Panel A of Table 5 reports the regression coefficient α1 on Δ COGS is positive and significant at $p < 0.01$ for the pre-period. For our post period in Panel B of Table 5, the regression coefficient α1 on Δ COGS is positive and significant at $p < 0.01$. However, the difference between the coefficients between the pre and post periods is quite small.

In the third column in Table 5, we report Model (2) results where the change in sales revenue is regressed on the change is SGA. In this analysis, the post-COVID coefficient is 0.9391 while it is only 0.7209 pre-COVID. Both coefficients are statistically significant. The fourth column reports the regression results for Model (3), which simultaneously includes COGS and SGA. All the coefficients are statistically significant, with the post-COVID coefficients being larger than the pre-COVID coefficients.

In Table 6, we report the results of the regression analyses where we include Market Share in the analysis. The regressions employed are:

$$\Delta Sale = \alpha_0 + \alpha_1 \Delta COGS + \alpha_2 Market - Share + \alpha_3 \Delta COGS * Market - Share + \varepsilon \quad (4)$$

$$\Delta Sale = \alpha_0 + \alpha_1 \Delta SGA + \alpha_2 Market - Share + \alpha_3 \Delta SGA * Market - Share + \varepsilon \quad (5)$$

$$\Delta Sale = \alpha_0 + \alpha_1 \Delta COGS + \alpha_2 \Delta SGA + \alpha_3 Market - Share + \varepsilon \quad (6)$$

$$\Delta Sale = \alpha_0 + \alpha_1 \Delta COGS + \alpha_2 \Delta SGA + \alpha_3 Market - Share + \alpha_4 \Delta COGS * Market - Share + \alpha_5 \Delta SGA * Market - Share + \varepsilon \quad (7)$$

In doing so, our results show that in the analysis based only on COGS and including Market-Share in Model (4), the pre-COVID coefficient is 0.6103 and the post-COVID coefficient is 1.0640. Both are statistically significant, with the post-COVID coefficient being substantially larger than the pre-COVID coefficient.

For Model (5), focused on SGA, the pre-COVID coefficient is 0.6501, and the post-COVID coefficient is 1.0510 when the Market Share is included in the analysis. However, only the post-COVID coefficient is statistically significant at a reasonable level. We also report in Table 6 Panels A and B that the regression coefficients pre-COVID and post-COVID infer that the change in sales revenue post-COVID is higher than pre-COVID.

Specifically, in pre-COVID, every 1% increase in cost of goods sold is associated with a 0.6103 increase in sale revenue while in post-COVID, every 1% increase in cost of goods sold is associated with a 1.0640 increase in sale revenue. It is important to note that the coefficient on Δ COGS is greater than 1 and higher post-COVID than pre-COVID.

This result is consistent with the prediction of our hypothesis H that companies are using COVID and other factors causing inflation to justify raising selling prices more than is justified by the increases in the cost of goods sold. The inference is that the increased cost of goods sold in post-COVID leads to a higher average difference in change of sales revenue than in pre-COVID.

Our results are consistent with the prediction of our hypothesis that companies are using COVID and other factors causing inflation to justify raising selling prices more than is justified by the increases in cost of goods sold and in selling, general, and administrative expenses.

TABLE 5
REGRESSION WITHOUT MARKET SHARE

Model (1): $\Delta Sale = \alpha_0 + \alpha_1 \Delta COGS + \varepsilon$
Model (2): $\Delta Sale = \alpha_0 + \alpha_1 \Delta SGA + \varepsilon$
Model (3): $\Delta Sale = \alpha_0 + \alpha_1 \Delta COGS + \alpha_2 \Delta SGA + \varepsilon$

Panel A: Pre-COVID 2018-2019

	Model (1)	Model (2)	Model (3)
Δ COGS	0.9405*** <0.0001		0.6844*** <0.0001
Δ SGA		0.7209*** <0.0001	0.3323*** <0.0001
Observations	25	24	24
Adjusted R-squared	0.8972	0.7162	0.9839

*, **, *** Indicate significance at the 0.10, 0.05, and 0.01 levels, respectively, using a two-tailed test.

Panel B: Post-COVID 2021-2022

	Model (1)	Model (2)	Model (3)
Δ COGS	0.9511*** <0.0001		0.7015*** <0.0001
Δ SGA		0.9391*** <0.0001	0.3314*** 0.0070
Observations	25	24	24
R-squared	0.8863	0.7126	0.9156

*, **, *** Indicate significance at the 0.10, 0.05, and 0.01 levels, respectively, using a two-tailed test.

TABLE 6
REGRESSION WITH MARKET SHARE

Model (4): $\Delta Sale = \alpha_0 + \alpha_1 \Delta COGS + \alpha_2 Market - Share + \alpha_3 \Delta COGS * Market - Share + \varepsilon$
Model (5): $\Delta Sale = \alpha_0 + \alpha_1 \Delta SGA + \alpha_2 Market - Share + \alpha_3 \Delta SGA * Market - Share + \varepsilon$
Model (6): $\Delta Sale = \alpha_0 + \alpha_1 \Delta COGS + \alpha_2 \Delta SGA + \alpha_3 Market - Share + \varepsilon$
Model (7): $\Delta Sale = \alpha_0 + \alpha_1 \Delta COGS + \alpha_2 \Delta SGA + \alpha_3 Market - Share + \alpha_4 \Delta COGS * Market - Share + \alpha_5 \Delta SGA * Market - Share + \varepsilon$

Panel A: Pre-COVID 2018-2019

	Model (4)	Model (5)	Model (6)	Model (7)
Δ COGS	0.6103*** 0.0005		0.6842*** <0.0001	0.6257*** <0.0001
Δ SGA		0.6501 0.0817	0.3324*** <0.0001	0.2984*** <0.0038
Market-Share	-0.0000 0.9075	-0.0003 0.6259	-0.0001 0.9462	-0.0000 0.8332
Δ COGS * Market-Share	0.0176 0.0222			0.0037 0.3537
Δ SGA * Market-Share		0.0031 0.8368		0.0007 0.8398
Observations	25	24	24	24
R-squared	0.9204	0.7197	0.9839	0.9849

*, **, *** Indicate significance at the 0.10, 0.05, and 0.01 levels, respectively, using a two-tailed test.

Panel B: Post-COVID 2021-2022

	Model (4)	Model (5)	Model (6)	Model (7)
Δ COGS	1.0640 *** <0.0001		0.7056*** <0.0001	0.9120*** <0.0001
Δ SGA		1.0510*** 0.0004	0.3261** 0.0137	0.2987* 0.0873
Market-Share	0.0007 0.2454	-0.0003 0.5026	0.0000 0.8987	0.0010* 0.0690
Δ COGS * Market-Share	-0.0050 0.3345			-0.0123** 0.0414
Δ SGA * Market-Share		-0.0031 0.6851		-0.0050 0.3097
Observations	25	24	24	24
R-squared	0.8937	0.7310	0.9156	0.9335

*, **, *** Indicate significance at the 0.10, 0.05, and 0.01 levels, respectively, using a two-tailed test.

CONCLUSIONS

Food prices matter not only because they are an important part of most consumers' consumption baskets but also because persistent levels of food inflation can lead to higher inflation expectations and eventually contribute to an upward inflation spiral. Our results suggest that companies with significant oligopoly or monopoly power can boost their prices higher than justified by the increases in costs following COVID-19. This leads to much higher prices for consumers and might suggest regulatory action during periods like COVID is needed for monopolistic or oligopolistic companies.

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APPENDIX 1: THE COMBINED MARKET SHARE OF THE TOP FOUR COMPANIES

Food Dominance Owned by Top Four Firms	Market Share (%)	Industry
Dry dinner mixed with meat	98.4	Prepared foods
Single serve yogurt/yogurt drinks	96.7	Animal products
Single serve prepared pasta dishes	94.4	Prepared foods
Single serve prepared sloppy sauce	93.9	Prepared foods
Carbonated soft drinks	92.9	Beverages
Dip	90.7	Snacks and condiments
Dry mac & cheese mixes	86.7	Prepared foods
Popcorn, microwave	86.5	Snacks and condiments
Canned tuna	85.4	Animal products
Baby formula (liquid concentrate)	84.6	Prepared foods
Mayonnaise	82.8	Snacks and condiments
Baby food	81.7	Prepared foods
Refrigerated soy milk	81.2	Beverages
Refrigerated almond milk	80.8	Beverages
Chocolate confectionary	80.3	Snacks and condiments
Beer	78.6	Beverages
Pasta (dry plain)	78.5	Veggies, fruits and grains
Bagels/bialys	77.2	Veggies, fruits and grains
Frozen meat substitute	76.1	Animal products
Canned pineapple	74.6	Veggies, fruits and grains
Yogurt	74.5	Snacks and condiments
Breakfast cereals	72.8	Veggies, fruits and grains
Hard/soft tortillas/taco kit	71.6	Prepared foods
Processed/imitation cheese slices	71.1	Animal products
Prepared soup	69.7	Prepared foods
Wine makers	68.9	Beverages
Coffee	68.3	Beverages
Single serve prepared salads	68.1	Prepared foods
Canned salmon	66.6	Animal products
Snack bars	66.4	Snacks and condiments
Frozen pizza	66.2	Prepared foods
Sour cream	63.9	Snacks and condiments
Doughnuts	61.5	Snacks and condiments
Biscuits (cookies & crackers)	60.9	Snacks and condiments
Fresh bread	60.8	Veggies, fruits and grains
Canned green peas	59.8	Veggies, fruits and grains
Canned potato/sweet potato	59.0	Veggies, fruits and grains
Turkey producers (pounds processed)	57.8	Animal products
Canned tomato	57.5	Veggies, fruits and grains
Tea - bags/loose	57.5	Beverages
Bottled canned green beans	55.7	Veggies, fruits and grains
Canned corn	55.1	Veggies, fruits and grains
Fresh cut salad	54.2	Veggies, fruits and grains
Table sauces	53.1	Snacks and condiments
Ready to drink coconut milk	52.3	Beverages
Rice	52.2	Veggies, fruits and grains

Food Dominance Owned by Top Four Firms	Market Share (%)	Industry
Bacon	52.0	Animal products
Bottled/canned beans	50.7	Veggies, fruits and grains
Bottled water	49.8	Beverages
Meat, beef & poultry processing	48.8	Animal products
Juice	46.7	Beverages
Egg producers	41.3	Animal products
Processed meats	39.1	Animal products
Cheese	36.0	Animal products
Craft beer	32.6	Beverages
Sweet bakery	32.0	Snacks and condiments
Sugar processors	28.9	Snacks and condiments
Egg brands	23.3	Animal products
Refrigerated whole milk	22.5	Animal products
Frozen fruit	21.5	Veggies, fruits and grains

APPENDIX 2: VARIABLE DEFINITIONS

Dependent Variable	
Δ Sale	= change of sale revenue as a percentage equal to the difference between the current period sales and the prior period sales, with this difference divided by the prior period sales
Independent Variables	
Δ COGS	= change of cost of goods sold as a percentage equal to the difference between the current period cost of goods sold and the prior period cost of goods sold, with this difference divided by the prior period cost of goods sold
Δ SGA	= change of selling, general, and administrative expenses as a percentage equal to the difference between the current period selling, general, and administrative expenses and the prior period selling, general, and administrative expenses, with this difference divided by the prior period selling, general, and administrative expenses
Market-Share	= calculated by taking the company's sales over the period and dividing it by the total sales of the industry over the same period
Δ COGS * Market-Share	= interaction between cost of goods sold and market share
Δ SGA * Market-Share	= interaction between selling, general, and administrative expenses and market share