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Markups and inflation: Evidence from firm-level data

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Abstract

In the past two years, Canada has experienced inflation rates that have not been seen in the past two decades. The rise of markups, i.e., price over marginal cost, can be one of the potential drivers or amplifiers of inflation. This study uses firm-level data to estimate markups in Canada before and during the COVID-19 pandemic. The results indicate that aggregate markups for non-financial businesses, excluding oil and gas industries, increased by 2.6% from the two years before the onset of COVID-19 to the second quarter of 2022. Compared with a range of inflation measures during the same period, the estimated increase in markups is relatively small. For example, during the same period, consumer price inflation, excluding energy, rose by 10.5%.

Keywords: Markups, inflation, imperfect competition, COVID-19, supply and demand shocks

Authors

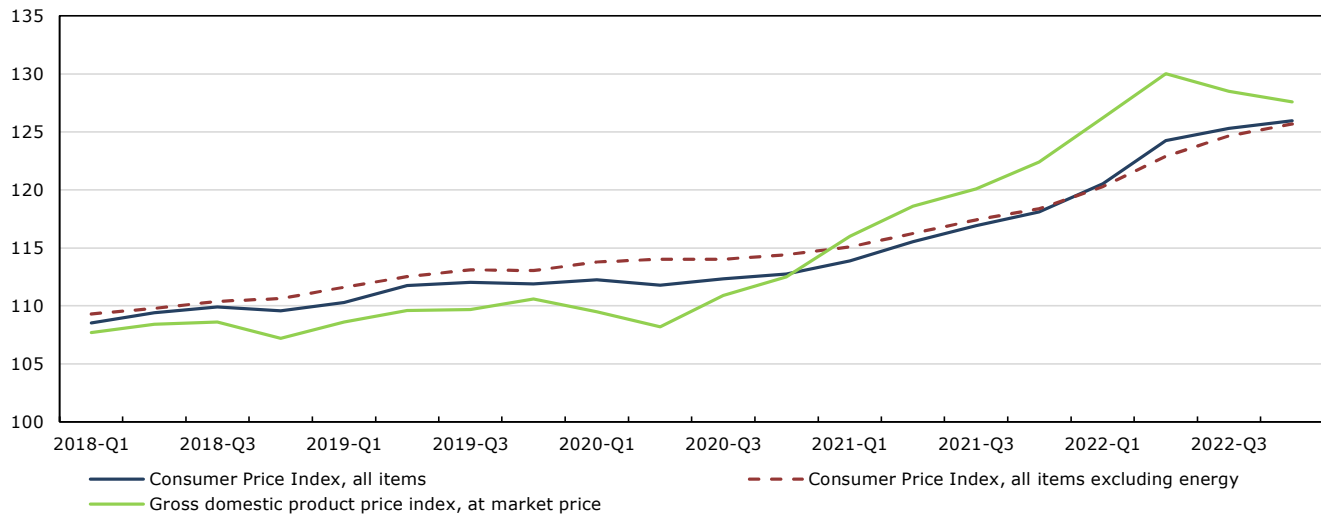
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Introduction

Since the beginning of the pandemic-induced recession, the world has experienced various disruptions, including COVID-19 lockdowns, supply-chain problems and geopolitical tensions. These disruptions affected the economy in terms of both supply and demand. By consequence, prices have increased (Chart 1), and high inflation has become one of the main concerns of Canadian households (Statistics Canada, 2022, June 9; Argitis, 2022). Inflation increased from an average of 2% year over year in the pre-pandemic period to around 8% year over year in mid-2022.

Chart 1
Price indexes, 2012=100

price level



Source: Statistics Canada. Common Open Data Repository tables 18-10-0004-01 and 36-10-0106-01.

Inflation can be caused by negative supply shocks, such as supply-chain disruptions, and positive demand shocks, especially during the recovery from the pandemic and post-COVID-19 period (Eickmeier and Hofmann, 2022; Shapiro, 2022).¹ Assuming a perfectly competitive market, Chen and Tombe (2023) find that both positive demand and negative supply shocks had important roles in driving inflation in Canada.

Regardless of whether supply or demand shocks are dominant, researchers have argued that market power can also contribute to inflation in imperfectly competitive markets. For example, Australian researchers Quiggin and Menezes (2022) argue that when there is an increase in demand, firms with market power increase their prices for any given quantity supplied. A firm that raises prices would normally experience a decline in their quantity sold and revenue when demand is stable, but this effect is mitigated when demand is rising. They argue that while market power is not the cause of inflation, it can amplify it when demand is rising. By contrast, Stiglitz and Regmi (2022) find that the aggregate consumption in the United States during the past two years stayed mainly below its long-term trend and only moved slightly above it. The authors argue that aggregate demand is not the primary driver of inflation; instead, inflation is largely driven by supply shocks, sectoral demand shifts and exercise of market power in this context. For Canada, Tombe (2022) points out that over 70% of the increased profit levels in Canada can be traced to mining, oil and gas activities, including refining industries, where firms do not have market power because prices are set by global markets. He suggests that market power did

1. Wang (2023) discusses the impact of import prices on Canadian inflation.

not play a significant role in explaining the increasing profits outside these areas, but he does not examine measures of market power, *per se*.

This paper uses firm-level data to estimate markups, i.e., price over marginal costs (the incremental cost of producing the final unit of output), and investigates the possible rise of markups as one of the potential contributors to the recent inflation. Markups have been used to study changes in the degree of competitive pressure in the economy over time. Before the pandemic, many economies were already experiencing growing market power (De Loecker and Eeckhout, 2018; Díez and Duval, 2019). Understanding the degree of competition in an economy is important. More competitive markets are associated with higher employment, welfare and productivity, and lower prices. Moreover, rising market power in the post-COVID-19 years may threaten economic recovery because it may be an obstacle to the entry of new businesses (Georgieva et al., 2021).²

This paper presents estimates of markups from 2018 to 2022. It focuses on the association between changes in markups and inflation, rather than on markups as a measure of the degree of competition in the economy, as short-term fluctuations in markups may not reflect a permanent structural change in the nature of competition.

Some studies have focused on the profitability of Canadian industries during the pandemic using industry-level data. This paper focuses on estimating markups using firm-level data. While a measure of profitability such as the profit margin (revenue minus costs, divided by revenue) is driven by price relative to average costs, the markup is focused on price relative to marginal costs—the cost measure that is more relevant to a firm’s production and pricing decisions. Profit margins may increase if fixed costs (costs that do not vary with the amount of production) decline, while markups may not necessarily do so.

Demand and supply shifts and markups

In a perfectly competitive environment, prices are set by the market, and the production decisions of any single firm do not have an impact on the market price. When the economy deviates from perfect competition, an individual business has some pricing power. It can set a higher price and produce and sell less, or it can set a lower price and produce and sell more. A business may have market power because, for example, it sells a differentiated product or because there are barriers that prevent competitors from entering the market. Profit-maximizing businesses increase their production and set their price where the increase in revenue from selling the final unit of output equals the incremental cost of producing that output, where marginal revenue equals marginal cost. The price is higher than marginal revenue and marginal cost because the price applies not only to the final unit sold but to all units sold.³ Firms with more market power experience a smaller drop in quantity of output sold when they raise their prices, so the gap between their price and marginal cost will be higher. The ratio between price and marginal cost is the markup:

$$P_t = Markup_t * MC_t \quad (1)$$

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2. Moreover, from the policy point of view, it is important to have a precise measure of markups and markup concentration in the Canadian economy, as some studies argue that the presence of market power can weaken the effects of monetary policy (Duval et al., 2021).
 3. For example, if a firm sells 10 units for \$1 each, for a total revenue of \$10, it can lower its price by 10 cents to 90 cents and sell two more units. In this situation, the total revenue is \$10.80 (12 times 90 cents). The marginal revenue is 80 cents, while the price is 90 cents.

Where P_t and MC_t are the price and the marginal cost of a business with market power at time t . From a business point of view, higher marginal costs or higher markups or both can lead to a change in prices.⁴

An increase in demand may raise marginal costs because of diminishing returns (each additional amount of input generates less output). For example, Jarsulic (2022) finds that in the United States, demand shifted from the services to the commodities sector during the pandemic, and this may have raised marginal costs for commodity producers. Thus, part of the price increase is related to increased marginal costs. In some frameworks and under certain conditions, markups can also increase. Increased demand may be accompanied by less sensitivity to price increases on the part of consumers. For example, after the easing of restrictions, individuals may be so eager that they are willing to travel, despite higher prices. Profit-maximizing businesses with market power take this into account and raise their markups and prices. Different frameworks, however, predict different outcomes, so the relationship between markups and demand shocks is an empirical question.⁵

Marginal costs and prices can also increase in the case of negative supply shocks. For example, rising energy prices or an increase in the price of other inputs related to supply-chain issues will increase the cost of producing and, therefore, output prices, at any given quantity (Kilian and Zhou, 2022). Also, the need to adapt production processes to post-COVID-19 realities may have led to declines in productivity and increased costs (Statistics Canada, 2023, April 18). At the same time, markups may also change in the face of supply shocks. Input shortages and rising costs may lead to the exit of less productive businesses, which would increase the market power and markups of remaining businesses. Under other conditions and frameworks, markups may also decrease with negative supply shocks,⁶ so empirical estimates are needed.

Methodology

To estimate markups, the paper follows De Loecker and Warzynski (2012) and De Loecker et al. (2020), which is based on the work of Hall (1988). In particular, firms minimize their costs, and from their first order conditions, the following equation can be obtained:

$$Markup_{it} = \beta_v \frac{Rev_{it}}{Variable_Cost_{it}} \quad (2)$$

Where $Markup_{it}$ is the value of markups for firm i at time t . Rev_{it} and $Variable_Cost_{it}$ are the revenue and the cost of variable input (i.e., operating expenses⁷) for firm i at time t . β_v is the output elasticity of variable input for firm i determined at the industry level categorized based on the two-digit North

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4. In more sophisticated models, firms may also adjust their prices if their inflation expectations change (Weber et al., 2022).
 5. Markups may increase (Wolman, 2001; Ambler, 2007; Berman et al., 2012), decrease (Ganapati et al., 2020) or stay constant. See Nekarda and Ramey (2020) for a review of the literature.
 6. For example, suppose a negative supply shock, such as a rise in wage costs, only increases the production cost of domestic businesses. In this case, domestic businesses may decrease their markups to compete with foreign competitors unaffected by the shock (Heise et al., 2022).
 7. De Loecker et al. (2020) use the cost of goods sold (COGS) as a measure of variable input. However, Basu (2019) highlights that using COGS may lead to a significant overestimation of markups. Instead, he suggests using labour as a measure of variable input. If labour is unavailable, Basu (2019) recommends a more comprehensive variable input, such as operating expenses, which is used in this paper. It should be noted that using operating expenses may result in an underestimation of markups for some firms if the price of materials used by a final firm already contains markups charged by an intermediate firm.

American Industry Classification System (NAICS). The paper follows De Loecker and Warzynski (2012) and Akerberg et al. (2015) to obtain the elasticity, β_v . In particular, the paper estimates the following Cobb–Douglas production function:

$$q_{it} = \beta_v v_{it} + \beta_k k_{it} + \omega_{it} + \epsilon_{it}, \quad (3)$$

Where q_{it} , v_{it} , k_{it} and ω_{it} are the logs of deflated revenue, operating expenses, capital and productivity, respectively. β_v and β_k are the elasticity of variable and capital inputs, and ϵ_{it} is an *i.i.d.* measurement error.⁸

Data

The paper uses firm-level data from the Quarterly Survey of Financial Statements (QSFS) produced by Statistics Canada. The survey collects data on financial statements of both publicly and non-publicly traded enterprises in Canada. An enterprise (hereafter, firm) can be a single corporation or a family of corporations under common ownership or control that produces consolidated financial statements.

The QSFS has three categories of firms that are classified based on their assets and revenues in each industry:

- take-all or large firms that are always surveyed
- medium-sized firms that are randomly surveyed
- take-none or small firms that are below the industry threshold for assets and revenues—the small firms are not sampled; rather, they are derived by applying the quarter-to-quarter movement of sample responses to annual data compiled from administrative data.⁹

The QSFS does not cover business enterprises controlled by governments or non-profit enterprises. Moreover, this paper excludes the finance and insurance (NAICS 52) and mining, quarrying, and oil and gas extraction (NAICS 21) industries because the former has different financial statements than the rest of the economy and the latter's prices are largely driven by global markets and developments. The microdata on which the estimation is based account for around 80% of the total revenue reported in the official aggregate estimates of total revenue from the QSFS that include an imputation for the take-none portion. Therefore, the changes in the estimated markups over time using the QSFS should broadly reflect the changes in the true aggregate markup. Moreover, the exercise of market power is typically associated with larger, more dominant firms, rather than small firms.

8. See De Loecker and Warzynski (2012), Akerberg et al. (2015), and De Loecker et al. (2020) for more technical details on how to estimate the production function.

9. For more detail on the QSFS dataset, please see <https://www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SDDS=2501>.

Results

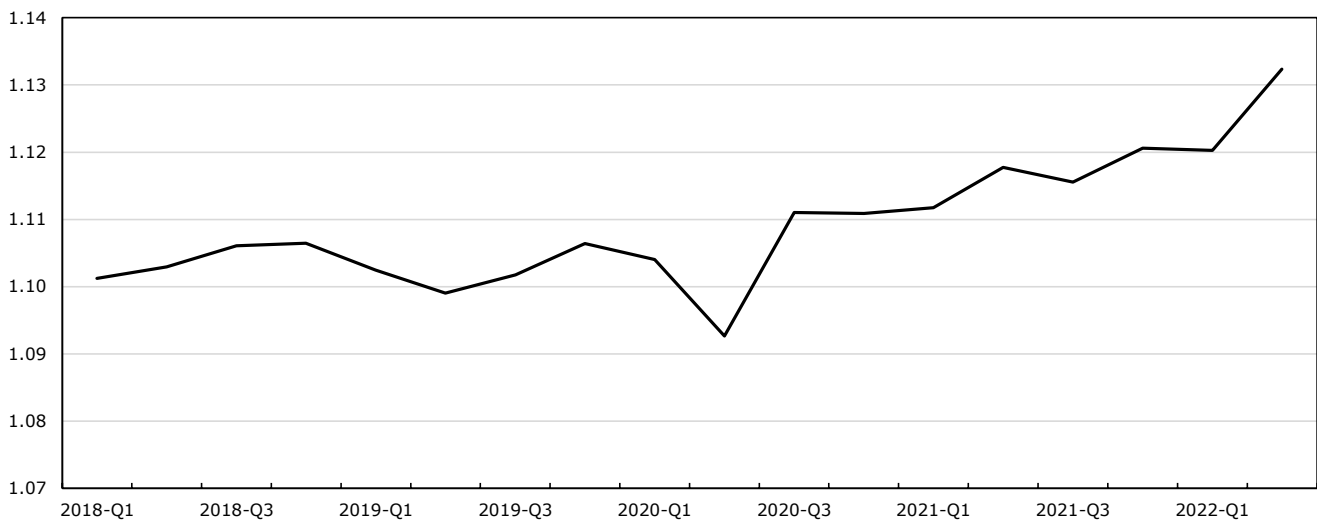
Aggregate markup

The results show that markups started rising in the third quarter of 2020, after the beginning of the pandemic. Chart 2 presents the estimated average weighted markup from the first quarter of 2018 to the second quarter of 2022. Each firm’s markup is weighted by its revenue to obtain a markup that is applicable to the aggregate output produced by all the surveyed firms. That is, the weighting takes into account that a small firm contributes less to the aggregate output in the economy than a large one.

The results show that—excluding the mining, quarrying, and oil and gas extraction sector; the finance and insurance sector; and non-profits—markups have increased by 2.6%, compared with the average markups in the two years before the pandemic. In particular, markups increased from 1.103 in 2018 and 2019 to 1.132 in the second quarter of 2022.

Chart 2
Overall weighted average markups

markup level



Source: Authors’ calculation using the Quarterly Survey of Financial Statements dataset.

As discussed, markups can be a potential driver of inflation. To estimate the impact of markups, the log difference of Equation (1) is taken to obtain the following relationship between the growth of prices, markups and marginal costs:

$$\Delta \ln P_t = \Delta \ln \mu_t + \Delta \ln MC_t \tag{4}$$

where the left-hand side is the growth of prices, i.e., cumulative inflation, over the sample period, and the right-hand side is the growth of markups and marginal costs. The gross domestic product (GDP) price index and Consumer Price Index (CPI) excluding and including energy are used to measure the growth of prices. Table 1 compares the growth in markups with alternative price growth rates, i.e., $\frac{\Delta \ln \mu_t}{\Delta \ln P_t}$, for each price index. Regardless of the price measure used, the growth in markups is a relatively small

fraction of the growth in prices.¹⁰ The growth in markups is 24.7%, 20.8% and 13.4% of the growth in the CPI excluding energy, CPI including energy and GDP price index, respectively. As mentioned, the weighted average markup is more applicable to aggregate output. Hence, the GDP price index can be a more appropriate price index to evaluate the relationship between inflation and markups, but the GDP price index, excluding the oil and gas sector, was not available to the authors.

Table 1
Markup versus price growth

	Before the pandemic (2018 to 2019)	2022 (second quarter)	Growth	Markup growth over price growth, i.e., $\Delta \ln \mu_t / \Delta \ln P_t$
			percent	
Markups	1.1	1.1	2.6	...
CPI excluding energy	111.2	122.9	10.5	24.7
CPI including energy	110.4	124.2	12.5	20.8
GDP price index	108.8	130.0	19.4	13.4

... not applicable

Notes: CPI = Consumer Price Index; GDP = gross domestic product.

Source: Authors' calculation using the Quarterly Survey of Financial Statements dataset.

The findings of this paper are consistent with studies that estimated markups using firm-level data in the United States. For example, Konczal and Lusiani (2022) find that markups after the onset of the pandemic in the United States have increased at the fastest annual pace since 1955 and reached their highest recorded level. They use the Compustat dataset, which contains financial statements of only publicly traded firms. By contrast, the QSFS dataset used in this paper covers both Canadian publicly traded firms and non-publicly traded ones. In another paper, Jarsulic (2022) uses industry-level data and shows that markups in the United States have increased during recovery periods. The author argues that the increase in markups in the 2020 recovery has been higher than that in the 2009 recovery, and in the 2020 recovery, rising markups increased prices by about 1 percentage point more than they did in the 2009 recovery. Jarsulic (2022) states that although the increased cost of production can be the main driver of inflation, it cannot be the only factor. The market power and rising markups, at least partially, can explain the surge in inflation.

Industry-level markups

Chart 3 illustrates markups at the industry level for the three sectors of manufacturing (NAICS 31, 32 and 33), wholesale trade (NAICS 41) and retail trade (NAICS 44 and 45).¹¹ The estimated markups are weighted by the revenue of firms. The results show that markups for the manufacturing sector increased from 1.093 before the pandemic to 1.151 in the second quarter of 2022. For the wholesale trade sector, they increased from 1.066 to 1.083. Finally, for the retail trade sector, the average markups increased from 1.038 to 1.063. In contrast to the manufacturing sector, which had a sharp drop in its markups at the beginning of the pandemic, the markups in the trade sectors did not show a significant decline. This could be related to the increased demand for health-related goods and groceries at the beginning of the pandemic. Also, the retail industries were less affected by the COVID-19 lockdowns because of the essentiality of their services. For example, retail customers spent \$669.6 billion in Canada in 2020,

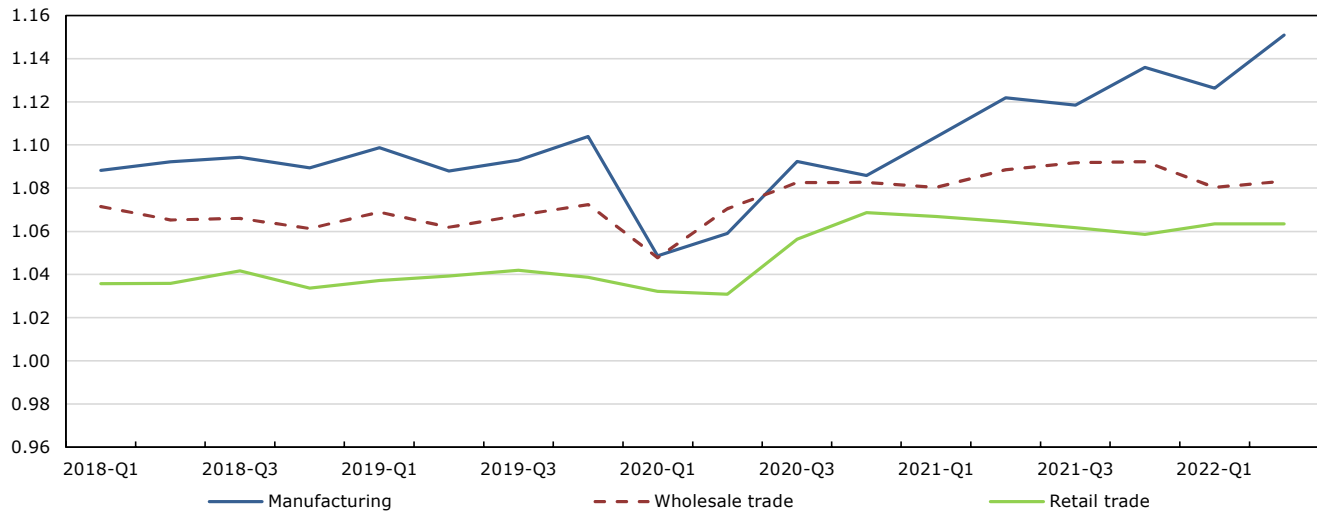
10. In addition to its relatively small size, there are also statistical error bounds around the point estimates of the markups. Estimating the error bounds could only provide further evidence that the change in the estimated markup is relatively small and would not alter the conclusion of study.

11. These three sectors are discussed separately because their estimated output elasticity of variable inputs (β_v) is more precise than that of the rest of the industries, related to using a more appropriate deflator. In general, the dependent variable in Equation (3), i.e., revenue, is deflated by a quarterly aggregate GDP deflator, except for the three above sectors, which used quarterly industry-level deflators, which were available to the authors.

leading to a slight decline of 0.1% in operating revenue, compared with the previous year. However, retailers' gross margins rose slightly, from 26.5% in 2019 to 26.8% in 2020. At the same time, their total operating expenses, including labour expenses, declined by 1.3% in 2020 (Statistics Canada, 2022, April 7).

Chart 3
Industry-level weighted average markups

markup level



Source: Authors' calculation using the Quarterly Survey of Financial Statements dataset.

Conclusion

Inflation since the onset of the pandemic has become one of the main concerns of Canadian households (Statistics Canada, 2022, June 9; Argitis, 2022). Regardless of whether negative supply shocks (Stiglitz and Regmi, 2022), positive demand shocks (Tombe, 2022) or both supply and demand shocks (Chen and Tombe, 2023) are the main drivers of inflation, studies show that markups can have a potential role in amplifying inflation (Quiggin and Menezes, 2022).

This study uses firm-level data to estimate markups, a measure of market power, in Canada. The paper finds that the average markups in Canada, excluding the two sectors of finance and insurance (NAICS 52) and mining, quarrying, and oil and gas extraction (NAICS 21), increased from 1.103 in the pre-pandemic period to 1.132 in the second quarter of 2022. In other words, markups increased by 2.6% over the study period. By comparison, the CPI including energy rose 12.5%, the CPI excluding energy rose 10.5% and the GDP deflator rose 19.4%. Therefore, although the rise of markups contributed to the increase in inflation, it does not appear to be the main driver.

Economic theory does not give clear predictions of how markups respond to demand and supply shocks, so it is not possible to determine whether the observed changes in markups are in line with normal profit-maximizing behaviour of firms. Furthermore, changes in markups over the business cycle are also model dependent, so it is not clear whether the observed increase in markups will reverse itself when the impact of the recent demand and supply shocks subside. However, if high markups persist, they may be an indication of growing market power, which could hinder future economic growth and competitiveness. In addition to providing updates on the evolution of markups, future work could estimate changes in the dispersion of markups to examine whether the increase in markups applies across all firms, or whether it is concentrated among those with already high markups. Furthermore, the role of firm dynamics in accounting for changes in markups could also be explored. Aggregate markups could be driven by the exit of low-markup firms, or the reallocation of market share to firms with higher markups.

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