

A BRIEF OVERVIEW OF THE CURRENT STATE OF EXCHANGE RATE MODELING*

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Resumo: Neste artigo fazemos um breve apanhado do estado atual dos modelos de comportamento das taxas de câmbio.

Abstract: The paper provides a brief overview of the current state of exchange rate modeling.

Keywords: Dornbusch model, monetarist model, portfolio balance model, chaotic models.

Palavras-chave: modelo Dornbusch, modelo monetarista, modelos caóticos.

JEL classification: F31, F41

Introduction

This paper provides a brief overview of the current state of exchange rate modeling. Section 2 discusses the status of the Dornbusch model. Section 3 evaluates the monetarist model, the portfolio balance model, and the intertemporal approach to the current account. Section 4 compares these structural models with the random walk hypothesis. Section 5 comments on the emergence of financial models. Section 6 compares the news approach to chaotic models. Section 7 presents the equilibrium exchange rate model and the liquidity model. Finally, Section 8 introduces the “redux” model.

1. The Dornbusch model

Nominal and real exchange rate volatility of the floating period following Bretton Woods was explained by overshooting in the Dornbusch (1976) model of exogenous output, where goods price stickiness is the critical reason why the exchange rate overshoots its long run value in response to monetary shocks. It is clear, however, that overshooting is possible in other models. Empirical evidence of overshooting is also weak (Obstfeld and Rogoff, 1995, p. 644; 1996, p. 678; also Eichenbaum and Evans, 1995). In particular, one empirical regularity

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inconsistent with overshooting is the well-documented (e.g. Flood, 1981) tendency for spot and forward exchange rates to move in tandem (Obstfeld and Rogoff, 1995, p. 644 n25). So it is uncertain whether overshooting should be regarded as an essential property of an exchange rate model (Obstfeld and Rogoff, 1995, p. 644).

Despite the fact that its empirical performance is not very successful (e.g. Taylor, 1995, pp. 28-30), the Dornbusch model played a dominant role in shaping the literature on exchange rate dynamics through the early nineties (Isard, 1995, p. 124), a fact demonstrating the “undeniable time-tested appeal of the traditional sticky-price Keynesian model” (Obstfeld and Rogoff, 1995, p. 625). Its prominence reflects the analytic simplicity of the model. However, the Dornbusch model also presents limitations related to its lack of microfoundations. The model provides an ad hoc specification of the price determination process and ignores the current account in the exchange rate determination (Isard, 1995, p. 124). Moreover, it disregards the intertemporal budget constraints needed to describe the current account and fiscal policy consistently; it provides no clear description of how monetary policy affects production decisions; and it has no meaningful welfare criteria, a fact which may yield misleading policy prescriptions (Obstfeld and Rogoff, 1995, p. 625).

There are a number of reasons why people still continue doing research using the Dornbusch model. First, most of the stories appearing in media reports on foreign exchange rates are consistent with the Dornbusch model (Stockman, 1987, p. 12). Secondly, despite its general empirical collapse, evidence is also beginning to show that data provide support for some of the long-run relationships suggested by the model, an example being long-run purchasing power parity (e.g. Froot and Rogoff, 1995).

2. Other structural models

The empirical evidence supportive of the structural models which are traditional alternatives to the Dornbusch model, namely the monetarist model and the portfolio balance model, is weak as well. Despite some initial success, the monetarist model has failed empirically (Taylor, 1995, pp. 28-30 presents a discussion). In particular, estimates of equations for the US dollar-Deutsche mark rate in the late seventies and beyond often produce coefficients which imply that increases in Germany's money supply during this period caused its currency to appreciate; this has been called “the mystery of the multiplying marks” (e.g. Taylor, 1995, p. 29). Although less empirical work had been carried out on the portfolio model, the supportive evidence has notwithstanding been weak (Taylor, 1995, pp. 30-31 shows details).

The traditional flexible price models of the exchange rate have been developed theoretically by the so-called intertemporal approach to the current account (e.g. Sachs, 1981; Obstfeld, 1982; and Frenkel and Razin, 1996). A widely accepted standpoint is, however, that most important problems in international macroeconomics—such as the effects of macro policies on output and exchange rates—cannot be satisfactorily addressed in the framework of perfect price flexibility. For this reason, empirical practitioners and policymakers have continued to use the traditional aggregate Dornbusch model (Obstfeld and Rogoff, 1995, pp. 624-625).

3. Random walk versus fundamental models

Overall, it can thus be said that modeling with the standard structural models has failed empirically. Such a poor performance was highlighted when studies demonstrated that a random walk predicts exchange rate behavior better than models based on the fundamentals of the economy. Following the studies by Meese and Rogoff (1983a; 1983b; 1988)—which showed that traditional structural models could not outperform a simple random walk in out-of-sample regressions—the inability to beat the random walk has been regarded as the standard by which to judge the empirical failure of the fundamental models.

To test the random walk hypothesis it is usual to consider the exchange rate dependent on its past value plus white noise. In such a first-order autoregressive process, a coefficient equaling one means that there is a unit root, i.e. the exchange rate series is non-stationary (random walk). Several empirical studies found that exchange rate data do exhibit unit roots, although the error term does not present constant variance (e.g. Meese and Singleton, 1982; Corbae and Ouliaris, 1986; Baillie and Bollerslev, 1989; and Baillie and McMahon, 1989). Thus, both non-stationarity of series and time dependent heteroskedasticity of the error term suggest that the exchange rate follow a martingale process (or Brownian motion, which is its continuous time analogue).

Notwithstanding a revival of the standard fundamentals seems to be on the way. One key to improving the forecast performance based on economic fundamentals appears to lie in the introduction of equation dynamics (Taylor, 1995, p. 34). In this connection, Koedijk and Schotman (1990) estimated an error-correction *real* exchange-rate equation and showed that it is superior, in sample, to a random walk. The bilateral real exchange rates between the United States, the United Kingdom, Germany, and Japan for the period February 1977 to June 1987 were considered in an econometric model—based on an extension of the Dornbusch model—using an error-correction approach with an observable macroeconomic determinant of the long-run real exchange rate. An efficient estimator was developed by pooling the data for these currencies and a significant mean reversion component was found. Despite the fact that the major trends of the non-dollar exchange rates can be explained by fundamentals, Koedijk and Schotman discovered that the dollar bubble between March 1984 and February 1985 cannot be understood by appealing to fundamentals.

Also using dynamic error-correction techniques, Mark (1995) considered an equation—which can be derived from the Dornbusch model—to investigate the performance of the monetary exchange-rate models concerning long-run predictability. In forecasting tests over longer horizons for several quarterly dollar exchange rates, evidence was found that fundamentals help predict the nominal exchange rate, particularly at the four-year horizon. While quarter-to-quarter exchange rate movements may be noisy, systematic movements related to fundamentals appear in the longer run. The study by Chinn and Meese (1995) also suggested that over long enough periods there is indeed a stationary relationship between the exchange rate and the fundamentals of the aggregate models. The revival of fundamentals is sometimes also associated with the rebirth of long-run purchasing power parity (Froot and Rogoff, 1995, present a comprehensive discussion on this).

Despite the revival of the standard fundamentals, the hypothesis that the exchange rate follows a martingale process should still be taken seriously. An interesting development has made it possible to conciliate the apparent divergence between random walk and fundamentals. The model of De Grauwe and Dewachter (1992), and De Grauwe, Dewachter, and Embrechts (1993, Chapter 5) gives supplementary speculative dynamics to the Dornbusch model by considering chart rules concerning forecasting; as a result, exchange rate movements can be explained by chaos. Charting or “technical analysis” refers to graphs of exchange rate movements trying to capture supposedly recurring patterns that allow forecasts of the exchange rate. The destabilizing expectations of this sort of speculator—the “chartists”—are thought of as a possible explanation for exchange rate movements away from the level consistent with macro fundamentals. Such a chaotic model is able to mimic the random walk pattern of the exchange rate despite the fact that the “stochastic” behavior is produced by its deterministic solution.

Massive foreign exchange intervention is shown to remove chaos in these models (Da Silva, 2000). What is more, Da Silva (2001) shows that a chaotic nominal exchange rate is still possible within the framework of the redux model to be presented in Section 8.

4. The rise of financial models

In the mid-eighties the general sentiment was that the research into exchange rate economics appeared to have grown tired of searching for new macroeconomic models (Dornbusch, 1987, p. 1). As a result, attention shifted from examination of macromodels toward work related to the foreign exchange market as a financial market *per se*. This trend was established when a number of studies pointed out that the nominal exchange rate shows much greater variability than the important fundamental variables of the structural models (e.g. Dornbusch and Frankel, 1988; Baxter and Stockman, 1989; Marston, 1989; Frankel and Froot, 1990; and Flood and Rose, 1993). This suggests that explanations of short-run exchange rate movements based solely on fundamentals may not prove successful, owing to the presence of speculative forces at work in the foreign exchange market which are not reflected in the usual set of macroeconomic fundamentals of the structural models (Taylor, 1995, p. 30).

The literature on foreign-exchange market microstructure focuses on the behavior of agents and market characteristics rather than on the influence of macro fundamentals. One motivation for such work is to understand the mechanisms generating deviations from fundamentals. A survey is provided by Flood (1991), and another useful reference is Frankel, Galli, and Giovannini (1995).

5. The news approach versus chaotic models

Other studies adopted the modeling strategy of reducing all structure of a model to only one single variable intending to focus analysis on the effect of “news”, i.e. unexpected changes in the exchange rate resulting from changes in the fundamentals that come as a surprise.

The news approach, thus, relies on the existence of an unexpected shock to explain every exchange rate movement. It was shown, however, that only a small proportion of spot movements of the exchange rate are caused by news (Goodhart, 1989). A survey of research about news is provided by Frankel and Rose (1995).

In comparison with the news approach, an advantage of chaotic models is that they do not rely on random shocks to explain shifts in the exchange rate, because currency crashes may emerge in these models without any change in their exogenous variables. In other words, crashes in the foreign exchange rate market can be explained by dynamic chaos without random external influences.

6. Other theoretical developments

As an offshoot of the macro literature on real business cycles, the equilibrium exchange rate model (e.g. Stockman, 1980; 1987; Lucas, 1982; and Svensson, 1985) gives a full account of the supply side. Related to the equilibrium model is the liquidity model (e.g. Grilli and Roubini, 1992), which extends the former by incorporating an extra cash-in-advance constraint. At this stage it is not possible to draw any firm conclusions concerning the empirical validity of the equilibrium or liquidity models (Taylor, 1995, p. 32). The emerging challenger of the equilibrium model is the redux model, as presented in the next section. The studies collected in Van Der Ploeg (1994) allow for a general appreciation of other new developments.

7. The redux model

The model of the exchange rate developed by Obstfeld and Rogoff (1995; 1996, Chapter 10)—the “redux” model—is a dynamic intertemporal two-country model that assumes monopolistic competition and sticky nominal prices in the short run. While preserving the sticky price feature of the Dornbusch model, it provides a more rigorous framework than the latter model by incorporating the intertemporal approach to the current account. This allows for evaluating the welfare effects of macro policies on output and the exchange rate, a possibility not contemplated by the flexible-price intertemporal approach. The results of the Obstfeld-Rogoff model sometimes differ sharply from those of either the Dornbusch model or the flexible-price intertemporal approach to the current account. In particular, the model gives a different view of the international welfare spillovers due to monetary and fiscal policies.

The testable results of the redux model—such as whether the distortions affecting the welfare effects of international monetary policy are empirically significant (Obstfeld and Rogoff, 1996, p. 688)—still have to stand up to empirical scrutiny. If they succeed, lack of microfoundations would explain partly the bad empirical performance of the Dornbusch model.

The wave of research initiated by the redux model is sometimes labeled “new open economy macroeconomics”. Lane (1999) and Sarno (2001) present surveys. Lane questions the current relevance of this literature for policymaking because many welfare results are highly sensitive to the precise denomination of price stickiness and the specification of preferences.

But the many unanswered questions that remain should ensure that the literature is likely to grow yet further in the coming years.

8. Concluding remarks

The Dornbusch model demonstrates undeniable time-tested appeal. The redux model comes up to update the Dornbusch model as regards microfoundations and a breakthrough is to allow for an explicit welfare analysis as far as policy is concerned. Nonetheless, the welfare results of the new open economy macroeconomics literature are highly sensitive to the precise denomination of price stickiness and the specification of preferences. For this reason, the literature is only of limited interest in policy circles. Notwithstanding the lack of welfare criteria of the Dornbusch model yields misleading policy prescriptions and this will encourage further research in the new open economy macroeconomics. Fruitful developments will also take into account the insights coming from the other models presented in this brief overview.

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