

“Sticky” sales

Temporary markdowns barely respond to changes in costs and economic conditions, suggesting that monetary policy generates only muted change in aggregate pricing

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Sales are ubiquitous in the U.S. economy. Black Friday, President’s Day, Mother’s Day, the Fourth of July; almost any occasion is cause for price cutting, accompanied by prominent signage, balloons and ads in traditional and social media to make the savings known far and wide. Retailers also put on sales ostensibly to clear out inventory, celebrate being on the sidewalk and go out of business.

Economists are interested in sales, not because they want cheap stuff (well, maybe they’re as partial to a deal as anyone), but because the role of sales has a bearing on a question central to macroeconomics: How flexible are prices? Price flexibility—how quickly prices adjust to changes in costs or demand—is crucial to understanding how shocks of any kind, including fiscal and monetary policy, affect economic performance.

Retail prices rise and fall frequently as merchants put items on sale and then restore the regular, or shelf, price. Indeed, the bulk of weekly and monthly variance in individual prices is due to sales promotions, not changes in regular prices. But there’s a lively debate in economics about the true flexibility of sale prices, from a macro perspective; for all their seeming fluidity, how readily do sales respond to changes in underlying costs and unexpected events that alter economic conditions?

How sale prices respond to wholesale cost shocks and broader macroeconomic shocks such as an increase in government spending or monetary policy stimulus, or a decrease in global aggregate demand, affects the flexibility of aggregate retail prices, with profound implications for monetary

policy and the accuracy of macroeconomic models that guide policymaking.

Monetary policy as a tool for influencing the economy depends on sticky prices—the idea that prices don’t adjust instantly to shifts in demand caused by changes in money supply. If they did, an increase in demand for goods and services due to monetary easing would trigger an immediate price rise, suppressing demand and leaving economic output and employment unchanged. Thus, the stickier are prices, the more effective is monetary policy in modulating economic growth in the short and medium run. (Economists generally agree that money is neutral in the long run; that is, over a long enough period of time, prices are actually quite flexible, so monetary policy has no long-run effect on the real economy.)

Recent work by Ben Malin, a senior research economist at the Minneapolis Fed, provides insight into the import of temporary sales for price stickiness and thus monetary policy. In “Informational Rigidities and the Stickiness of Temporary Sales” (Minneapolis Fed Staff Report 513, online at minneapolisfed.org), Malin uses a rich data set of prices from a U.S. retail chain to investigate how retail prices adjust in response to wholesale price increases and other economic shocks. Joining Malin in the research are economists Emi Nakamura and Jón Steinsson of Columbia University, and marketing professors Eric Anderson and Duncan Simester of Northwestern University and MIT, respectively.

Surprisingly, the authors find no change in the frequency and depth of price cuts in response to shocks. Their analysis, which also taps micro price data underlying the consumer price index to look at how sales at a representative sample of U.S. retailers respond to booms and downturns, shows that merchants rely exclusively on regular prices to adapt

to cost changes and evolving economic conditions. The research “supports the view that the behavior of regular prices is what matters for aggregate price flexibility,” Malin said in interview.

Why do retailers refrain from using sales to respond to economic shocks—putting more items on sale and offering deeper discounts during recessions, for example? A possible explanation lies in sticky information theory, the idea that prices can be slow to react to shocks if price setting decisions are based on old information. The researchers suggest that sales activity in the retail industry is governed by “sticky plans”—a trade promotion system in which sale calendars and prices are adjusted infrequently.

Price changes, deconstructed

Over the past decade, empirical research on price setting has received fresh impetus from studies that make use of large data sets of transaction prices to test theories about how prices, including temporary sale prices, respond to changes in costs and macroeconomic shocks. Greater access to data from government and private sources, combined with advances in computing power, has given economists the tools to delve into the complex mechanics of price adjustment and develop more nuanced macroeconomic models.

“Economists have developed various theories to explain why retail prices don’t change continuously,” Malin said. “Different theories assume different underlying frictions—say, imperfect information or the costs of changing prices—and, as a result, they may have different implications for how overall inflation responds to monetary policy. How do we know which theory is correct? One approach is to see which theory is most consistent with the new micro data.”

In a seminal 2004 paper,¹ Mark Bills of the University of Rochester and Peter Klenow of Stanford University used unpublished price data from the Bureau of Labor Statistics (BLS) to show that consumer prices change much more often than reported in previous studies based on more limited data. However, Bills and Klenow (a consultant with the Minneapolis Fed) also found that prices of some goods—like gasoline and tomatoes—change much more frequently than others, such as men’s haircuts and taxi fares. (See “Price Signals” in the September

2003 *Region* for a longer discussion of Klenow’s research, online at minneapolisfed.org.)

Subsequent empirical work on pricing has found that much of this apparent price flexibility stems from sales and that sale prices behave differently from regular prices. In a 2008 study, Nakamura and Steinsson examine BLS micro-level price data and show that removing temporary price cuts substantially reduces the frequency of price changes. Minneapolis Fed consultant Patrick Kehoe and Virgiliu Midrigan of New York University, a former research economist at the Bank, observe that sales are frequent yet fleeting. In a 2012 Minneapolis Fed Staff Report (SR 413, online at minneapolisfed.org), Kehoe and Midrigan conclude that because sales are temporary—prices of items often quickly revert to the preexisting price—they contribute much less to price adjustments than do changes in relatively sticky regular prices.

Some researchers have drawn upon sticky information theory to explain the patterns of price changes seen in the data. Economists such as Christopher Sims of Princeton University, Greg Mankiw of Harvard and John Willis of the Federal Reserve Bank of Kansas City have developed models in which price setters have imperfect information about macroeconomic shocks. As a result, after a shock, prices often continue to reflect economic conditions that prevailed before the shock. In a 2007 study, Klenow and Willis show that price changes in BLS micro data fit a sticky information model in which people are slow to update information on shocks to the money supply and firm productivity.

In their paper, Malin and his fellow researchers build upon and extend these lines of research into the nature of sales and their role in price adjustment.

Tracking sales at the checkout

Retailers use sales to appeal to price-sensitive shoppers, a strategy known as price discrimination. Discounts also serve to catch consumers’ attention and pull them into stores. But sales would also seem to provide a means, besides changing regular prices, for merchants to react to changes in costs or economic fundamentals. When wholesale prices rise, or consumer demand increases because the economy is doing well, retailers could conceivably hold fewer sales or reduce the depth of price cuts. Conversely, when wholesale prices fall or demand

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drops for some reason, merchants could choose to cut loose with sales and slash prices.

“Temporary discounts occur,” Malin said, “and from a macro perspective, the question is, well, when those sales occur, are they occurring in response to aggregate conditions, or are they just something that’s been done to price discriminate across consumers?”

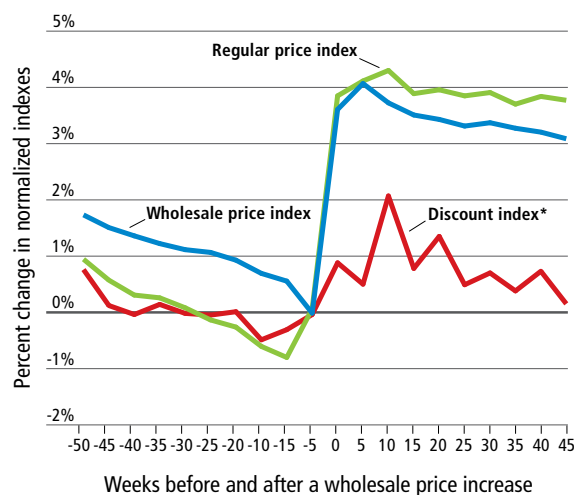
His answer emerges from exhaustive analysis of millions of sales transactions harvested from the data banks of a major retailer of groceries, health and beauty products, and other merchandise.

As marketing experts with connections in the retail industry, Malin’s co-authors Anderson and Simester had access to price data from the retailer (anonymous at the firm’s request). This trove of information—almost four years of checkout scanner records from a sample of about 100 stores situated in Eastern and Midwest states—provided the means to study how the retailer responds to changes in wholesale cost.

For each product, the scanner data list the number of units sold weekly in each store and prices—the wholesale price, the regular retail price and the price that was actually paid (less than the regular price for products on sale). The researchers use regression techniques to analyze correlations between wholesale price changes and the frequency and size of changes in both regular and sale prices, with the latter accounting for 95 percent of price changes at the stores.

The results of this experiment run counter to what many economists would expect—that retailers adjust both regular prices and discounts when costs increase. Analysis (see chart) shows that in most cases, regular retail prices adjust quickly to higher wholesale prices, rising sharply and closely tracking wholesale prices over succeeding months. (In some instances, regular prices don’t adjust fully to the cost increase, or adjustment is delayed.)

Response of Regular Price Index and Discount Index to an increase in the wholesale price



*Discount Index = Regular Price – Sale Price
Source: Authors’ calculations based on scanner price data from a large U.S. retailer

Sale prices, on the other hand, don’t react strongly to increases in wholesale prices. Despite the fact that the vast majority of variance in retail prices is due to weekly fluctuations in sale prices, “we find no evidence that wholesale price increases yield a systematic reduction in discounts,” the authors write. Moreover, the frequency and depth of discounts temporarily *increase* following a cost increase, partly offsetting the price adjustment achieved by raising regular prices.

“I think people would expect that firms use all margins of price adjustment: They adjust their regular price some, and they adjust their discounts some as well,” Malin said. “But it turns out that this retailer isn’t using both margins; all of the adjustment is coming through changes in regular prices.”

Impervious to shocks

Additional analyses that broaden the scope of the investigation beyond one type of cost shock or a single retailer support these main findings. First, the researchers look at how the retailer reacts to changes in commodity costs and unemployment rates. If price setters at stores use temporary sales to respond to underlying movements in production costs and changing economic conditions, the frequency and depth of price cuts should reflect that.

Noting that the period of study saw a rapid rise and subsequent fall in the price of oil and other commodities, the authors analyze the response of wholesale prices, regular prices and discounts to changes in diesel oil prices from 2007 to 2008. And they examine how changes in local unemployment rates affect prices at stores in those geographic areas.

In both cases, temporary sales fail to react to macroeconomic shocks. When the price of diesel oil spikes, the frequency of increases in wholesale prices and regular retail prices also rises sharply. In contrast, sale activity remains unaffected by the run-up in diesel prices. Similarly, a small increase in local unemployment triggers significantly lower regular prices at area stores. But there is no change in how often sales occur or the depth of discounts.

But what if the retail chain that supplied the confidential sales data is not representative of the consumer packaged goods industry as a whole? The researchers turn to BLS micro data underlying the consumer price index to test their findings in the wider arena of the overall U.S. economy.

The BLS data don't track wholesale prices, so the response of regular prices versus sales to economic shocks can't be directly compared. However, the contribution of temporary sales to price adjustment can be inferred by measuring aggregate price increases over the business cycle. The inflation rate typically rises during booms and falls during downturns. If retailers use sales to react to a new economic environment—putting on more sales or increasing discounts during downturns, for example—excluding sales from retail prices would make a difference in measured inflation. Without sales, inflation rate swings would be dampened; inflation would be lower in booms (relative to retail prices with sales, because upward price adjustment could occur only through regular price increases) and higher in recessions.

In the BLS price data, a “sale flag” is used to indicate discounted products, allowing the researchers to trace the pulse of inflation over the past quarter-century with and without sales. Their analysis reveals sales as a nonfactor in inflation as economic activity waxes and wanes. “By throwing out sales, we should reduce the amount of cyclical behavior [of inflation],” Malin said. “What we actually find is that excluding sales from the aggregate price index doesn't make a big difference when it comes to the cyclical behavior of inflation.”

The researchers also simulate the impact of a monetary policy shock—a one-quarter percent increase in the federal funds rate—on inflation with sales and sans sales, and find scant difference between the two measures.

Taken together, the empirical evidence makes a strong case for the authors' thesis that sales don't play an important role in how prices respond to cost changes or more general economic shocks. Evidence for why this is so must come from other sources—sticky information theory and insight into how retailers plan and execute sales.

Sales as “sticky plans”

Sound business practice would seem to dictate that retailers use all the tools at their disposal to respond when wholesale prices rise or the economy takes a turn. “We find that retailers adjust their regular price a bunch, but they're not adjusting their sales margin at all,” Malin said. “And so then the question is, why wouldn't they? What's keeping them from doing that?”

“Sticky plans” may hold the answer. The researchers suggest that markdowns in the retail industry are controlled by a trade promotion system that reacts slowly to changes in costs or economic conditions. In this system, prices are flexible but information is sticky; because of the complexities of holding sales, it's costly to change sales pricing or the timing of promotions.

Previous research by Simester and Anderson—including information gathered by a student interning at the retail firm that provided the scanner data—has shown that sales require considerable planning and coordination between retailers and manufacturers. A promotion may be accompanied by coupons, in-store displays, newspaper and radio advertising, and online marketing. Promotion

calendars and budgets arranged up to a year ahead largely determine the timing and depth of sales, and often retailers are contractually bound to follow through.

“All of these things mean that you can’t just sit down on Monday morning and say, ‘Hey, the economy’s a little weaker today; let’s have a sale tomorrow,’” Malin said. “It turns out that in the retail industry, they make these plans further in advance.”

Given these informational rigidities, the gains from responding to cost shocks through sales may not be worth the time and effort. The researchers use a recent model of sales behavior, developed by economists Igal Hendel and Aviv Nevo of Northwestern University, in which there are two types of customers: “loyals” and “bargain hunters.” While sales are vital for attracting the more price-sensitive bargain hunters and maximizing profits, varying the magnitude of these discounts in response to cost shocks is not.

In the Hendel-Nevo model, firms can change both regular and sale prices in response to cost changes. As its costs increase, a firm maximizes its profits by reducing discounts as well as by raising regular prices. But the loss incurred by not changing the size of the discount is minuscule—less than a tenth of 1 percent of the optimal profits that could be obtained by fine-tuning regular prices *and* sale prices.

“The firm leaves very little money on the table when it forgoes the opportunity to vary its sale prices in response to cost shocks,” the authors write. Thus it makes financial sense for retailers to respond to changes in costs or economic shocks primarily by adjusting regular prices, while sticking to their sale plans.

But despite the minimal role of sales in price adjustment, sales are still important to the economy. For example, retailers may use sales to soften the blow of increases to regular prices, helping to sustain consumer demand. This may explain, the authors suggest, why sales activity at the major retailer temporarily rises after a wholesale cost increase; the firm is trying to mask the hike in the regular shelf price.

And even if merchants don’t change their sales tactics in response to cost changes and economic shocks, *consumers’* use of sales may still respond. Some studies have found that the share of goods purchased on sale increases during recessions.

Cutting through the noise

The finding that retailers largely ignore sales as a price adjustment tool bolsters the view that regular prices are the main driver of overall price change in the economy. If this is the case, rapid and frequent changes in sale prices can be regarded as “noise” that hides underlying, fundamental price shifts in response to shocks such as higher commodity costs.

The authors’ conclusion has significance for macroeconomic models that inform monetary policy. Economists use these models to predict the impact of policy action, such as an uptick in the federal funds rate, on consumer demand and prices.

The question,” Malin said, “is how quickly does the aggregate price level respond to a monetary policy shock?” Since sales occur much more often than regular price changes, aggregate prices would react quickly to changes in monetary policy if sales responded to monetary policy shocks. The finding that they don’t means that it takes longer for aggregate prices to adjust to monetary policy action.

On the whole, “our research implies that aggregate prices are stickier than they would be if sales did respond to shocks,” Malin said. However, the investigation by no means settles the long-standing debate about price flexibility versus stickiness, and the real effects of monetary policy on the economy. Although the findings suggest that aggregate retail prices are not entirely flexible, more research is needed to get a clearer picture of how prices react to changes in economic conditions, and of the scope of policy action.

Much of that work is likely to be empirical in nature, exploiting micro data to advance understanding. In another recent paper (Minneapolis Fed Staff Report 516, online at minneapolisfed.org), Malin, Bils and Klenow use BLS household and industry data to examine the role of product market frictions (such as sticky prices) in worsening unemployment during recessions.

“Facts are essential for testing theories, and with new facts come new theories,” Malin said. ^R

Endnote

¹ Bils, M.J., and P. Klenow. 2004. “Some Evidence on the Importance of Sticky Prices.” *Journal of Political Economy* 112 (5): 947-85.