The role of the Exchange Rate in Monetary Policy Rule – A Critical Evaluation

Alan BRISTOW

Abstract

In this essay, I examine the issues around the inclusion of the exchange rate channel into monetary policy rules, and look at how several central banks currently address exchange rates when determining interest rates. I then go onto examining the model used by Taylor in his paper, and discuss issues around this approach and make some suggestions of some desirable features for using the exchange rate channel in a policy rule. I then go on to provide an example of a very general policy rule and briefly discuss how it could be used in setting interest rates.

1 Introduction

Many countries choose to have a floating exchange rate for the flexibility that arises from using monetary policy and inflation targeting to manage the economy. The advantages of floating exchange rates over fixed exchanges rates are well known and combined with the benefits of simple monetary policy and inflation targeting means many countries operate under the combination of these policies.

There is however a strong debate over how to take exchange rates into account when carrying out monetary policy and how the interest rate should react to movement in the exchange rate. Another issue is around whether exchange rates should affect interest rates directly or should the central bank concentrate on the rate of inflation and output in deciding monetary policy.

2 Central Banks' use of the exchange rate channel in monetary policy rules

Taking stock of the use of the exchange rate channel across several central banks yields a common approach, several Centrals banks like the Bank of Canada, Reserve Bank of New Zealand and Riskbank (Sweden) do not attempt to affect the underlying trend of exchange rate movements. The usual approach is to model the changes in the exchange rate via uncovered interest parity rules and take into account the effects that movements in exchange rates may have on inflation. They then take the change in inflation into account when setting interest rates. The effect of changes in interest rates on the exchange rate is considered ambiguous, and many central banks don't target specific bands of value for their currency.

Central banks do make occasional forays into currency markets in order to smooth out short term volatility, but no long term strategy of maintaining the exchange rate exists. By maintaining stability of inflation, it is believed to contribute some measure of stability of exchange rates.

3 The role of the exchange rate in monetary policy rules

The paper by **Taylor (2001)** examined the role of the exchange rate in monetary policy rules. He highlights several approaches to the issue in current research: i) put monetary policy rule in a macroeconomic model, ii) solve the model using some numerical solution algorithm, iii) examine the properties of the stochastic behaviour of the variables (inflation and output) and iv) choose a rule which gives the best performance, using a loss function.

In previous research, the exchange rate is usually included as part of an arbitrage equation relating the interest rates in one country to those of another through the expected rate of appreciation of the exchange rate. The assumptions that many models employ in regard to policy evaluation include ex ante interest-rate parity conditions or a reduced form relationship between the real interest rate and the real exchange rate. The exchange rate also affects the terms of trade and the knock-on effects to the flows of exports and imports.

The paper then goes on to examine several possible implementations of exchange rates into a monetary policy rule via the following form:

$$I_t = f\pi_t + gy_t + h_0e_t + h_1e_{t-1}$$

Where I_t is the short term interest rate, π_t is the rate of inflation, y_t is the deviation of real GDP from potential GDP and e_t is the real exchange rate. Taylor reviews the findings of several papers which look at different possible values for h_0 and h_1 and how these represent different ideas on the effect on the exchange rate on monetary policy.

- Setting $h_o < 0$ and $h_1 = 0$ would imply that higher than expected exchange rates would force a loosening of monetary policy through reduction of the interest rate.
- Setting $h_0 < 0$ and $h_1 > 0$, where $|h_0| > |h_1|$means that initial interest rate reaction is partially offset in the next period.

- Setting $h_0 < 0$ and $h_1 = -h_0$ implies that interest rates reacts to the change in the exchange rate, not the absolute value.

Each of these interpretations would require an underlying structural model to simulate the rule and find their comparative merits.

The negative sign for h_0 is required as an appreciation of the exchange rate would have a contractionary effect on aggregate demand. Foreign goods become cheaper relative to domestic goods, leading to a reduction in net exports. The cut in interest rates helps mitigate this contraction. The partial interest-rate offset is from the lagged impact of the change in exchange rate on inflation. As the decline in inflation is temporary, it is not appropriate for a central bank to use additional easing as lower than desired inflation would result.

An open economy model with a negative interest rate response ($h_0 < 0$) and a partial interest-rate offset ($h_1 > 0$) leads to better performance than having both 'h' parameters equal zero. Performance is measured by the size of fluctuations of real GDP around potential GDP and the size of fluctuations around the inflation target, both of which are a proxy for peoples' preferences. The result was reducing inflation volatility by 0.1% which is quite small considering the coefficients used for the reaction variables.

Another study used forward looking agents with more explicit micro-foundations led to a reduction in inflation volatility, but also led to an increase in the volatility of output. These results indicate that the possibility of small performance improvements from reacting to the exchange rate, while also causing a reduction in performance.

To explain these results, Taylor considers both the direct reaction of the interest rate to the exchange rate, and the indirect reaction that exists. Due to the indirect effects of movements in the exchange rate on inflation and output, rules which do not specifically react to movements in the exchange rate will react through the changes on the levels of imports, exports and inflation which occur. The indirect effect comes from inertia and rational expectations

and may hold an advantage over the direct effect as fewer fluctuations in the interest rate occur.

4 Methods & Arguments

The conclusion from Taylor's paper is that further research is required to confirm the idea that the indirect effect of exchange rates lowers the level of volatility in interest rates. The first issue is how to include the exchange rate in a model in order to influence the interest rate in a way which is comparable with the data.

If the exchange rate is included as part of a monetary policy rule, there is the possibility that 'double counting' exists if the exchange rate is used to determine current levels of inflation and/or output. If the effects of the exchange rate on output and inflation are not included elsewhere within the model, then this is not an issue. However, if it is explicitly included then it is arguable that it should not be included as part of the monetary policy rule, as the effects could also be felt via the resultant changes in inflation and output and affect the interest rate by a greater magnitude than anticipated.

The paper by **Garcia, Restrepo and Roger (2009)** examined whether including exchange rates explicitly in a central bank's policy reaction function can improve macroeconomic performance. They found that including a variable for exchange rate smoothing is helpful for handling risk premium shocks, as long as the weight assigned to the term is relatively small. They find very little effects on the volatility of output and inflation. This suggests that it's not strictly necessary to include an explicit mechanism of the exchange rate affecting the interest rate inside a macroeconomic model.

Uncovered Interest rate Parity (UIP) is an arbitrage condition used by many models which rules out excess profits in asset markets. When an appreciation is expected (the domestic currency increases in value in relation to the foreign currency), UIP indicates that the interest rate should decrease at the same rate in order to keep parity with the foreign interest rate and if it doesn't then arbitrage profits may be made. Unfortunately UIP is not backed up by

empirical evidence which implies that UIP isn't a robust rule for modelling the effects of exchange rates on interest rates.

The paper by **West & Engel (2005)** explains how asset prices approach a random walk when they are an I(1) process and the discount factor is nearing one. As exchange rates can be considered as asset pricing of currency, this result explains the puzzle that variables like output, inflation, and interest rates do little to predict changes in floating exchange rates. They also show that the empirical data suggests that exchange rates help to predict fundamental variables. They conclude that exchange rates and fundamentals are linked in a way that is consistent with asset-pricing models of the exchange rate. This implies that changing the interest rate to affect the exchange rate is unlikely to succeed but the relationship holds in the other direction.

5 Indirect and direct effects of exchange rates

Considering the indirect effects of the exchange rate on imports and exports, imports become relatively cheaper during an appreciation and increase. Exports are more ambiguous and initially, exports should decrease from an appreciation in the exchange rate, and increase during depreciations. Quotas and tariffs on exported goods imposed by other countries limits the actual changes that occur and it isn't always clear how the net export level will entirely react. Generally, due to the change in imports, the net export level will fall which translates into a fall in output either from the exporting sector or from domestic producers crowded out by cheaper imports. Therefore exchange rate movements can increase volatility in output.

In regard to inflation, during an appreciation, the falling price of imports lowers the impact of inflation from imported goods, lowering the overall rate of inflation for the economy as a whole. This offsets inflation from changes in domestic goods price. Therefore it can be argued that exchange rate movements decrease volatility of inflation.

However, from an appreciation (depreciation), volatility of inflation is falling (rising), but output volatility is rising (falling) and a trade-off between output and inflation exists. This feeds into the preferences of the central bank, depending on whether they believe that inflation or output volatility is more damaging to the economy determines how they will react. This trade-off may be diminished as highlighted by **Adolfson (2001)**, where inflation in import prices does not match a one-to-one change in the exchange rate from the effects of nominal rigidities or price discrimination. This is known as incomplete exchange rate pass-through which may limit the effect on inflation, and consequently limit the response needed by the central bank.

Having a strong currency shields an economy from price rises in imported goods but punishes the export sector. Under a weak currency, the price rises are amplified but the export sector benefits from more competitive pricing. As many central banks lean towards the idea of a 'conservative' central banker, the volatility of inflation is considered more damaging, and this suggests that central banks will be more likely to respond to depreciations than appreciations in the exchange rate, unless a sustained period of strength or weakness of the currency threatens to shift inflation outside of the target band or for output to vary significantly.

This implies that an additional rule could be created for showing the indirect effects of exchange rates and indirectly determining monetary policy, but not within the monetary policy rule itself. It could help determine the relative cost to the economy from the changes in both inflation and output, and the effects of these changes feed into the monetary policy rule. If either inflation or output goes beyond an acceptable threshold then the central bank could step in with an appropriate change to the interest rate.

6 Modelling of exchange rates

The model that Taylor uses to highlight the different approaches works by setting values of the coefficients of the current and previous period exchange rate ignores the effects on the interest rate via changes in output and inflation that may occur. It is also backwards looking in that it doesn't take into

account expectations around the exchange rate. Another issue is that exchange rates may vary significantly before a change in the interest rate occurs, so the relationship cannot be described as linear.

Taylor also highlights the issue that there is no intercept term in the rule, which implies a target rate of inflation of zero and that the interest rate and exchange rate are measured relative to the long run steady state values. Many countries choose a low positive inflation rate (1-3%) or have a band around a central value as a target. The Inflation rate is not set to zero to avoid the risk of potential deflation within the economy and needs to be taken into account when forming the rule. It could be included by measuring difference from target inflation as opposed to just the rate of inflation.

It is difficult to accurately measure the impact of changes in exchange rates upon net exports and inflation, as the three variables are closely entwined. Looking at the changes in each variable individually keeps the function simple, without unnecessary technical complications. The use of a non-linear, partially-backward and -forward looking rule in some form can describe the effects of exchange rates on inflation and output in a potentially informative way.

An example of such a rule is:

$$\omega = \log(|\Delta M|) - \log(|\Delta X|) + \alpha.(\pi M_t - \pi M_t^e) + \beta.(s_t - s_t^{LR}) + \zeta.(s_{t-1} - s_{t-1}^{LR})$$

By taking into account changes in imports ($\log(|\Delta M|)$ and exports ($\log(|\Delta X|)$), changes in current imported inflation from the expected level ($\pi M_t - \pi M_t^e$) and changes in exchange rate from the long run trend both currently ($s_t - s_t^{LR}$) and historically ($s_{t-1} - s_{t-1}^{LR}$), we can then measure some amount of 'loss'(ω) suffered by the economy. This information can be fed into the monetary policy rule with a coefficient determined by the preferences of the central bank on the importance of such information in order to determine a suitable interest rate. The values α, β and ζ are weights to show the preferences of the central bank when reacting towards changes in inflation and current and historical exchange rates.

This rule is forward looking in regard to the changes in imported inflation, but not to the changes in the exchange rate. It's not feasible to accurately predict exchange rates as they resemble a random walk over the short term. The expectations of future exchange rates would be contained within expectations of future imported inflation. If expectations of imported inflation increase, then this implies some expectation of a depreciation of the exchange rate in the near future. This example also addresses the issue of a non-linear relationship between exchange rates and interest rates, as the total 'loss' is passed into the monetary policy function, not the difference alone in exchange rates.

This example gives an idea of how such a rule could be applied, but further work is required to see how variations on this idea affect a structured model and how well it fits existing data across countries. It is very possible to have different rules for different countries, especially between developed economies and emerging economies.

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