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Monetary policy and exchange rate overshooting: Dornbusch was right after all☆

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ABSTRACT

Dornbusch's exchange rate overshooting hypothesis is a central building block in international macroeconomics. Yet, empirical studies of monetary policy have typically found exchange rate effects that are inconsistent with overshooting. This puzzling result has been viewed by some researchers as a "stylized fact" to be reckoned with in policy modelling. However, many of these studies, in particular those using vector autoregressive (VARs) approaches, have disregarded the strong contemporaneous interaction between monetary policy and exchange rate movements by placing zero restrictions on them. In contrast, we achieve identification by imposing a long-run neutrality restriction on the real exchange rate, thereby allowing for contemporaneous interaction between the interest rate and the exchange rate. In a study of four open economies, we find that the puzzles disappear. In particular, a contractionary monetary policy shock has a strong effect on the exchange rate, which appreciates on impact. The maximum effect occurs within 1–2 quarters, and the exchange rate thereafter gradually depreciates to baseline, consistent with the Dornbusch overshooting hypothesis and with few exceptions consistent with uncovered interest parity (UIP).

1. Introduction

Dornbusch's (1976) well-known exchange rate overshooting hypothesis is a central building block in international macroeconomics, stating that an increase in the interest rate should cause the nominal exchange rate to appreciate instantaneously, and then depreciate in line with uncovered interest parity (UIP). Its influence is evident in the rapidly growing "New Open Economy Macroeconomics" (NOEM) literature (see Obstfeld and Rogoff, 1995, 2000) as well as in practical policy discussions spanning far outside the academic sphere. With what seems like an ever-increasing number of citations, it has been described as one of the most important papers in international economics of the twentieth century (Rogoff, 2002).

When confronted with data, however, few empirical studies that analyse the effects of monetary policy have found support for Dornbusch overshooting; see e.g. Sims (1992), Eichenbaum and Evans (1995) and Kim and Roubini (2000) for G7 countries, Peersman and Smets (2003) and Favero and Marcellino (2004) for the aggregate Euro area, Mojon and Peersman (2003) for individual Euro area countries and Lindé (2003) for Sweden. Instead, they have found that following a contractionary monetary policy shock, the real exchange rate either depreciates, or, if it appreciates, it does so only gradually and for a prolonged period of up to 3 years, thereby giving a hump-shaped response that violates UIP. In the literature, the first phenomenon has been termed the *exchange rate puzzle*, whereas the second has been referred to as *delayed overshooting* or the *forward discount puzzle*, see Cushman and Zha (1997). In light of all this evidence that is inconsistent with Dornbusch overshooting and UIP, one might expect the theory to have been abandoned by economists. Yet, this is not the case. Both the hypothesis of Dornbusch overshooting and the UIP remain at the core of theories of international economics. The elegance and clarity of

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the Dornbusch model as well as its obvious policy relevance has put it in a separate class from other international macroeconomic papers (Rogoff, 2002).

The common approach for establishing the quantitative effects of monetary policy in the above mentioned studies has been the structural vector autoregressive (VAR) approach, first initiated by Sims (1980).[1] There is, however, a major challenge when analysing the open economy through structural VARs; namely how to properly address the simultaneity problem between monetary policy and the exchange rate. Most of the VAR studies of open economies (including those mentioned above), deal with a possible simultaneity problem by placing recursive, zero contemporaneous restrictions on the interaction between monetary policy and exchange rates.[2] However, by not allowing for potential simultaneity effects in the identification of monetary policy shock, they may have produced a numerically important bias in the estimate of the degree of interdependence.[3]

This point has recently been emphasized by Faust and Rogers (2003), exploring sign restrictions. By dropping what they call *dubious* (zero contemporaneous) restrictions one by one, they find that the responses in the exchange rate to (U.S.) monetary policy are sensitive to the restrictions imposed. Their results allow for an early peak in the exchange rate, which may allow for the conventional overshooting model. However, the effect is not uniquely identified, so no robust conclusions can be drawn with regard to the exact timing of the peak response, which could be immediate or delayed. Similar results are also found in Scholl and Uhlig (2008), using a procedure related to that of Faust and Rogers (2003).

Hence, the implied interest rate and exchange rate responses following a monetary policy shock continue to remain distinct from Dornbusch's prediction, with both the delayed overshooting feature and/or deviation from UIP emerging as consensus. In fact, some researchers now view the puzzles themselves as *stylized facts*, which recent "Dynamic Stochastic General Equilibrium" (DSGE) models should seek to replicate, see e.g. Smets and Wouters (2002), Lindé et al. (2004), Murchison et al. (2004) and Adolfson et al. (2008). However, as DSGE models have begun to dominate the field of applied macroeconomics and policymaking, it now seems more likely that the economic profession might eventually abandon the Dornbusch overshooting model, also in theory.

This paper strongly cautions against allowing for exchange rate puzzles to develop into consensus for the following reason: although relying on sign restrictions is a useful way of testing the implications of alternative short term restrictions, this approach implies a weak form of identification that may produce weak results (Fry and Pagan, 2007). The main objection to this approach is that the identification scheme will be non-unique. Due to the weakness of information contained in the sign restrictions, there are many impulse responses that can satisfy each sign restriction. Drawing an inference with regard to the precise timing of a peak response in the exchange rate instead requires a strong form of information. This suggests that one should seek to identify VAR models by applying restrictions that ensure a *unique* identification while keeping the contemporaneous interaction between monetary policy and the exchange rate intact. Doing so, we find that the Dornbusch overshooting results hold after all.

To be more precise, this paper suggests identification by restricting the long run multipliers of shocks. In particular, monetary policy shocks are assumed to have no long run effect on the level of the real exchange rate. In the short run, however, monetary policy is free to influence the exchange rate. Eventually though, the effect dies out and the real exchange rate returns to its initial level. This is a standard neutrality assumption that holds for a large class of models in the monetary policy literature (see Obstfeld, 1985; Clarida and Gali, 1994).

Once allowing for a contemporaneous relationship between the interest rate and the exchange rate, the remaining VAR can be identified using standard recursive zero restrictions on the impact matrix of shocks; assuming a lagged response in domestic variables (such as output and inflation) to monetary policy shocks. That monetary policy affects domestic variables with a lag, is consistent with the transmission mechanism of monetary policy emphasised in Svensson's (1997) theoretical set up. These restrictions are therefore less controversial, and studies identifying monetary policy without these restrictions have found qualitatively similar results, see for example Faust et al. (2004) and the references therein. Furthermore, the assumption of a delayed response in output and inflation *combined* with a long run neutrality restriction on the real exchange rate following a monetary policy surprise, are core assumptions underlying Dornbusch's overshooting model, which are consistent with NOEM implications (Lane, 2001) and empirically realistic (Rogoff, 2002).

We impose the alternative identification strategy on four small open economies with floating exchange rates: Australia, Canada, New Zealand and Sweden, and the results are striking.[4] Contrary to the findings of recent studies, we find that a contractionary monetary policy shock has a strong effect on the real exchange rate, which appreciates on impact. The maximum impact occurs within 1–2 quarters, and the exchange rate thereafter gradually depreciates back to baseline, consistent with the Dornbusch overshooting hypothesis and with few exceptions consistent with UIP.

The rest of this paper is organised as follows: Section 2 discusses the VAR methodology used to identify monetary policy shocks; Section 3 presents the empirical results; Section 4 provides extensive robustness checks (focusing both on model specification and identifying restrictions); and Section 5 concludes.

2. The structural VAR model

The variables in the VAR model are chosen to reflect the theoretical set up of a New-Keynesian small open economy model, such as that described in Clarida et al. (2001) and Svensson (2000). In particular, the VAR model comprises the annual change in the log of consumer prices (π_t)–referred to hereafter as inflation, the log of real gross domestic product, (y_t), the three-month domestic interest rate (i_t), the trade-weighted foreign interest rate (i_t^*) and the first difference of the log of the trade-weighted real exchange rate (Δe_t).

We follow the traditional closed economy VAR literature (Christiano et al., 1999, 2005, among many others), in that a standard recursive structure is identified between macroeconomic variables and monetary policy, so that macroeconomic variables such as output and inflation do not react contemporaneously to monetary

[1] For the role of VAR models in policy analysis, see for instance Greenspan (2005).

[2] To be precise, Kim and Roubini (2000) allow for a contemporaneous interaction between monetary policy and the exchange rate, but assume instead that monetary policymakers do not respond contemporaneously to changes in the foreign interest rate. As a result they observe fewer puzzles in the exchange rates than other studies, although for some countries (notably Canada and Germany), a pronounced delay overshooting puzzle still remains.

[3] A related problem has also been pointed out when identifying the interdependence between monetary policy and the stock market in the U.S., see Bjørnland and Leitemo (2009).

[4] See also Bjørnland (2008) for an analysis of Norway that finds corroborate results. That analysis builds on the present model, but due to a much shorter sample (1993–2005), explores event studies using daily data.