Economic Brief

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Inflation Expectations: Their Sources and Effects

By Yash P. Mehra and Devin Reilly

Shocks to the macroeconomy can affect the public's expectations about inflation. But if the Federal Reserve monitors those expectations carefully and vigilantly pursues price stability, it can establish credibility and keep inflation in check.

Over the past year, rising inflation paired with growing unemployment have posed an increasingly complex problem for the Federal Reserve. The Consumer Price Index (CPI) jumped 5.6 percent from July 2007 to July 2008, a rate of growth not seen since the early 1990s. Given this macroeconomic climate, understanding the Federal Reserve's ability to control inflation has become even more important. A recent paper by Sylvain Leduc, Keith Sill, and Tom Stark (2007), referred to hereafter as LSS (2007)[1] , analyzes the significance of the public's inflation expectations on actual inflation. The authors find that, prior to 1979, the Fed accommodated high inflation expectations, which in turn created persistent inflation spikes. This behavior is not present after 1979, providing evidence that the Fed changed its response to inflation. While LSS (2007) focused more on movements in actual inflation, a recent paper from the Richmond Fed investigates macroeconomic determinants of inflation and their effects on expected inflation.[2] In their spring 2008 article in the Federal Reserve Bank of Richmond's *Economic Quarterly* " On the Sources of Movements in Inflation Expectations: A Few Insights from a VAR Model," Yash Mehra and Christopher Herrington use a model similar to LSS (2007) to measure the impact of macroeconomic shocks on expectations and how these effects have changed over the sample period: 1953 to 2007.

Current research on this topic is of considerable interest to the Federal Reserve, as its principal task is achieving and maintaining price stability. This *Economic Brief* provides a discussion of the methodology and results of Mehra and Herrington's paper, as well as its implications for Federal Reserve policy in regards to inflation.

MODEL MECHANICS AND VARIABLE MEASUREMENT

Mehra and Herrington's paper uses a structural vector autoregression (VAR) that was initially used in LSS (2007). A VAR is an econometric model that describes the evolution of the interactions between several variables. In this context, the authors use a VAR to analyze the behavior of expected inflation, actual inflation, commodity prices, the unemployment rate, the short-term nominal interest rate, and an oil shock variable. Using a structure similar to LSS (2007), the authors are able to specify the model so that only certain variables are affected by contemporaneous information. For instance, under the basic setup, expectations of inflation in a given time period are unaffected by the other variables in the VAR at that time. They are affected only by past

levels of expectations and past values of the other five variables. Mehra and Herrington also use alternative specifications, where expectations can respond contemporaneously to all other variables. This exercise does not significantly change the results of the model.

Expected inflation is measured by the Livingston Survey, which summarizes the eight-month-ahead CPI forecasts of experts from industry, government, academia, and banking, and is conducted twice a year by the Federal Reserve Bank of Philadelphia. Actual inflation is taken as a six-month change in the CPI. Commodity prices and unemployment are six-month averages of their respective indices. Short-term nominal interest rates are six-month averages of the three-month Treasury bill rate. The oil shock is measured by a dummy variable, which can be formulated in one of two ways, both outlined by James Hamilton (2003).[3] The first method looks at oil price increases stemming from drops in oil production caused by political events. Hamilton isolates five of these events, and the dummy variable takes a value equal to the drop in world production for each event and is otherwise zero. The other method measures net oil price increases relative to past two-year peaks. This allows the VAR to consider recent episodes in which oil shocks were not caused by political disruption, but rather by growing demand from developing economies.

EXPECTATION DYNAMICS CHANGE IN THE 1980S

Figure 1 contains a graphical representation of some of the variables included in the VAR. They are split into two separate time periods, the first half of 1950 through the first half of 1979, and the second half of 1979 through the first half of 2007. We notice from the top panels of Figure 1 that expectations do move with actual inflation in both periods, but also tend to under-predict inflation when it is accelerating and over-predict it when it is decelerating. This implies that survey participants did not respond immediately to actual inflation numbers, which in turn suggests that the co-movement of the two variables may have come from actual inflation responding to expectations. We can also see from the movements in the real interest rate that the Fed responded more aggressively during the 1980s to inflation than before. The real rate turned negative during the inflation of the late 1970s, contributing to persistent inflation throughout the decade. However, in the 1980s, monetary policy became much more responsive, with interest rates rising more sharply to combat high inflation.

Figure 2 shows how one-time, unanticipated shocks to each variable affect public expectations of inflation.[4] These shocks are 1 percent increases for all variables in the VAR except commodity prices, for which a shock represents a 100 percent increase. It is striking to see the differences between the Great Inflation (GI) period, the first half of 1953 through the first half of 1979, and the Great Moderation (GM) period, the first half of 1985 through the first half of 2007.[5] During the GI period, we see that both actual inflation and expectations shocks have a sustained impact on expected inflation, lasting all 12 years of the simulation. In the GM period, these same shocks cause only transitory increases in expected inflation: Expectations begin to fall after only one year, quickly returning to pre-shock levels.

For a 100 percent commodity price shock, expectations in the GI period see a 10 percent increase after a year, lasting throughout the entire simulation. Yet, for the GM period, we see a very small jump in expectations one period after the same shock. Also, after one year, expectations fall back to pre-shock levels. Unemployment increases have opposite effects in the GI and GM periods. In the former, expected inflation permanently increases, while in the latter, there is a temporary decrease in expected inflation. These results point to a change in the nature of expectations between the GI and GM periods – namely, they suggest a stabilization in expectations in the 1980s.

MONETARY POLICY RESPONSE TO VARIOUS SHOCKS

A common explanation for persistent inflation in the 1970s is that the monetary policy response was not sufficiently aggressive. Figure 3 shows the responses of actual inflation, expectations, the nominal interest rate, and the real interest rate to a 1 percent expectations shock. This figure is broken into three periods: GI, GM, and a third period, 1979 to 2001. In the pre-1979 sample, the nominal rate rises with a shock, but not enough to keep the real rate positive for an extended period of time. For the 1979 to 2001 period, the response is far less accommodating to inflation, with a more than 1 percent jump in the real interest rate. For the GM period, the response is somewhat muted; however, Mehra and Herrington argue that this may be because this period witnessed low and stable inflation, which would naturally lead to less aggressive responses than when the Fed was attempting to reduce inflation during the 1980s. There are similar interest rate responses to a shock in commodity prices. The real rate becomes negative in the GI period, but aggressively rises in both periods after 1979. Finally, although oil shocks have transitory effects on expected inflation in all three time periods, they are more muted after 1979 than during the GI period. In fact, the GM period sees an initial statistically significant *decline* in expected inflation following an oil shock.

These three responses demonstrate how expectations are shaped by the Federal Reserve's response to inflation. When people are confident that the Fed will not accommodate inflation, their expectations will not change significantly, thereby making a persistent increase in actual inflation unlikely. Each result is consistent with the idea that the

Fed's aggressive interest rate policy after 1979 helped to keep responses in expectations temporary and more muted. It also implies that the Federal Reserve has earned a great deal of credibility since 1979. People now are confident that the interest rate response to a shock will be strong enough to combat inflation, and, therefore, they do not adjust their long-term expectations in response to a one-time shock. This is especially true for commodity price shocks. In the pre-1979 sample, commodity price shocks account for between 40 percent and 50 percent of the variance in expectations. However, after 1979, these same shocks account for only between 11 percent and 22 percent of that variation. This points to an increased confidence that the Fed will contain inflation even as the public faces higher commodity prices.

CONCLUDING THOUGHTS

Mehra and Herrington's paper uses a VAR including the following variables: expected inflation, actual inflation, commodity prices, short-term interest rates, unemployment, and oil shocks to analyze the macroeconomic factors that may influence expectations of inflation, and how these influences have changed over the sample period of 1953 to 2007. During the Great Inflation period, unanticipated shocks to expected inflation, commodity prices, and actual inflation all led to sustained and significant increases in expectations. After 1979, these responses are more muted, which may help to explain why shocks after 1979 have not led to persistent increases in inflation.

A major source of these changes is the more aggressive response of the Federal Reserve after 1979 to economic shocks that affect expectations. Prior to 1979, nominal interest rates did not rise sufficiently to offset expectations spikes, and thus real rates fell. This accommodative policy allowed for permanent increases in expected inflation, which in turn pushed up actual inflation. However, in the sample periods after 1979, we see a stronger interest rate response following a shock. This kept inflation expectations in check, and strongly influenced the lack of inflation persistence in the post-1979 period. It also suggests that the Fed has gained credibility since 1979, as the general public no longer changes its inflation expectations in response to oil or commodity shocks, since it believes the Fed will not allow those shocks to pass through to actual inflation levels.

Further research could potentially show that the results change when more variables are considered. For instance, Andrew Ang, Geert Bekaert, and Min Wei (2006) argue that surveys provide better forecasts of inflation since they may capture information from several sources not summarized by a single model.[6] In addition, a VAR is inherently backward-looking since expectations respond only to past or, at most, current variables. These concerns mean that exogenous movements in expectations may in fact represent overlooked variables, which could be an area of further research. Despite this, "On the Sources of Movements in Inflation Expectations" provides insight into inflation dynamics and suggests that the Fed must seek to monitor expectations to ensure that they do not unhinge and turn into persistent increases in actual inflation ■

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ENDNOTES

[1] Leduc, Sylvain, Keith Sill, and Tom Stark. 2007. "Self-Fulfilling Expectations and the Inflation of the 1970s: Evidence from the Livingston Survey." *Journal of Monetary Economics* 54: 433-459.

[2] Mehra, Yash P., and Christopher Herrington. 2008. "On the Sources of Movements in Inflation Expectations: A Few Insights from a VAR Model." Federal Reserve Bank of Richmond *Economic Quarterly* 94: 121-146.

[3] Hamilton, James D. 2003. "What is an Oil Shock?" *Journal of Econometrics* 113: 363-398.

[4] Figures 2 and 3 show the point estimates produced by the model. In their paper, Mehra and Herrington also estimate 68 percent and 90 percent confidence bands.

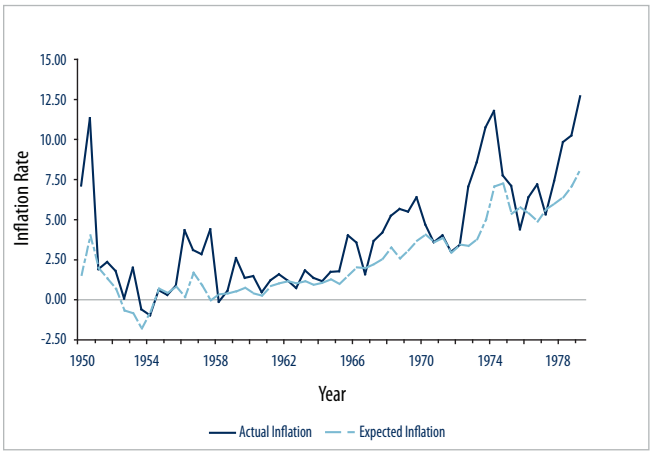
[5] The Great Inflation period discussed in the article includes the subperiod 1953 to 1965, when inflation was low and stable. The authors included this subperiod to produce more reliable estimates of VAR parameters.

[6] Ang , Andrew, Geert Bekaert, and Min Wei. 2006. "Do Macro Variables, Asset Markets, or Surveys Forecast Inflation Better?" Finance and Economics Discussion Series 2006-15, Board of Governors of the Federal Reserve System.

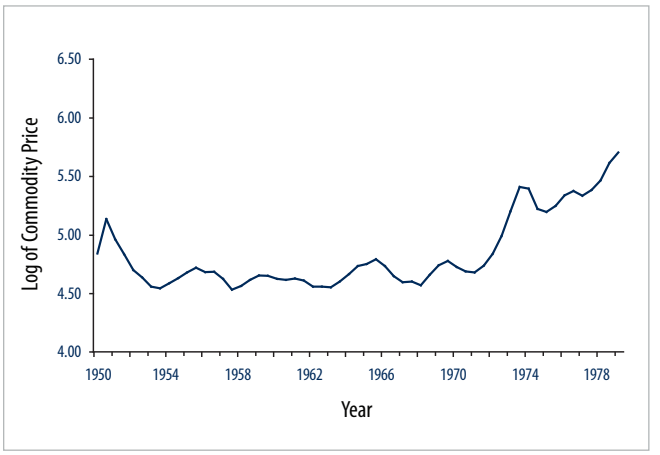
FIGURE 1: VAR DATA

1950:1 TO 1979:1

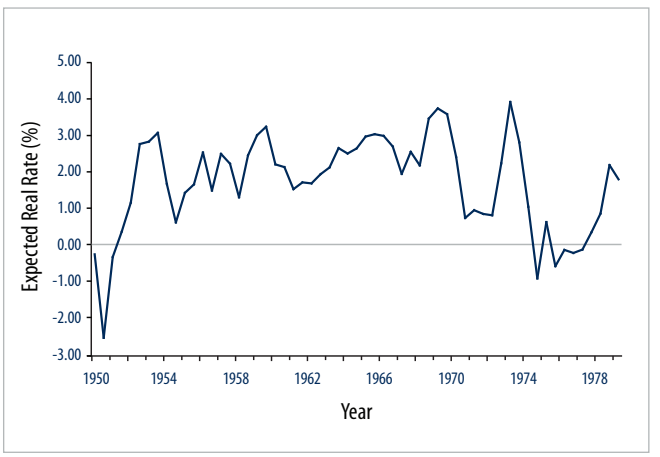
EXPECTED AND ACTUAL INFLATION



LOG OF COMMODITY PRICES

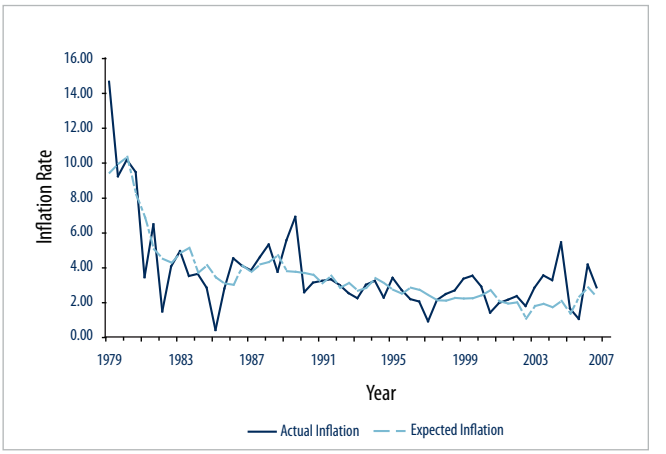


EXPECTED REAL RATE

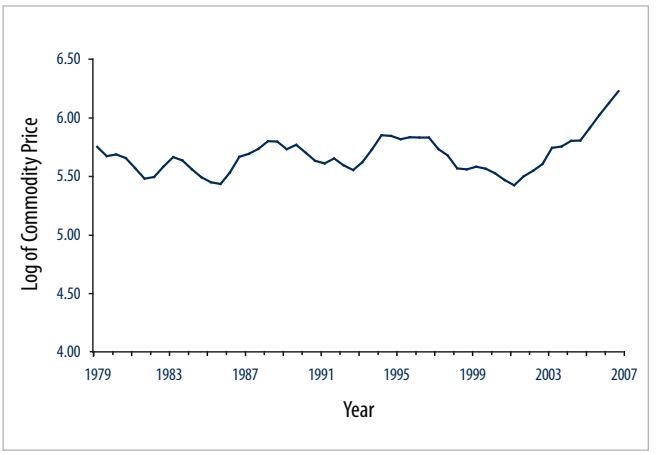


1979:2 TO 2007:1

EXPECTED AND ACTUAL INFLATION



LOG OF COMMODITY PRICES



EXPECTED REAL RATE

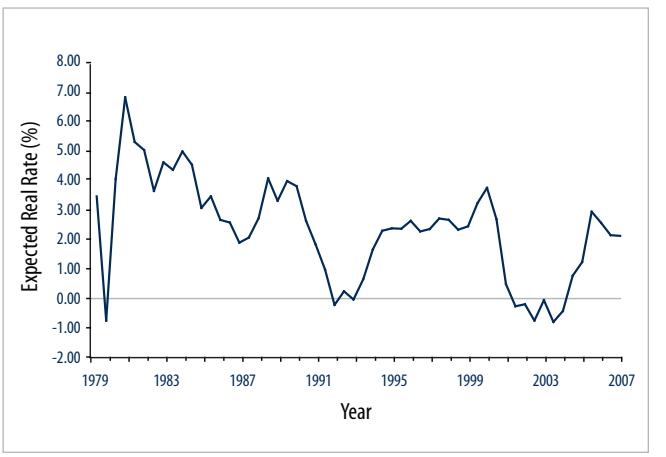


FIGURE 2: EXPECTED INFLATION RESPONSE TO . . .

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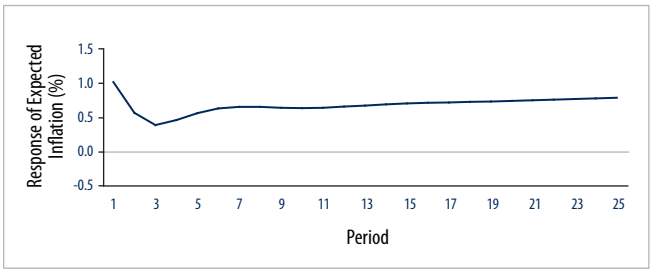
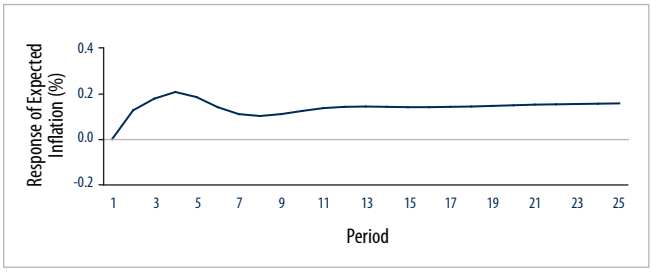
1953:1 TO 1979:1

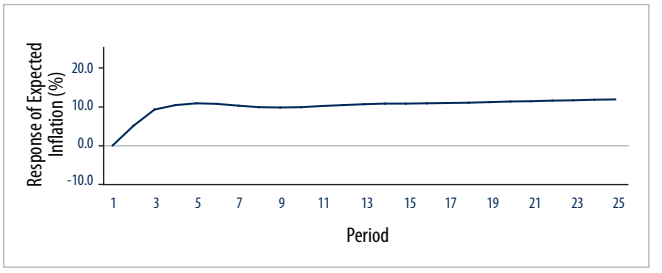
EXPECTATIONS SHOCK



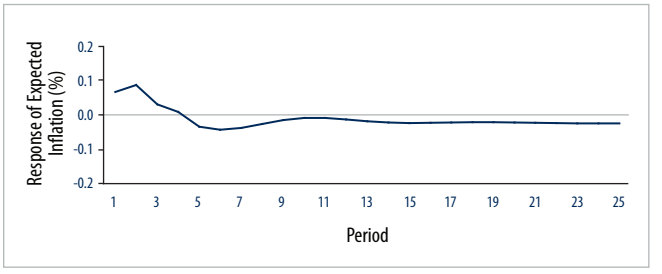
INFLATION SHOCK



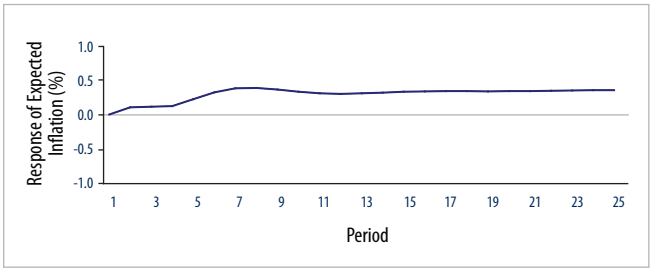
COMMODITY PRICE SHOCK



OIL SHOCK

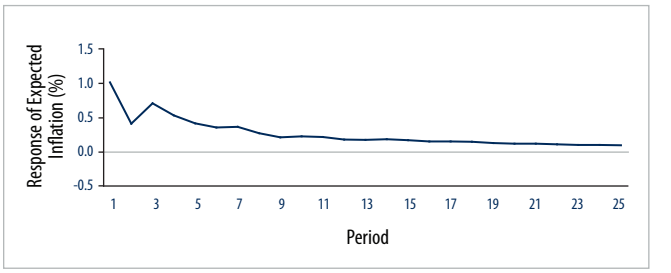


UNEMPLOYMENT SHOCK

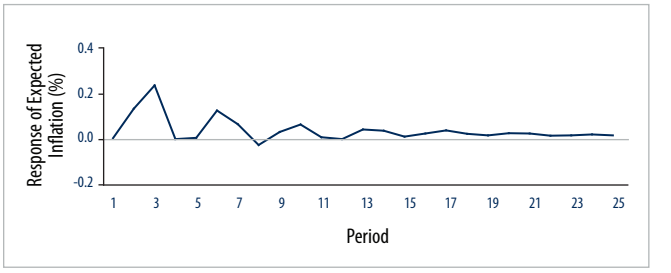


1985:1 TO 2007:1

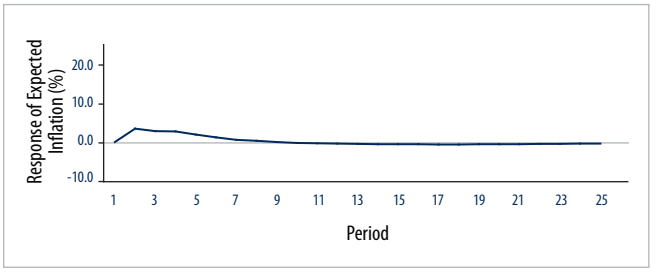
EXPECTATIONS SHOCK



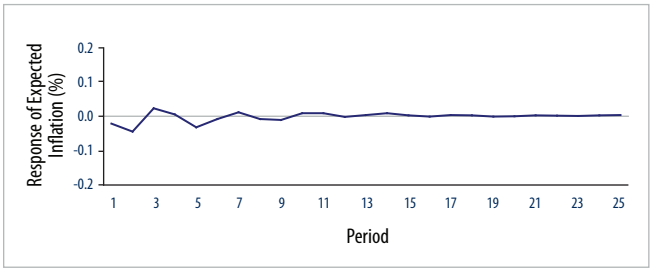
INFLATION SHOCK



COMMODITY PRICE SHOCK



OIL SHOCK



UNEMPLOYMENT SHOCK

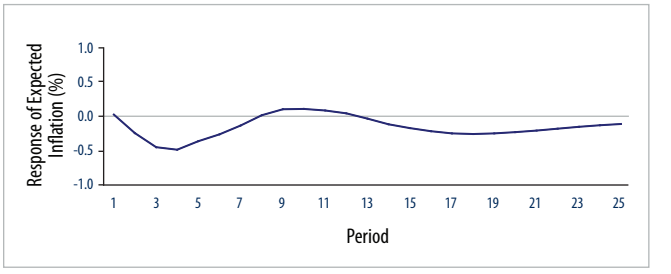
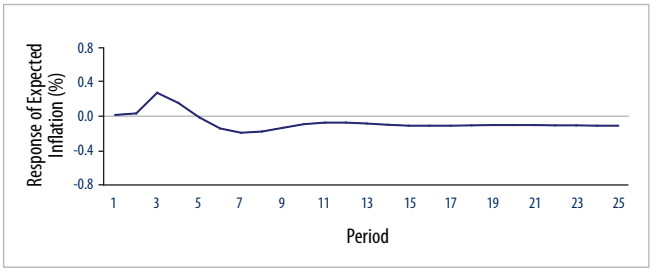


FIGURE 2: EXPECTED INFLATION RESPONSE TO . . .

(continued from Page 5)

1953:1 TO 1979:1

TO INTEREST RATE SHOCK



1985:1 TO 2007:1

TO INTEREST RATE SHOCK

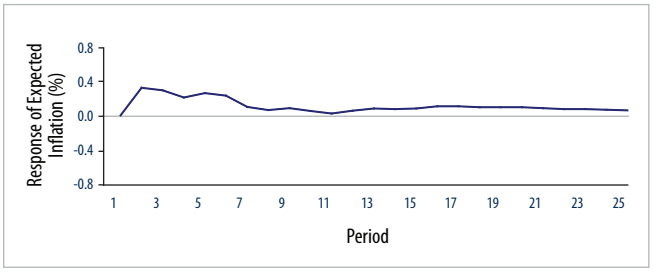
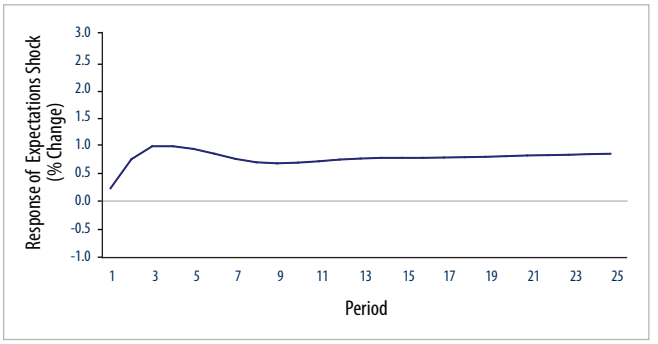


FIGURE 3: SHOCK TO INFLATION EXPECTATIONS

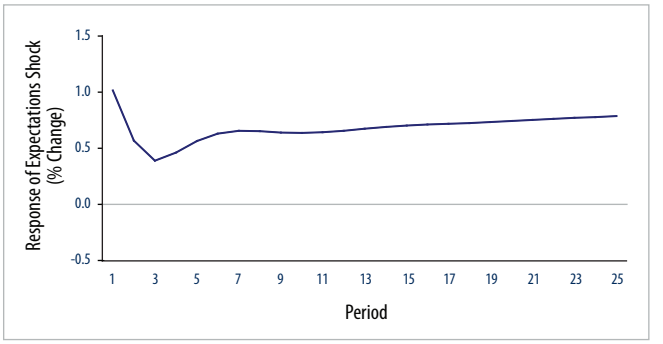
(continued to Page 7)

1953:1 TO 1979:1

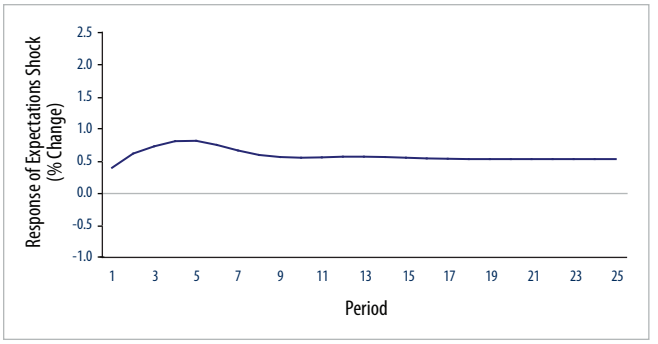
INFLATION RESPONSE



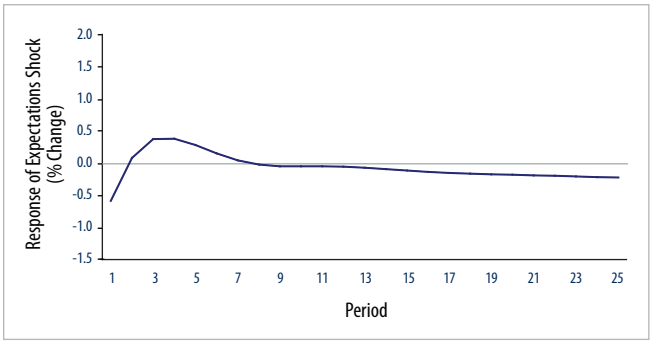
EXPECTED INFLATION RESPONSE



NOMINAL INTEREST RATE RESPONSE

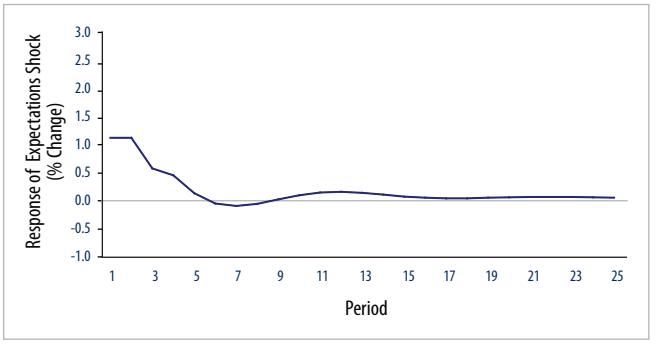


REAL INTEREST RATE RESPONSE



1979:2 TO 2001:1

INFLATION RESPONSE



EXPECTED INFLATION RESPONSE

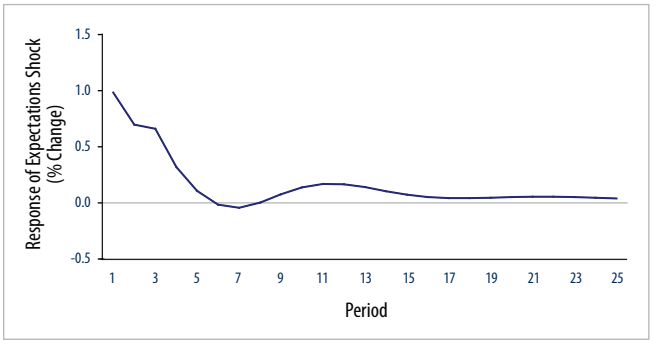
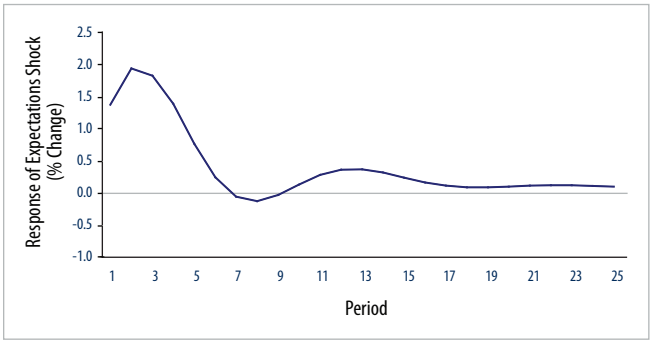


FIGURE 3: SHOCK TO INFLATION EXPECTATIONS

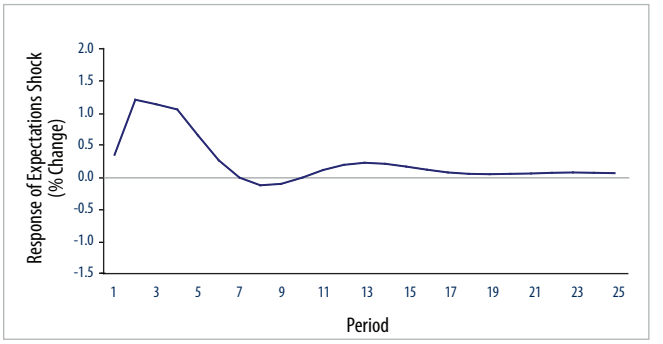
(continued from Page 6)

1979:2 TO 2001:1

NOMINAL INTEREST RATE RESPONSE

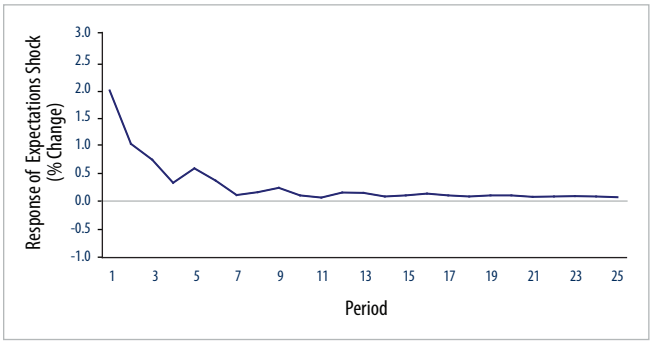


REAL INTEREST RATE RESPONSE

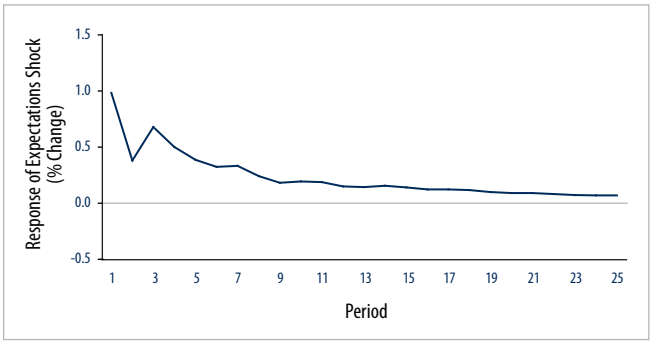


1985:1 TO 2007:1

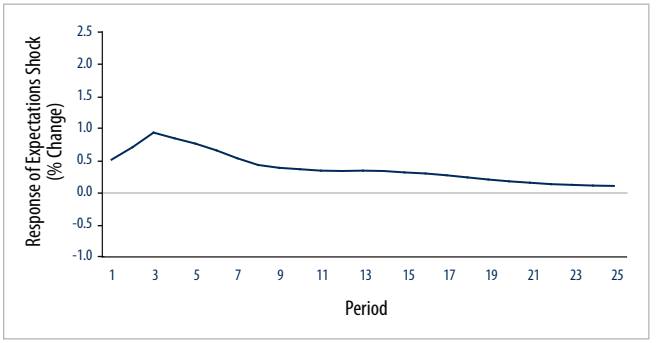
INFLATION RESPONSE



EXPECTED INFLATION RESPONSE



NOMINAL INTEREST RATE RESPONSE



REAL INTEREST RATE RESPONSE