



# Interest rate and the exchange rate: A non-monotonic tale



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## ABSTRACT

For over 30 years, the empirical international finance literature has been unable to detect a clear systematic relationship between interest rates and the nominal exchange rate. We take a fresh look at the data and uncover a new stylized fact for a cross-section of countries: the relationship between the exchange rate and short-term interest rates is *non-monotonic*. Small increases in the nominal interest rate appreciate the currency, whereas larger increases depreciate the currency. We develop a model that explains this stylized fact based on the interaction of three effects. Higher interest rates increase money demand and hence appreciate the currency but also raise the fiscal deficit and depress output, both of which tend to depreciate the currency. We provide cross-country evidence for the presence of these effects in the data.

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## 1. Introduction

The relationship between interest rates and exchange rates has long been a key focus of international economics. Most standard theoretical models of nominal exchange rates predict that exchange rates are determined by economic fundamentals. One such fundamental is the interest rate differential between home and abroad. The data on this issue however has not provided an unambiguous answer. A number of studies that have examined the time series relationship between interest rates and the nominal exchange rate tend to either find conflicting results that depend on the sample of countries and/or the time period studied, or tend to find insignificant results.<sup>1</sup>

The absence of a clear empirical relationship between interest rates and the exchange rate is even more problematic from the perspective of practitioners. A short-term interest rate is the typical policy instrument used by policymakers to affect currency values (and monetary conditions more generally).<sup>2</sup> If there is no clear relationship in the data, then why do

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<sup>1</sup> Amongst studies that have directly examined the relationship between interest rates and exchange rates, Eichenbaum and Evans (1995) find that for the G7 countries interest rate innovations tend to appreciate the currency. On the other hand, Calvo and Reinhart (2002) find that for developing countries there is no systematic relationship between the two variables. A more general empirical result is that fundamentals (including interest rate differentials) are poor predictors of exchange rates. Specifically, random-walk exchange rate forecasting models usually outperform fundamentals based models. In other words, most models do not explain exchange rates movements (see Meese, 1990). This fact is highlighted in Obstfeld and Rogoff (2000) who call it the “exchange rate disconnect puzzle”.

<sup>2</sup> We should note that, in the aftermath of the Asian crisis in the late 1990s, there was a contentious debate regarding the soundness of the International Monetary Fund's (IMF) advice to affected countries of raising interest rates to stabilize the rapidly depreciating domestic currencies. IMF critics (like Joseph Stiglitz and Jeffrey Sachs) were of the view that this policy may not even work and, even if it did, its costs would be just too high. In fact,

policymakers persist in using the interest rate instrument to affect exchange rates? Are the typical time series empirical results camouflaging some key features of this relationship?

It is important to note at the very outset that this issue of the effect of interest rates on the level of the exchange rate is distinct from issues surrounding the uncovered interest parity (UIP) condition. UIP is an arbitrage relationship between the *level* of the interest rate and the rate of *change* of the exchange rate. There is a voluminous literature which attempts to document and/or explain the failure of this relationship (the “forward premium anomaly”).<sup>3</sup> Instead, our main focus is on the effects of policy-induced changes in the *level* of the interest rate on the *level* of the exchange rate, which is a very different exercise and focus. Our study is thus more in the spirit of the pioneering work of Meese and Rogoff (1983) who tested various models of exchange rate determination for their statistical fit to the data.<sup>4</sup>

We start our paper by taking another look at the data but with a new and different perspective. In contrast to most of the empirical tests that focus on the time series dimension of the relationship between the levels of the exchange rate and interest rates, we examine the relationship along the cross-sectional dimension. Our cross-sectional approach is motivated by our interest in the long run relationship between policy-induced changes in the interest rate and the effects on the nominal exchange rate. In order to abstract from issues surrounding short run rigidities (nominal or real) which may complicate the relationship between the two, we choose instead to focus on the long run.<sup>5</sup> We identify long run effects using the cross-sectional variation across countries in the long run averages of the two variables.

Using data from a cross-country sample of 80 countries during periods when their exchange rates were flexible, we show that the relationship between long run averages of the exchange rate and interest rates is non-monotonic. Specifically, we find that exchange rates tend to appreciate in the long-run with permanently higher policy-controlled interest rates but only till some point. Beyond a certain point, further increases in interest rates start depreciating the exchange rate in the long-run.<sup>6</sup> This is a new stylized fact which, in a sense, is a cross-sectional cousin of the mixed evidence on the time series relationship between interest rates and the exchange rate.

We then develop a simple monetary model to argue that there is no theoretical reason to expect a monotonic relationship between interest rates and exchange rates. In fact, our model predicts that the relationship between interest rates and exchange rates is inherently non-monotonic. We show that it takes surprisingly small modifications of an otherwise standard optimizing monetary model to generate non-monotonicities. Hence, assuming that our model captures some essential features of the real world (as we will argue), it follows that there is nothing surprising in the fact that the empirical literature has failed to unearth a systematic monotonic relationship between interest rates and exchange rates, since there may be none to begin with. We view the ability of our theoretical model to potentially generate both appreciations or depreciations of the exchange rate in the long run to be a key contribution of the paper.

In building our model, we take as a starting point the fact that most analysts seem to agree that higher interest rates affect key macroeconomic variables essentially through three channels. First, higher interest rates raise the demand for domestic-currency denominated assets thus leading, all else equal, to an appreciation of the currency. Henceforth, we shall refer to this as the “money demand effect”. Second, higher domestic interest rates induce a contraction in domestic output through a credit channel. All else equal, this effect tends to depreciate the currency. We shall refer to this channel as the “output effect”. Third, an increase in interest rates increases the debt service burden of the fiscal authority. This in turn increases inflationary expectations and, hence, weakens the currency. We shall call this the “fiscal effect”.<sup>7</sup>

We proceed to construct a model that captures these three effects. We incorporate the money demand effect by allowing for an independent interest rate instrument. Following Calvo and Vegh (1995), interest rate policy is essentially modeled as the central bank’s ability to pay interest on part of the money supply. In particular, we assume that households hold interest-bearing money in the form of bank deposits. Commercial banks, in turn, hold as part of their portfolio non-tradable government bonds (“domestic bonds”) issued by the central bank. In this set-up, the interest rate on these non-tradable bonds (hereafter referred to as the *policy-controlled* interest rate) is an *additional* policy instrument.<sup>8</sup> Raising this policy-controlled interest rate leads, all else equal, to higher money demand (the money demand effect).

The model also embodies a credit channel à la Bernanke and Blinder (1988). The presence of this credit channel implies that higher interest rate on domestic bonds crowds out the supply of bank credit to the private sector and causes an output

(footnote continued)

a large empirical literature on the topic has failed to unearth a systematic effect of higher interest on the currency values during the crisis period in the affected Asian economies (see Kraay, 2003).

<sup>3</sup> See Engel (2011) for a recent analysis. In fact in the model that we formalize later in the paper, interest parity holds for internationally traded bonds. Hence, almost by construction, we do not shed any new light on the observed deviations from UIP since that is not the object of our interest.

<sup>4</sup> Some recent papers that also share our focus on examining the effects of policy controlled interest rates (via Taylor rules) on exchange rates are Engel and West (2006) and Molodtsova and Papell (2009), among others.

<sup>5</sup> Put differently, we are interested in a horizon that is long enough for short-run rigidities not to matter since we will be thinking in terms of a model with fully flexible prices and no other rigidities.

<sup>6</sup> Since our interest lies in the *long-term* relationship between interest rates and the exchange rate, any changes in the interest rate we discuss are considered to be once-and-for-all and their effects on the exchange rate to be long-run effects.

<sup>7</sup> Indeed, the specific margins we introduce here reflect some of the concerns and arguments made by observers during the Asian crisis regarding the efficacy of using interest rates to defend against speculative attacks. The arguments at that time often centered around the positive effects of interest rate defense on the demand for domestic currency denominated assets (argued by Stanley Fisher representing the IMF) and the deleterious effects of higher interest rates on domestic output and inflation (argued by people like Joseph Stiglitz and Jeffrey Sachs).

<sup>8</sup> The nominal interest rate on tradable bonds will be referred to as the *market* interest rate.

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