Inflation Announcements and Asymmetric Exchange Rate Responses

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Abstract

Previous literature has documented but not yet explained asymmetric exchange rate responses to unanticipated inflation announcements under a credible inflation-targeting regime. We present a theoretical model explaining the reported asymmetries in exchange-rate responses based on asymmetries in monetary policy preferences.

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1. Introduction

Existing studies have documented that announcements on the values of leading macro-indicators are followed by significant exchange rate impact responses (for a survey see Neely, 2010). The exchange rate effects of inflation announcements, in particular, have received extensive attention with previous research having established two stylised facts:

First, when positive (negative) inflation surprises occur, i.e. when actual inflation is announced to have exceeded (fall below) its expected value, the impact effect for the domestic currency is often to appreciate (depreciate) (see Clarida and Waldman, 2008 and Conrad and Lamla, 2010). This response goes against the predictions of the textbook Purchasing Power Parity (PPP) hypothesis under which increasing (decreasing) inflation rates cause currency depreciation (appreciation). This, at first sight paradoxical, exchange rate behaviour has been convincingly explained on the basis of a credible inflation-targeting monetary policy: If expectations are well-anchored to a credible inflation target, positive (negative) inflation surprises trigger increases (reductions) in short-term domestic interest rates leading to increased (reduced) real returns on the domestic currency (see Neely, 2010). These, in turn, cause increased (reduced) demand for domestic currency leading to its appreciation (depreciation).

The second stylised fact is that the relationship described above is not linear but subject to sign-effects: The depreciations following announcements of inflation rates lower than expected are larger in absolute size, and of stronger statistical significance, than the appreciations following announcements of inflation rates higher than expected (see Clarida and Weldman, 2008). So far no theoretical justification has been provided for this second stylised fact. This paper presents such a theoretical explanation. To foreshadow what follows, like the explanation of the first stylised fact, our explanation is based on monetary policy considerations and, in particular, asymmetric monetary policy preferences.

2. Theoretical framework

In this section, we lay out a simple theoretical framework demonstrating that asymmetric exchange rate responses can occur as long as the monetary authority weights the downside of the economy more than the upside. A widely-cited theoretical model allowing asymmetric policy preferences between positive and negative deviations from output and inflation targets has been provided by Surico (2007a). His analysis is motivated on two grounds. First, public statements by highly-ranked officials, including Alan Blinder, the ex-vice-chairman of the Board of Governors of the Federal Reserve, according to which *"central banks will take far more political heat when it tightens [monetary policy] pre-emptively to avoid higher inflation than when it eases pre-emptively to avoid higher unemployment"* (Blinder, 1998, p. 19-20). Moreover, theoretical models exploring various sources causing state-dependent business cycle costs predict more aggressive monetary policy responses during periods of economic slowdowns rather than expansions [among others, see Kahneman and Tyrersky (1979) and Persson and Tabellini (1999)].[1] Empirical evidence confirming the existence of asymmetric monetary policy responses to different phases of the business cycle has been provided by numerous studies, including Ruge-Murcia (2003), Surico (2007a,b) and Cuckierman and Muscatelli (2008).

The model by Surico (2007a) refers to a closed economy and, as such, does not capture the effects of asymmetric monetary policy preferences on exchange rate behaviour. Therefore, it

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[1] Kahneman and Tversky (1979) argue that the psychology of choice reveals that agents deciding under uncertainty attach higher weights on the probability of losses rather than gains. This suggests that policy makers who aggregate over individual welfare follow loss-averse policy rules. Persson and Tabellini (1999) show that retrospective voting combined with imperfect competition about the incumbent's talent results into politicians imposing on central banks asymmetric policy objectives involving more aggressive monetary policy responses during economic downturns.

cannot explain the asymmetric response of exchange rates to inflation announcements stated in the introduction section. We present an open economy model in which asymmetric policy preferences cause not only asymmetric responses of nominal interest rates (as it is the case in Surico's analysis) but, also asymmetric responses of exchange rates. We denote output gap by $y_t = Y_t - \overline{Y_t}$, where, respectively, Y_t and $\overline{Y_t}$ are the logs of real gross domestic product (GDP) and potential real GDP. The inflation rate, π_t, is defined as the percent change in the aggregate price level between periods *t*-1 and *t*. We borrow from the new Keynesian framework surveyed in Clarida et al. (1999) where the output gap and the inflation rate are expressed in terms of an *IS* curve and a Phillips curve. We adopt an *IS* equation which following Clarida and Weldman (2008), is augmented with the nominal exchange rate as follows:

$$y_t = -\phi[i_t - \pi^e_{t+1}] + \theta S_t + y^e_{t+1} + \varepsilon_t \tag{1}$$

where i_t is the nominal interest rate, S_t the nominal exchange rate (increasing values denote depreciation), ε_t an innovation to the output gap, $\phi > 0$, $\theta > 0$ and superscript e denotes the expectation of a variable. Following Clarida et al. (1999), the Phillips equation is written as:

$$\pi_t = \lambda y_t + \beta \pi^e_{t+1} + \eta_t \tag{2}$$

where $\lambda > 0$, $\beta > 0$ and η_t is an innovation to the inflation rate. Finally, we assume uncovered interest rate parity given by:

$$(1 + i_t) = \frac{S^e_{t+1}}{S_t}(1 + i^f_t) \tag{3}$$

where i^f_t denotes the foreign interest rate.[2] Following Surico (2007a) the monetary authority chooses the interest rate that minimizes the loss function, *L*:

$$L = \frac{e^{\alpha(\pi_t-\pi^*)} - \alpha(\pi_t-\pi^*) - 1}{\alpha^2} + \delta\left[\frac{e^{\gamma y_t} - \gamma y_t - 1}{\gamma^2}\right] + \frac{\mu}{2}(i_t - i^*)^2 \tag{4}$$

[2] $\pi^e_{t+1}$is assumed constant due to inflation-target credibility. S^e_{t+1} is also constant due to π^e_{t+1} being constant.

where π^* and i^* denote the inflation target and the interest rate target, respectively. Parameters δ and μ capture the aversion of the monetary authority toward output and interest rate fluctuations while parameters α and γ capture asymmetries in the response of the monetary authority to deviations of the inflation rate and the output gap rate from their targets. For negative values of α the monetary authority, when setting the interest rate, assigns higher weights to levels of the inflation rate below the target level. Likewise, for negative values of γ, the monetary authority weights more the downside of the economy (i.e. negative output gaps). In other words, for negative values of α and γ, the monetary authority perceives the costs of the business cycles as asymmetric by assigning relatively higher weights to low values of the inflation rate and the output gap. As pointed out by Surico (2007a), reduced-form estimates of post-war US policy rules indicate that the preferences of the Federal Reserve have been highly asymmetric with respect to both inflation and output gaps, with the latter being the dominant source of nonlinearity after 1983. Similar evidence is presented by Surico (2007b) for monetary policy in the euro area where output contractions are found to trigger larger policy responses than output expansions of the same size.

The monetary authority minimizes L in (4) subject to (1), (2) and (3). The first-order condition reads:

$$\left[\phi + \theta\left(\frac{s_t}{1+i_t}\right)\right] Z_t = \mu(i_t - i^*) \tag{5}$$

where,

$$Z_t = \lambda \frac{e^{\alpha(\pi_t - \pi^*)} - 1}{\alpha} + \delta \frac{e^{\gamma y_t} - 1}{\gamma}$$

To show the asymmetry in the exchange-rate response caused by the preference asymmetry in the monetary policy reaction function, we consider a calibrated version of our model where we set the inflation rate and interest rate targets to 2 and 4 percent, respectively.

The expected exchange rate is normalized to unity and the foreign interest rate is set equal to 4 percent. There is no strong prior information about the values of parameters α and γ so they are both set equal to -0.5, consistent with some estimates reported in Surico (2007a). The values of the rest of the parameters are chosen as follows: $\mu = \delta = 1$, $\lambda = 0.3$, $\beta = 0.5$, $\phi = 0.5$ and $\theta = 0.1$ (results for alternative parameter values are discussed further below). For simplicity, we assume that fluctuations are driven either by innovations in the output gap (ε_t) or in the inflation rate (η_t). In our example we set $\eta_t = 0$. Note that for fixed expectations for the inflation rate, the actual inflation rate is analogous to the output gap. That is, when the output gap is negative, the inflation rate is relatively low, whereas when the output gap is positive, the inflation rate is relatively high.

Figure 1 displays the calibrated responses of the interest rate and the exchange rate to different levels of the output gap (the numbers are expressed in percentages). Specifically, it displays a simple case where exchange rate behaviour exhibits the exchange-rate response asymmetry observed in the data, as long as the monetary authority has asymmetric preferences according to which the downside of the economy is weighted more than the upside. The figure shows that when the economy is performing above its potential level (i.e. positive output gaps, depicted to the right-hand side of $y = 0$ on the horizontal axis), the monetary authority increases the interest rate in response to an increasing output gap but in a diminishing fashion. In other words, the response of the interest rate is less aggressive for higher levels of the output gap. This result is consistent with a scenario where the positive output gap triggers an inflation announcement of higher inflation, which in turn leads to an increase in the nominal interest rate. In that case, it follows from uncovered interest rate parity that interest rate increases lead to moderate appreciations of the exchange rate for higher levels of the output gap. Equivalently, when the economy experiences high inflation rates, there are moderate appreciations of the exchange rate. Notice that for high levels of the output gap (or high inflation rates) the exchange rate response becomes almost flat following the upward response of the interest rate, which is consistent with the appreciation's low empirical statistical significance.

INSERT FIGURE 1

The opposite occurs when the economy experiences recessionary output gaps (negative output gaps, depicted to the left-hand side of $y = 0$ on the horizontal axis). Under these conditions, the monetary authority decreases drastically the interest rate as the recession deepens. This result is consistent with a scenario where the negative output gap triggers an inflation announcement of lower inflation, which in turn leads to a reduction in the interest rate. The result of the aggressive interest-rate reduction is that the economy experiences large and increasing depreciations of its currency, consistent with the depreciation's strong empirical statistical significance. Equivalently, when the economy experiences low inflation, there are significant depreciations of the exchange rate. It is thus demonstrated that, under certain conditions, asymmetric monetary policy preferences may lead to asymmetric exchange rate responses consistent with the empirical patterns outlined in the introduction.

Our calibration analysis suggests that the asymmetry of the exchange rate displayed in Figure 1 is robust to values of α and γ much smaller or slightly larger than -0.5.[3] In addition, the asymmetry is generated even when only one of α or γ is negative (see Surico, 2007b). However, if $\gamma > 0$ and $\alpha < 0$, the absolute value of α must be relatively larger than the value of γ to generate the form of asymmetry displayed in Figure 1. Figure 2 displays the calibrated responses of the interest rate and the exchange rate for $\alpha = -1.3$ and $\gamma = 0.5$. Figure 3 demonstrates that the form of asymmetry displayed in Figure 1 is preserved even when the value of α is changed to a relatively large positive value (in this case to 1.3). Overall, figures 2

[3] For example, for $\alpha = \gamma > 0.7$, the responses in the region where $y < 0$ become less smooth.

and 3, suggest that the role of the size of parameter γ is more important than that of parameter α in generating the type of exchange rate asymmetry observed in the data.

INSERT FIGURES 2 AND 3

Note that instead of the output gap we could have had the inflation rate on the horizontal axis of figures 1-3. The asymmetric exchange rate response is robust for values of θ, ϕ, δ and λ less than and slightly greater than 0.1, 0.5, 1 and 0.3, respectively. Although the magnitude of the responses changes, the underlying asymmetry of the exchange rate is unaffected across any value of β. Finally, the main result is robust to different values of μ, as long as they are not smaller than 0.7; when $\mu < 0.7$, the responses become less smooth.

3. Summary

Empirical studies have established that countries operating a credible inflation-targeting monetary policy experience asymmetric exchange rate responses under inflation surprises of equal magnitude but opposite sign. This paper provided a theoretical explanation of this previously unexplained stylised fact based on asymmetric monetary policy preferences. The intuition underlying our model is that if monetary authorities have larger aversion to negative rather than positive output gap values (and/or to inflation rates below the target level), as suggested by a substantial theoretical and empirical literature on asymmetric monetary policy preferences, they will stand ready to reduce nominal interest rates more aggressively when nominal interest rates must be reduced to meet a credible inflation target rather than to increase them when interest rates need to be increased to meet the same inflation target. Rational markets anticipating the difference in the speed of adjustment of nominal interest rates, and by extension real returns, will then stand ready to sell higher volumes of the domestic currency under negative inflation surprises rather than the volumes they will be willing to buy under positive ones. This difference causes asymmetric exchange rate responses to inflation surprises of equal magnitude but opposite sign.

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Figure 1: The response of the interest rate and the exchange rate to different levels of the output gap ($\alpha = \gamma = -0.5$)

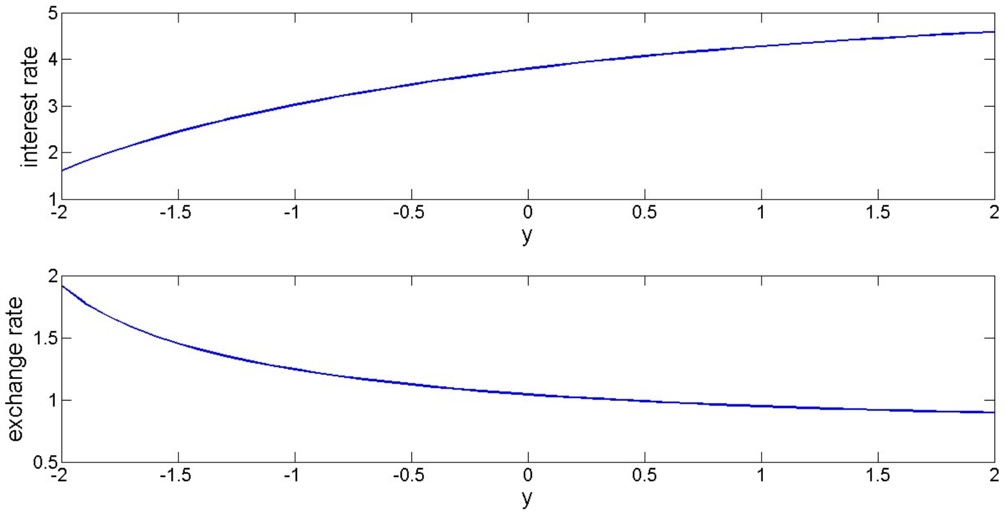

Figure 2: The response of the interest rate and the exchange rate to different levels of the output gap ($\alpha = -1.3\,, \gamma = 0.5$)

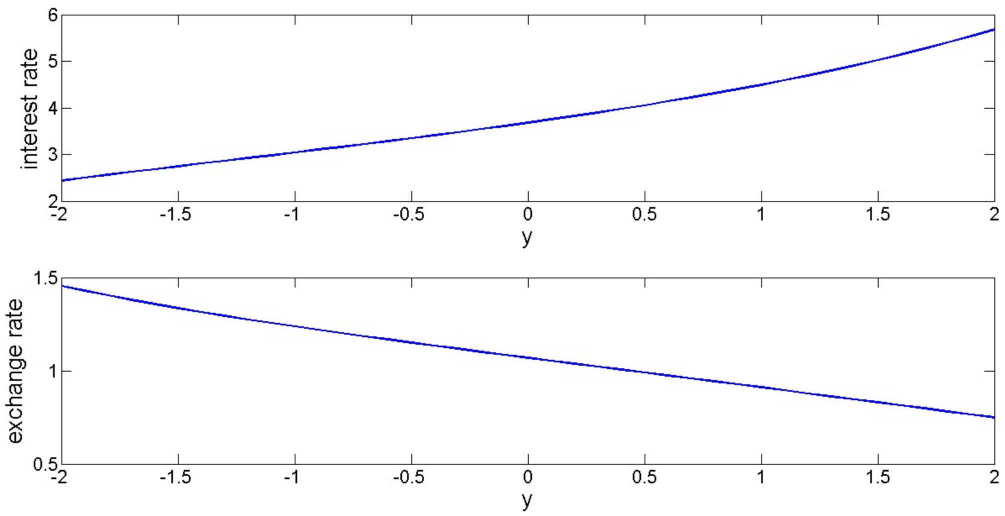

Figure 3: The response of the interest rate and the exchange rate to different levels of the output gap ($\alpha = 1.3,\ \gamma = -0.5$)