CHAPTER 15

Interest Rates and Inflation

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The conventional view among economists is that higher interest rates reduce inflation. However, the prolonged period of low inflation and low interest rates in advanced economies following the global financial crisis appears to be inconsistent with this view. This situation has sparked a debate: do lower interest rates increase inflation (the conventional view), or do they lead to lower inflation (the so-called Neo-Fisherian view)? This chapter finds strong evidence in favor of the conventional view of monetary policy transmission in Brazil. While lower inflation and lower nominal interest rates can be achieved over the long term by targeting a lower level of inflation, this outcome is likely to come at the cost of lower output (and employment) in the short term—a cost that can be mitigated by enhancing monetary policy transparency and credibility. Monetary policy transmission could be made more efficient by reducing distortions and improving the allocation of resources in the financial sector.

INTRODUCTION

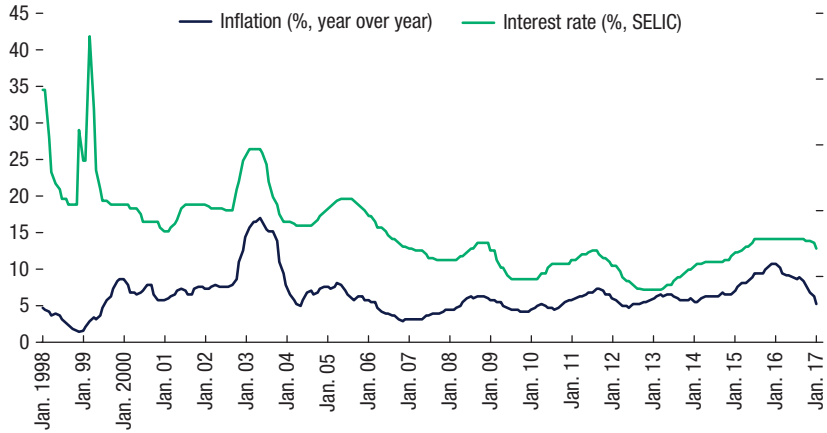
The conventional view among economists is that *higher* interest rates lead to *lower* inflation. The rationale behind this view is that higher interest rates increase the cost of borrowing and dampen demand across the economy, resulting in excess supply and lower inflation. In this context, higher interest rates reduce inflation through several channels, including the exchange rate channel, the credit channel, and the bank–balance sheet channel (see Mishkin 1996). A central bank facing the prospect of higher-than-targeted inflation would raise interest rates enough to increase the real (inflation-adjusted) cost of borrowing, thereby reducing aggregate demand and returning inflation back toward the desired level.

Some debate has occurred about whether *lower* inflation can be achieved by setting *lower* policy interest rates, the so-called Neo-Fisherian effect. At the heart of the debate is a well-known equation in economics, the Fisher equation, that relates the nominal interest rate R_t to the real interest rate r_t and expected inflation $E_t\pi_{t+1}$ (all annualized):

$$R_t = r_t + E_t\pi_{t+1}.$$

Taken at face value, and assuming that the real interest rate is fixed in the long term, the equation implies that a lower long-term inflation rate can be achieved by permanently setting the nominal interest rate to a lower level (see Cochrane

Figure 15.1. Headline Inflation and Policy Rate



Source: Haver Analytics.
Note: SELIC = Sistema Especial de Liquidação e Custodia (Special Clearance and Escrow System).

2016). Indeed, proponents of this view often point to the positive relationship between nominal interest rates and inflation seen across many countries as evidence of Neo-Fisherian effects (see Figure 15.1).[1]

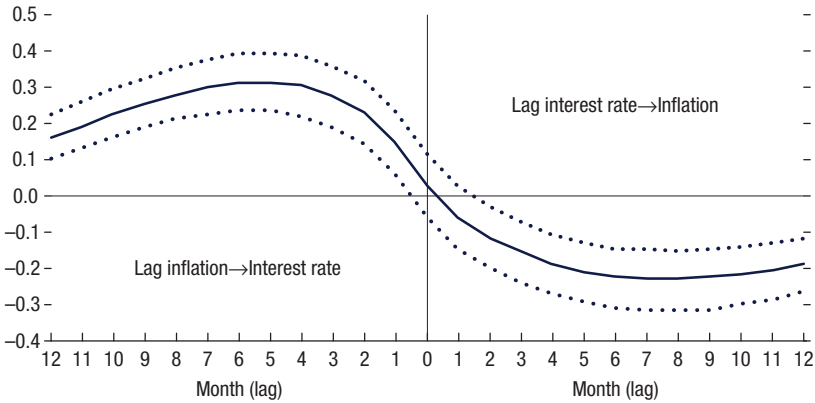
Would a commitment to fixing the policy interest rate to a lower level eventually lead to lower inflation? To answer this question, this chapter presents an empirical analysis conducted to assess the impact of changes in Brazil's policy rate on inflation. The chapter then evaluates a simple model with long-term Neo-Fisherian effects in the context of several countries' historical experiences in making the transition to lower levels of inflation. A summary of key findings and policy conclusions rounds out the chapter.

EMPIRICAL ANALYSIS

The empirical analysis is based on vector autoregressions (VARs). The baseline VAR is estimated using monthly data ranging from 2003 to 2016 and contains six variables: monthly headline inflation, the nominal interest rate (Sistema Especial de Liquidação e Custodia, or SELIC), the output gap, 12-month-ahead inflation expectations, monthly percentage changes of commodity prices, and monthly percentage changes of the real effective exchange rate. Inflation responses to the interest rate are likely to differ across different sectors of the economy, so in addition to the baseline VAR, five additional VARs are estimated as a robustness check, including inflation for different sectors of the economy. Overall, the

[1]Neo-Fisherian effects exist in standard models used by central banks under the assumption that economic agents have perfect foresight and do not base their decisions on past observations. See García-Schmidt and Woodford (2015) and Garín and Sims (2016).

Figure 15.2. Correlation: Headline Inflation and Interest Rate
(Correlation and 20th to 80th percentiles)



Source: IMF staff estimates.
Note: Dotted lines show 20th and 80th percentiles.

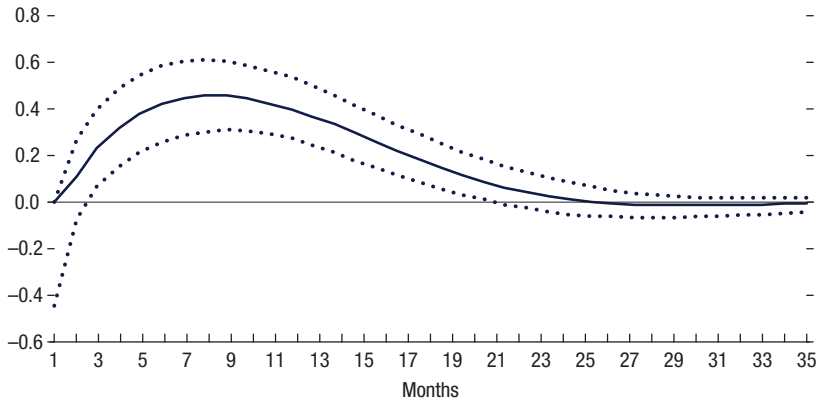
empirical analysis examines the impact of policy interest rate changes on headline inflation, non-regulated-price inflation, regulated-price inflation, service-price inflation, tradables inflation, and nontradables inflation.[2]

Cross-correlations show that *higher* inflation leads to *higher* interest rates and *higher* interest rates lead to *lower* inflation, consistent with the conventional view. The estimated cross-correlation function from the baseline VAR is displayed in Figure 15.2; the results for all inflation rates can be found in Annex 15.1. The results show a statistically significant positive relationship between past levels of inflation and the interest rate, and a statistically significant negative relationship between past levels of the interest rate and inflation. These results broadly reflect the standard view of the transmission of monetary policy to inflation. Because inflation tends to lead the policy interest rate, it appears that the central bank has responded to inflation developments over this sample, partly as the result of unanticipated demand and supply shocks (such as food and regulated-price shocks, and exchange rate shocks). The results also suggest a peak correlation between leads and lags of inflation and leads and lags of the interest rate of about six months.

Structural VARs also support the conventional view that an unexpected cut in the policy interest rate increases inflation in the short term. Responses of headline inflation to a 100 basis point cut in the policy interest rate are displayed in Figure 15.3; the results for all other inflation rates can be found in Annex 15.1.

[2]VAR lag lengths are selected using the Schwarz-Bayesian Inflation Criterion. Parameter uncertainty is captured in the analysis using bootstrapping methods, where for each VAR is resampled 1,000 times.

Figure 15.3. Headline Inflation after 100 Basis Point Cut in Policy Rate
(Percent, annualized)



Source: IMF staff estimates.
Note: Dotted lines show 20th and 80th percentiles.

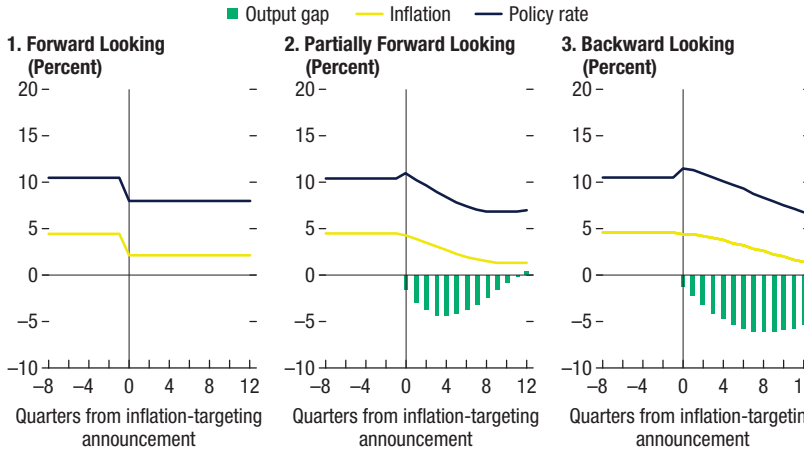
Here, the uncertainty about the responses relates both to uncertainty about the parameters of the VARs and to the recursive ordering used to identify the monetary policy shock.[3] Examining all possible recursive identification schemes allows the analysis to be indifferent to whether an interest rate shock has a contemporaneous or a lagged impact on inflation. The results show that an unexpected cut in the policy interest rate tends to increase inflation over time, with the magnitude of the impact dependent on the sector of the economy. The peak impact generally occurs about nine months after the shock. The short-term impact of a lower interest rate on inflation is less clear-cut, with identification schemes that allow for a cut in the interest rate to immediately affect inflation (within the same month) sometimes suggesting a positive relationship between inflation and interest rate shocks. Overall, however, the results from the structural VARs strongly support the standard view of monetary policy transmission.

HOW CAN LOWER INFLATION BE ACHIEVED OVER THE LONG TERM?

Although little evidence suggests that a lower interest rate leads to lower inflation in Brazil in the short term, the long-term Fisher equation can still help inform policy advice. The long-term Fisher equation is

[3]Each VAR contains six variables, so there are 720 different ways to order the variables to identify shocks; 69 of these orderings lead to unique inflation responses to an interest rate shock. Using bootstrapping methods, 1,000 parameterizations of each reduced-form model are simulated, leading to 69,000 different estimates of the response of inflation to an interest rate for each VAR examined.

Figure 15.4. Simulated Responses to a Change in the Inflation Target from 4.5 Percent to 2 Percent



Source: IMF staff calculations.

$$R^* = r^* + \pi^*,$$

in which the steady-state nominal interest rate is equal to the steady-state real interest rate plus the inflation target. Assuming the long-term neutrality of money (that is, nominal variables do not affect real variables in the long term), the inflation target determines the steady-state nominal interest rate. This relationship can easily be inserted into a simple (and standard) New Keynesian model (see Annex 15.1).

Model-based simulations show that lower long-term inflation and nominal interest rates can be achieved by lowering the inflation target, but this strategy is likely to be costly in the short term when the central bank has limited policy credibility. The results show that a reduction in the inflation target reduces both the nominal interest rate and inflation in the long term (Figure 15.4). If households and firms in the economy have expectations that are either partially forward-looking or entirely backward-looking, the transition to the new inflation target requires lower output to move inflation expectations to the new target; the real interest rate must rise to reduce demand in the short term. On the other hand, in a purely forward-looking model the central bank is fully credible, and households and firms fully understand the future implications of monetary policy actions and immediately embed this knowledge in their expectations. In this case, the transition of inflation and nominal interest rates to the new target is instantaneous once the target is announced, and output is unaffected.

Disinflation episodes across countries show that inflation was slow to adjust to lower levels and the transition to lower inflation was costly to output, reflecting unanchored inflation expectations and limited monetary policy credibility before

the disinflation. Figure 15.5 shows the behavior of inflation, interest rates, and the output gap in the two years before the adoption of inflation targeting in the first five countries that formally adopted the practice, in addition to the Volker disinflation episode in the United States, beginning in 1981.[4] The behavior of inflation, interest rates, and the output gap follow broadly similar trends across countries. Nominal interest rates and inflation rates were positively correlated and tended to decline together once the central bank formally adopted inflation targeting; output gaps generally moved into negative territory. These results are qualitatively (and quantitatively) very similar to the simulation results obtained when households' and firms' expectations for inflation and output are not assumed to be entirely forward-looking. The large output losses during disinflation across these countries likely reflect a high degree of inflation persistence and limited policy credibility before the adoption of inflation targeting. Changing the inflation target would likely be less costly if the central bank had more policy credibility and more-anchored inflation expectations before the target change.

CONCLUSIONS

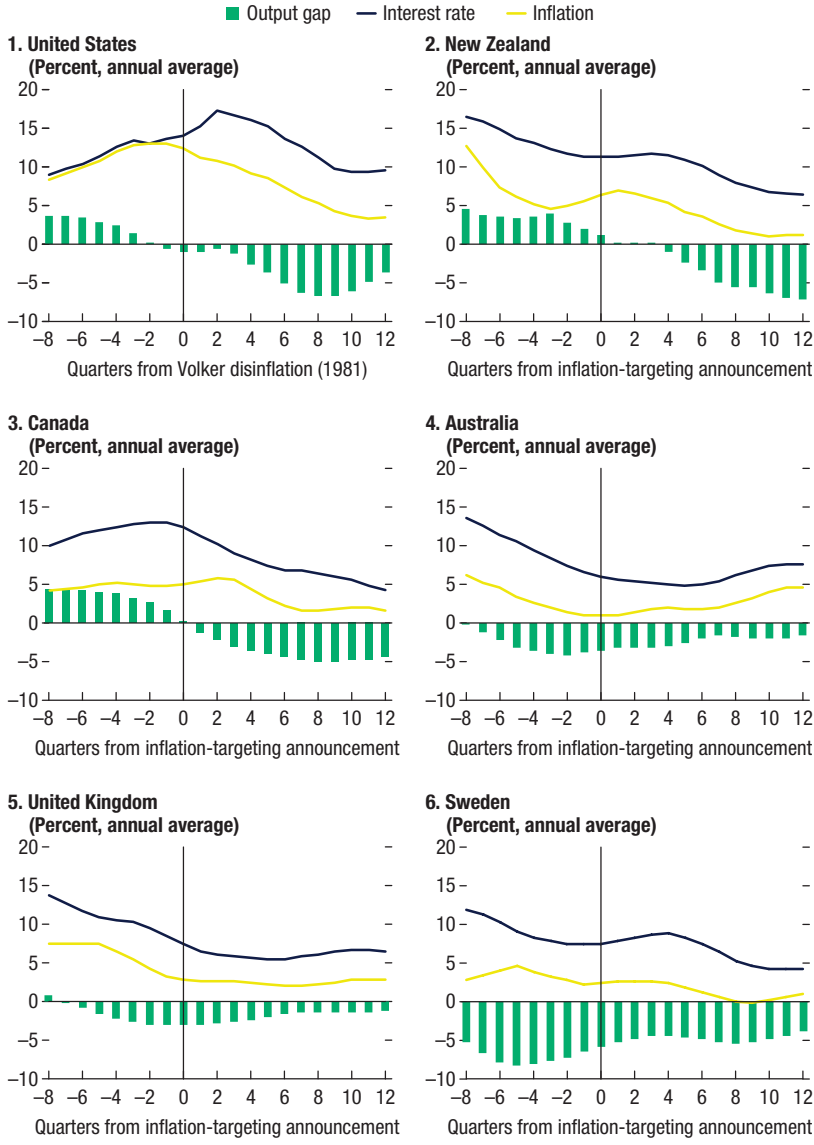
There is strong evidence of the conventional view of monetary policy transmission in Brazil, suggesting that a cut in the policy interest rate leads to higher inflation in the short term. Cross-correlations show that higher inflation leads to higher nominal interest rates, and higher interest rates result in a reduction in inflation. Because inflation tends to lead the policy interest rate examined in the sample, it appears that the central bank has responded to inflation developments, partly as the result of unanticipated demand and supply shocks (such as food and regulated-price shocks, and exchange rate shocks). Structural VARs also suggest that an unexpected cut in the policy interest rate leads to a broad-based rise in inflation across the sectors examined, with the peak impact on inflation occurring about nine months after a monetary policy shock.

Model-based simulations and cross-country evidence suggest that lower inflation and lower nominal interest rates can be achieved over the longer term if the central bank commits to a lower inflation target. If households and firms base their output and inflation expectations on the past (even partially), the transition to the new inflation target comes at the cost of lower output in the short term, with larger output losses and more prolonged transition periods occurring when expectations are more backward-looking. An examination of disinflation episodes across several countries broadly supports the key findings from model simulations that assume that expectations were at least partially backward-looking before disinflation.

Although permanently lowering inflation in Brazil will not be easy, a lower inflation target could be achieved at less cost with enhanced monetary policy

[4]For each country, the output gap is defined as the percentage deviation of real GDP from a linear trend.

Figure 15.5. Disinflation Episodes across Countries



Source: IMF staff estimates.

transparency and credibility. Enhanced credibility can better anchor inflation expectations, reduce the persistence of inflation, improve the short-term trade-off between inflation and output, and mitigate the associated cost should a lower inflation target be desired over the medium term. As discussed in Domit and others (2016), there are several dimensions along which Brazil's inflation-targeting framework can be improved to enhance transparency and credibility, including increasing the autonomy of the central bank and changing the inflation target from a range that needs to be met at the end of each year to a longer-term point target. The National Monetary Council made a step in this direction in 2016 by narrowing the target range from 4.5 percent +/–2 percent to 4.5 percent +/–1.5 percent beginning in 2018. In 2017, it also announced that it would reduce the inflation target to 4.25 percent for 2019 and to 4 percent for 2020.

Monetary policy transmission could also be made more efficient by reducing distortions and improving resource allocation in the financial sector. There is general agreement that the effectiveness of monetary policy in Brazil could be improved by changing various credit policies that involve earmarking and credit subsidies. As already planned by the authorities, the gap between the subsidized interest rate on long-term lending (Taxa de Juros de Longo Prazo, or TJLP) and market interest rates will be reduced over time. Linking the TJLP more tightly to a market-determined rate will enhance the transmission of SELIC changes to longer-term interest rates, will increase the potency of a given change in the SELIC, and could contribute to lowering interest rate volatility over the business cycle. Improving the efficiency of resource allocation in the financial sector could also contribute to a lower long-term real interest rate in Brazil, allowing lower nominal interest rates for a given inflation target.[5]

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[5]See Minutes of the 205th Meeting of the Monetary Policy Committee of the Central Bank of Brazil for a discussion.

ANNEX 15.1. DATA AND ROBUSTNESS DATA

Annex Table 15.1.1. Data, Sources and Transforms

Series	Source	Transform*
Headline IPCA	IGBE	Δlog(x)*1200
Nontradable IPCA	IGBE	Δlog(x)*1200
Tradable IPCA	IGBE	Δlog(x)*1200
Services IPCA	IGBE	Δlog(x)*1200
Nonregulated IPCA	IGBE	Δlog(x)*1200
Regulated IPCA	IGBE	Δlog(x)*1200
Inflation expectations (12 months ahead)	BCB	x
Interest rate (SELIC)	BCB	x-hptrend(x)
Activity Index (IBC-BR)	BCB	log(x)*100-hptrend(log(x))*100
Commodity Price Index (IC-BR)	BCB	Δlog(x)*1200
Real Effective Exchange Rate (broad)	JP Morgan	Δlog(x)*1200

Source: IMF staff.
Note: *Δ = first difference; BCB = Central Bank of Brazil; hptrend = Hodrick-Prescott Filter; IGBE = Brazilian Institute of Geography and Statistics.

Empirical Results

See Figures 15.1.1 and 15.1.2.

Simple Model

The investment/saving (IS) curve relates the current level of the output gap, y_t, to the lagged output gap, expectations of the future output gap, and the real interest rate (deviation from the steady state):

$$y_t = \delta E_t y_{t+1} + (1 - \delta) y_{t-1} - \sigma\left(R_t - E_t \pi_{t+1} - r^*\right).$$

The Phillips curve relates the current level of inflation to inflation expectations, past inflation, and the output gap (where $0 \leq \alpha \leq 1$) :

$$\pi_t = \alpha E_t \pi_{t+1} + (1 - \alpha) \pi_{t-1} + \gamma y_t.$$

The monetary policy rule relates the nominal interest rate to the steady-state nominal interest rate and the expected deviation of inflation from the inflation target:

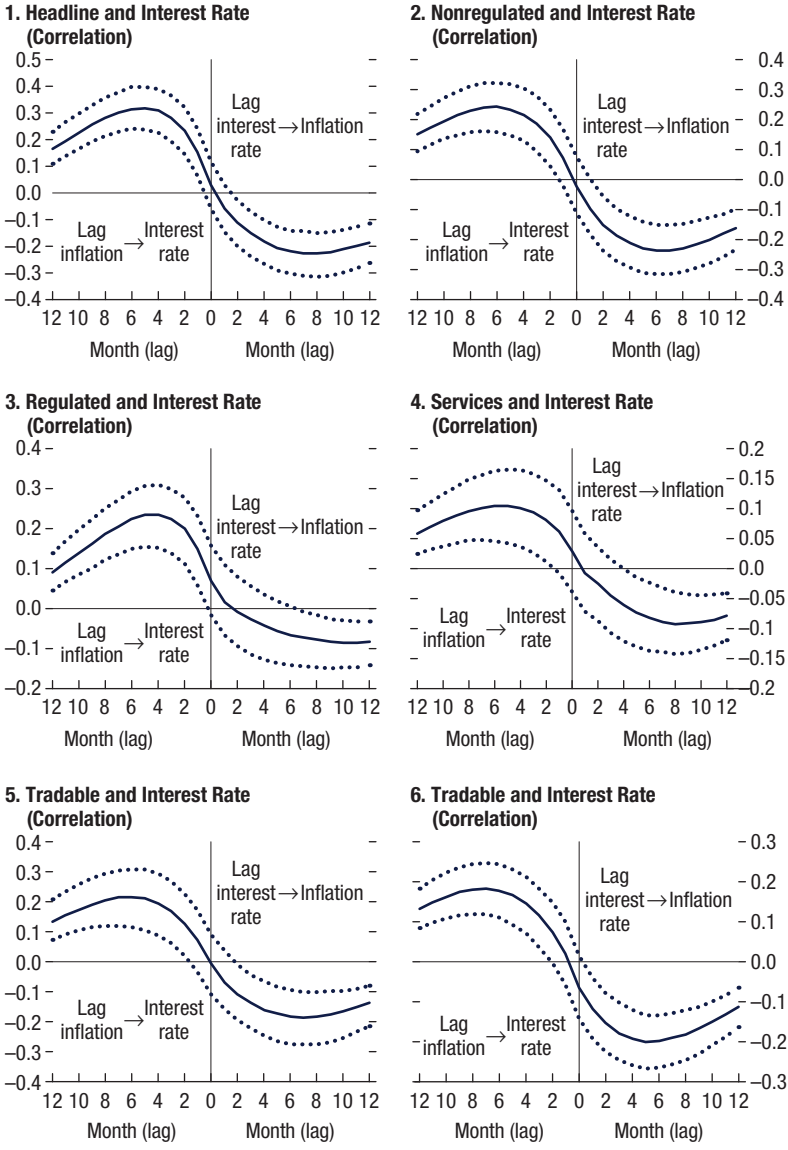
$$R_t = R^* + \mu\left(E_t \pi_{t+1} - \pi^*\right),$$

where $\mu > 1$ to ensure a unique and stable solution, and the long-term Fisher equation is

$$R^* = r^* + \pi^*.$$

The parameter values are $\sigma = 1$, $\gamma = 0.05$, $\mu = 1.5$, and $r^* = 6$. The parameters in the Phillips and IS curves related to persistence are $\delta = \alpha = 1$ in the forward-looking model, $\delta = \alpha = 0.5$ in the partially forward-looking model, and $\delta = \alpha = 0$ in the backward-looking model.

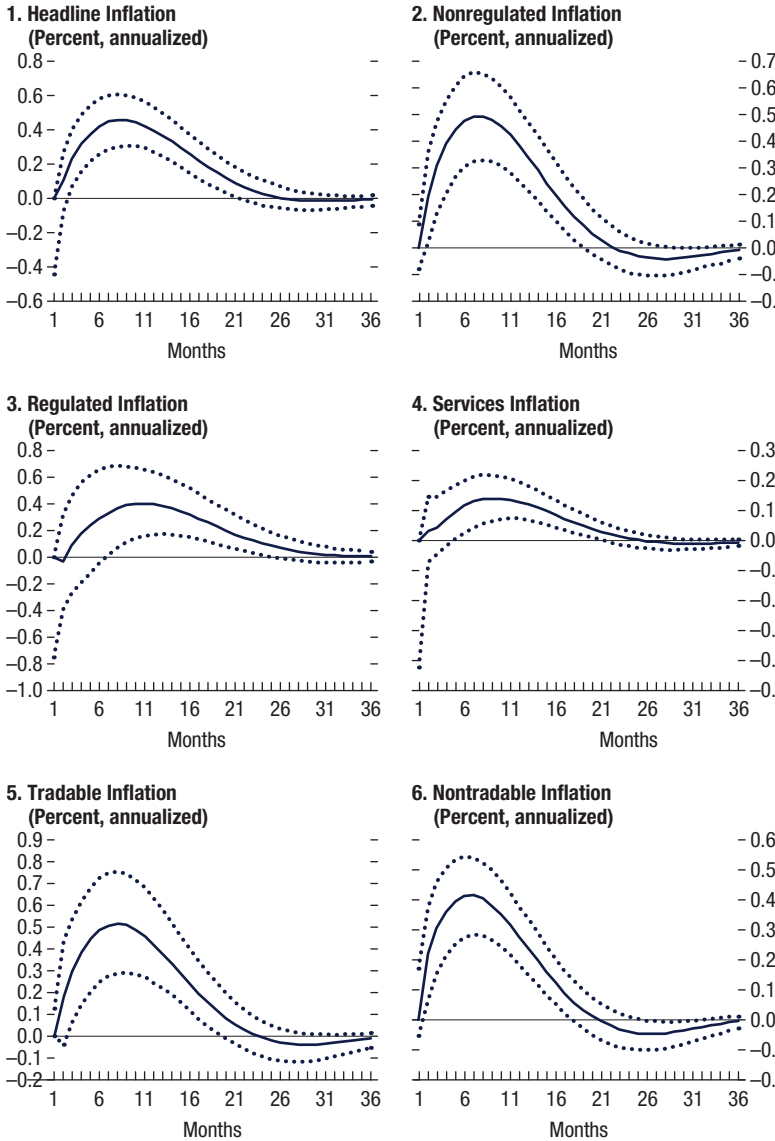
Figure 15.1.1. Range of Cross-Correlations between the Interest and Inflation Rates
(Median and 20th and 80th percentiles)



Source: IMF staff estimates.

Figure 15.1.2. Range of Inflation Responses to 100 Basis Point Cut in Policy Rate

(Median and 20th and 80th percentiles)



Source: IMF staff estimates.