



Are Some Prices in the CPI More Forward Looking than Others? We Think So.

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Some of the items that make up the Consumer Price Index change prices frequently, while others are slow to change. We explore whether these two sets of prices—sticky and flexible—provide insight on different aspects of the inflation process. We find that sticky prices appear to incorporate expectations about future inflation to a greater degree than prices that change on a frequent basis, while flexible prices respond more powerfully to economic conditions—economic slack. Importantly, our sticky-price measure seems to contain a component of inflation expectations, and that component may be useful when trying to gauge where inflation is heading.

Like it or not—and there are many in the “not” camp—the workhorse for forecasting medium-term inflation is the expectations-augmented Phillips curve, variations of which are sometimes called New Keynesian Phillips curves. In this forecast, often produced from a single price aggregate like the Consumer Price Index (CPI) or the price deflator for personal consumption expenditures, inflation is a function of two forces: the inflation expectations of the public and the amount of slack in the economy. Inflation expectations are an important consideration in wage and price decisions, and slack influences the pricing power of firms and workers.

Of course, the basic forces that shape the conventional inflation forecast do not do so in the same way for all prices. For example, some prices are “sticky,” which means that they may not respond to changing market conditions as quickly as other, more “flexible-price” goods. And because sticky prices are slow to change, it seems reasonable to assume that when these prices are set, they incorporate expectations about future inflation to a greater degree than prices that change on a frequent basis.

In this *Commentary*, we use the published components of the CPI to compute two subindexes, a sticky-price composite of the CPI and a flexible-price CPI. We believe the evidence indicates that the flexible-price measure is, in fact, much more responsive to changes in the economic environment—slack—while the sticky-price variant appears to be more forward looking.

Price Stickiness in the Consumer Price Index

What makes a price sticky? The answer to this question has puzzled economists since John Maynard Keynes built his General Theory around sticky prices more than 70 years ago. The prevailing belief is that, in some markets, changing prices can involve significant costs. These costs can greatly reduce the incentive of firms to change prices.

While a sticky price may not be as responsive to economic conditions as a flexible price, it may do a better job of incorporating inflation expectations. Since price setters understand that it will be costly to change prices, they will want their price decisions to account for inflation over the periods between their infrequent price changes.

While some economists wrestle with the question of what, exactly, causes prices to be sticky, others have taken on the tedious task of documenting the speed at which prices adjust. The most comprehensive investigation into how quickly prices adjust that we know of was published a few years ago by economists Mark Bils and Peter Klenow. Bils and Klenow dug through the raw data for the 350 detailed spending categories that are used to construct the CPI. They found that half of these categories changed their prices at least every 4.3 months. Some categories changed their prices much more frequently; price changes for tomatoes, for example, occurred every three weeks. And some goods, like coin-operated laundries, changed prices on average only every 6½ years or so.

Table 1. Flexible and Sticky Prices in the CPI Market Basket

Flexible-price items	Frequency of adjustment^a	Relative importance	Sticky-price items	Frequency of adjustment^a	Relative importance
Motor fuel	0.7	3.2	Infants' and toddlers' apparel	5.3	0.2
Car and truck rental	1.2	0.1	Household furnishings and operations	5.3	4.8
Fresh fruits and vegetables	1.3	0.9	Motor vehicle maintenance and repair	5.8	1.2
Fuel oil and other fuels	1.5	0.3	Motor vehicle insurance	5.9	2.0
Gas (piped) and electricity	1.6	4.2	Medical care commodities	6.2	1.6
Meats, poultry, fish, and eggs	1.9	1.9	Personal care products	6.7	0.7
Used cars and trucks ^b	2.0	1.6	Alcoholic beverages	7.3	1.1
Leased cars and trucks ^b	2.0	0.6	Recreation	7.9	5.7
New vehicles	2.0	4.5	Miscellaneous personal goods	8.1	0.2
Women's and girls' apparel	2.3	1.5	Communication	8.4	3.2
Dairy and related products	2.6	0.9	Public transportation	9.4	1.1
Nonalcoholic beverages and beverage materials	2.7	1.0	Tenants' and household insurance	10.1	0.3
Lodging away from home	3.1	2.5	Food away from home	10.7	6.5
Processed fruits and vegetables	3.2	0.3	Rent of primary residence ^b	11.0	6.0
Men's and boys' apparel	3.2	0.9	OER, Northeast ^b	11.0	5.3
Cereals and bakery products	3.3	1.2	OER, Midwest ^b	11.0	4.5
Footwear	3.4	0.7	OER, South ^b	11.0	7.7
Other food at home	3.6	2.0	OER, West ^b	11.0	6.9
Jewelry and watches	3.9	0.4	Education	11.1	3.1
Motor vehicle parts and equipment	4.1	0.4	Medical care services	14.0	4.8
Tobacco and smoking products	4.2	0.8	Water, sewer, and trash collection services	14.3	1.0
Total, flexible-price items		29.8	Motor vehicle fees	16.4	0.5
Total, core flexible-price items		14.0	Personal care services	23.7	0.6
			Miscellaneous personal services	25.9	1.1
			Total, sticky-price items		70.1
			Total, core sticky-price items		63.6
			Total, non-OER sticky-price items		45.7

a. In months.
 b. These items were not investigated in Bils and Klenow (2004). The only housing component in the Bils and Klenow dataset is “housing at school excluding board,” and we report that estimate for the housing categories in this work. While there may be only a weak correspondence between housing at school, rental housing, and owners’ equivalent rent, rents used by the Bureau of Labor Statistics to construct the CPI are computed over six-month horizons, making these data, by construction, sticky-price goods.
 Sources: Bureau of Labor Statistics; Bils and Klenow (2004); authors’ calculations.

Using this information, we divided the published components of the monthly CPI (45 categories derived from the raw price data) into their “sticky-price” and “flexible-price” aggregates. While it isn’t at all clear where one should draw the line between a sticky price and a flexible price, we thought the average frequency of price change found in the Bils and Klenow research was a natural separating point. If price changes for a particular CPI component occur less often, on average, than every 4.3 months, we called that component a “sticky-price” good. Goods that change prices more frequently than this we labeled “flexible-price” goods.¹

Table 1 shows the components of the CPI market basket along with their relative weights and the frequency of price change for the component as suggested by the research of Bils and Klenow. In terms of the overall, or “headline” CPI, we judge that about 70 percent of it is composed of sticky-price goods and 30 percent of flexible-price goods. About half of the flexible-price CPI comprises food and energy goods, the remainder being largely autos, apparel, and lodging away from home. The sticky-price CPI includes many service-based categories, including medical services, education, and personal care services, as well as most of the housing categories which, by construction, change only infrequently.

So, What Do These Measures Show?

As you may have guessed, the sticky-price CPI exhibits a relatively smooth trend—with only 2 percent of the variance of the flexible-price measure from one month to the next (figure 1). We also produced “core” measures of the sticky and flexible CPI (the sticky- and flexible-price CPI measures less food and energy components—see figure 2).

Again, the flexible core CPI shows much more volatility than the alternative sticky-price core measure—in fact, 8 times as much.²

We make special note of the variance of these measures since 1983 (see table 2). Specifically, we see that the volatility of the flexible-price measures has been relatively constant across time. However, the volatility in the sticky-price measures has diminished considerably since 1983. Some of this difference is due to a change in the method used by the BLS to compute the cost of home ownership, but certainly not all.³ When we subtract out the shelter component from the sticky-price index, volatility still falls significantly after 1983.

The success of the “Volcker-era” Fed in bringing inflation under control has been widely documented to have anchored inflation expectations. Many survey measures of inflation expectations exhibit this anchoring (lower volatility), starting in the mid-1980s. A very similar pattern of lower volatility occurred in the sticky-price measures over the same time period, which is consistent with the view that an expectations component is being expressed through these measures. In other words, we think these data point to an expectations component in the sticky-price CPI that is not very evident in the flexible-price measure.

If the sticky-price CPI captures one input to the expectations-augmented Phillips curve, does the flexible-price CPI capture the other? Are flexible prices more sensitive to

economic conditions and do the flexible-price CPI measures reflect economic slack better as a result? Our analysis suggests that they do.

We examine a simple linear relationship between the amount of slack in the economy (in this case using the difference between the rate of unemployment and the natural rate of unemployment as calculated by the Congressional Budget Office) and 12-month changes in the headline CPI, the flexible price CPI, and the sticky-price CPI (figure 3).

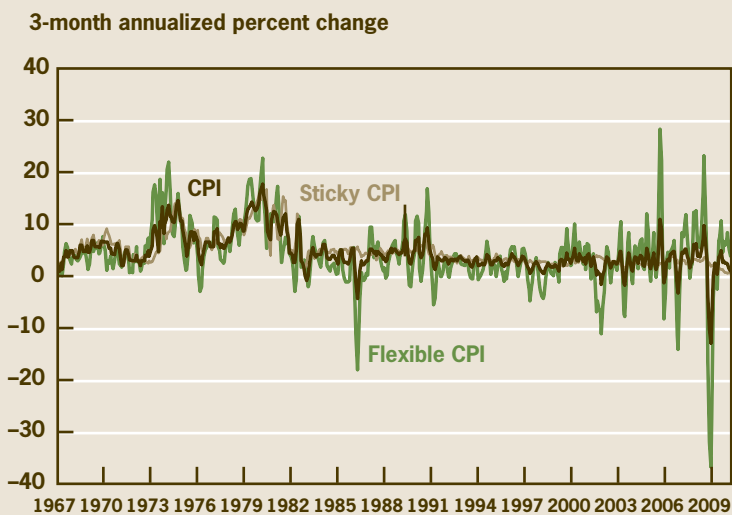
Clearly, changes in the flexible-price measure have a stronger negative relation to the unemployment gap than the overall CPI, a pretty good indication that these prices are more responsive to economic conditions than prices on average. However, the sticky-price CPI, if anything, appears to have a slight positive (though not statistically significant) correlation with the unemployment gap.⁴

The differences between the slopes of the flexible CPI and the sticky CPI regression lines, thus their differing responses to the unemployment gap, got us thinking about how these different measures would inform an inflation forecast. Would either the relatively strong responsiveness of the flexible CPI or the embedded expectations in the sticky-price measures add important information about the future path of inflation?

Sticky and Flexible Prices in the Inflation Outlook

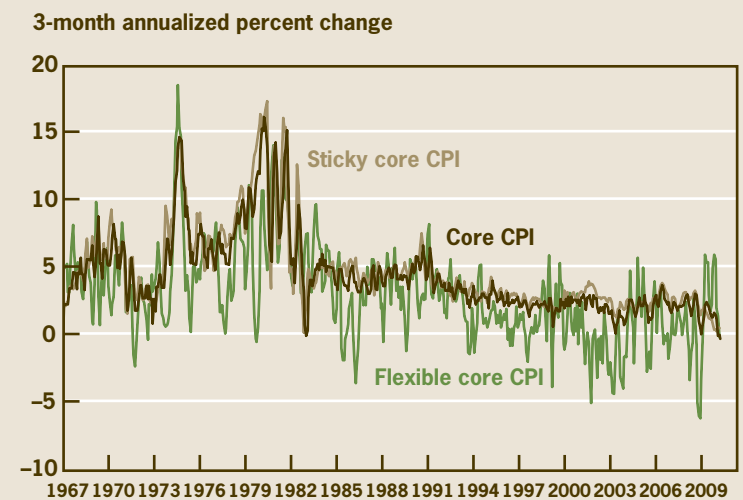
To test whether these new measures have any predictive power, we employ a rather standard, uncomplicated Phillips curve specification to forecast the 1-, 3-, 12-, and 24-month-ahead CPI inflation rate. The unemployment gap is calculated as before. For inflation expectations, we use lagged versions of various measures of the CPI: the overall CPI, the flexible-price CPI, the sticky-price CPI, and their core representations. In each equation, we use 12 lags of the

Figure 1. CPI by Degree of Flexibility



Sources: Bureau of Labor Statistics; authors' calculations.

Figure 2. Core CPI by Degree of Flexibility



Sources: Bureau of Labor Statistics; authors' calculations.

unemployment gap to represent the degree of slack in the economy.⁵

We are interested in whether changes in the flexible CPI or sticky CPI improve the forecast of headline inflation at various numbers of months into the future. The accuracy of each forecast, reported in table 3, is measured by comparing its root mean squared error (RMSE) to the RMSE of the forecast produced from the headline CPI. A relative RMSE less than 1.0 indicates that the alternative proxy for inflation expectations is more accurate than the headline CPI. We focus on the time after 1983, due to the possible existence of a regime shift in the late 1970s to early 1980s.

We find that forecasts of the headline CPI that are based on the sticky-price data tend to be more accurate than the forecasts based on headline inflation. Further, CPI predictions using sticky-price data perform pretty well relative to CPI forecasts using core CPI data.^{6,7} We also find that the relative accuracy of the sticky-price Phillips curve increases as the forecast horizon gets longer. For example, when predicting three months ahead, we find that the sticky-price Phillips curve reduces the RMSE of the forecast only about 2 percent relative to the headline CPI. For the 24-month-ahead forecast, the improvement in the RMSE was about 14 percent. The flexible-price measure, at least on the surface, does not seem to forecast well, and it performs increasingly worse as the forecast horizon gets longer.

Conclusion

We don't claim that our sticky-price Phillips curve produces a demonstrably better forecast of the CPI—given its simplicity, we would be very surprised if it did. But we nevertheless wanted to see if some prices in the CPI are more responsive to the business cycle, and if some are more forward looking. Our experiments with this data suggest that the answer to both questions is yes.

We found that the flexible-price series tends to bounce violently from month to month, presumably as it responds to changing market conditions, including the degree of economic slack. On the other hand, sticky prices are, well, sticky, slow to adjust to economic conditions. Importantly, the sticky-price measure seems to contain a component of inflation expectations, and that component may be useful when trying to discern where inflation is heading.

Where is inflation heading? Well, the last FOMC statement held that the view that “inflation is likely to be subdued for some time.” We certainly don't have reason to question that outlook. Indeed, while the recent trend in the core flexible CPI has risen some recently—it's up 3.3 percent over the past 12 months (ending in March)—the trend in the core sticky-price CPI continues to decline. Even excluding shelter, the 12-month growth rate in the core sticky CPI has fallen 1.1 percentage points since December 2008, down to 1.8 percent in March. So on the basis of these cuts of the CPI, we think “subdued for some time” sums up the price trends nicely.

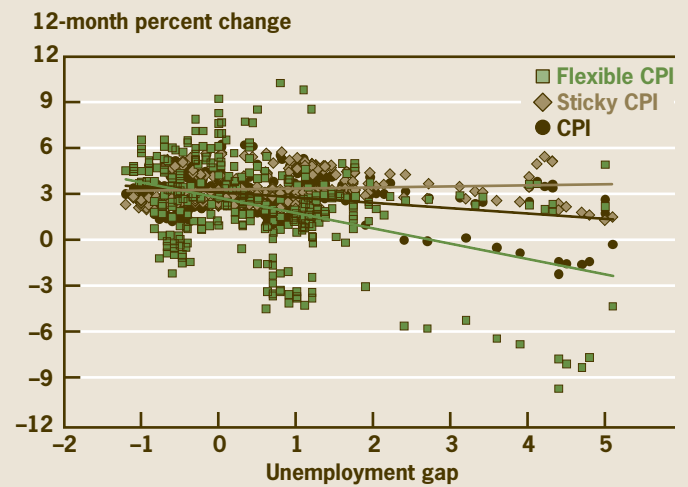
Table 2. Monthly Variance of Flexible and Sticky-Price CPI Aggregates

	Flexible CPI	Core Flexible CPI	Sticky CPI	Core sticky CPI	Sticky CPI excluding shelter	Core sticky CPI excluding shelter
Total sample	67.29	19.90	10.63	11.56	6.89	7.62
1983–forward	71.46	15.79	1.70	1.90	2.10	2.58

Note: The variance was calculated from the one-month annualized percent changes in each variable.

Sources: Bureau of Labor Statistics; authors' calculations.

Figure 3. Disaggregated CPI Phillips Curves: 1983–2009



Sources: Bureau of Labor Statistics; Congressional Budget Office; authors' calculations.

Table 3. Headline CPI Forecast Accuracy: Relative Root Mean Squared Errors

	Flexible	Core flexible	Sticky	Core sticky	Core CPI
1 month ahead	1.002	1.025	1.007	1.025	1.010
3 months ahead	1.049	1.006	0.988	0.996	0.994
12 months ahead	1.116	1.052	0.955	0.969	0.953
24 months ahead	1.355	1.165	0.858	0.869	0.987

Notes: The out-of-sample forecast period is 2000:M1–2007:M12 (estimated over 1983:M1–1999:M12).

The RMSEs are based on comparing alternative Phillips curve forecasts of the CPI to the forecast obtained from the CPI Phillips curve benchmark (i.e., the RMSE of each alternative CPI forecast divided by the RMSE of the benchmark CPI forecast).

Sources: Bureau of Labor Statistics; authors' calculations.

Footnotes

1. Because we are dealing with broader spending categories than Bils and Klenow, who used unpublished entry-level items, we could only imperfectly match our data set to their research. So admittedly, some art was applied in instances where sticky-price goods and flexible-price goods coexisted in the same spending category. In these cases, we used a weighted average of the entry-level data to compute the average frequency of price change that maps into our broader component indexes.

2. Another observation from these data is that sticky prices have tended to rise at a faster rate, on average, than the core flexible-price index. Obviously, something more than the degree of price flexibility distinguishes these two price measures. We take no stand on the nature of this differential.

3. In 1983, the BLS changed its methodology for computing the cost of home ownership from a “cash flow” approach, to an “owners’ equivalent rent” approach, precisely because the former approach was thought to be excessively volatile.

4. The relationship (or lack of thereof) between the unemployment gap and the sticky-price series excluding food and energy and excluding OER is quantitatively similar to the headline sticky series.

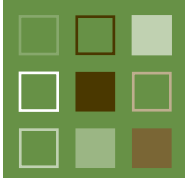
5. We allow for up to 12 lags of an inflation measure (CPI, flexible CPI, sticky CPI) and 12 lags of the unemployment gap, to be chosen independently by the Akaike information criterion (AIC). We use the Newey-West correction for HAC standard errors.

6. Due to the arbitrary nature of the stickiness cutoff (4.3 months), we also ran the tests with a six-month designation and found similar results. Also, we ran the equations with fixed lags and found the same general result.

7. We also make the comparison to a “naïve” forecast—one that assumes inflation over the next t periods will be equal to the annualized inflation rate over the past t periods. Over every forecast horizon tested, we find that forecasts that incorporate lagged sticky prices have a lower relative RMSE than a “naïve” forecast.

Recommended Reading

“Some Evidence on the Importance of Sticky Prices,” by Mark Bils and Peter J. Klenow. *Journal of Political Economy*, 2004.



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