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# Into the Mussa puzzle: monetary policy regimes and the real exchange rate in a small open economy

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## Abstract

Industrial countries moving from fixed to floating exchange rate regimes experience dramatic rises in the variability of the real exchange rate. This evidence, forcefully documented by Mussa [Nominal exchange regimes and the behavior of real exchange rates: evidence and implications. Carnegie-Rochester Conference Series on Public Policy 25 (1986) 117], is a puzzle because it is hard to reconcile with the assumption of flexible prices. This paper lays out a dynamic general equilibrium model of a small open economy that combines nominal price rigidity with a systematic behavior of monetary policy able to approximate a continuum of exchange rate regimes. A version of the model with complete exchange rate pass-through is broadly consistent with Mussa's findings. Most importantly, this holds independently of the underlying source of fluctuations in the economy, stressing the role of the nominal exchange rate regime per se in affecting the variability of the real exchange rate. However, only a model featuring incomplete exchange rate pass-through can account for a broader range of exchange rate statistics. Finally there exist ranges of values for either the degree of openness or the elasticity of substitution between domestic and foreign goods for which the baseline model is also consistent with the empirical insensitivity of output volatility to the type of exchange rate regime, as documented by Baxter and Stockman [Journal of Monetary Economics 23 (1989) 377].

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## 1. Introduction

For a long time economists have debated about whether fluctuations in the exchange rates reflect mere changes in relative money prices, as opposed to changes in the relative prices of goods or inputs. In a very influential paper, Mussa forcefully documents two facts:<sup>1</sup> (i) Nominal and real exchange rates are strongly correlated; (ii) Industrial countries moving from fixed to floating exchange rate regimes experience dramatic rises in the variability of the real exchange rate. In Fig. 1, the German Mark–U.S. Dollar nominal and real exchange rates (*top panel*), the short-run variations of the real exchange rate (*medium*) and of its components (*bottom*) are plotted. The evidence is striking. Nominal and real exchange rate are almost perfectly correlated. A sharp increase in volatility stands out in the post-Bretton-Woods era for both the real and the nominal exchange rate, as opposed to a noticeably constant variability of the price level ratio. The decomposition of the real exchange rate into nominal depreciation rate and inflation differential shows a very weak correlation between these two components. Table 1 reports exchange rates statistics for several OECD countries. The volatility of the real depreciation rate is on average more than four times higher under floating than under fixed rates. The correlation between nominal and real exchange rate under floating is close to unity. Overall, the movements of the nominal exchange rate seem to play a dominant role in shaping the short-run variations of the real exchange rate. According to Mussa, these regularities systematically apply to every postwar exchange rate regime shift undertaken by an industrial country.

At this point, it might seem that little room remains to argue that the exchange rates are a purely nominal phenomenon. Why, then, has this evidence often been treated as a puzzle? In principle the high correlation between nominal and real exchange rates may be rationalized in economies with perfectly flexible prices and a high incidence of real shocks, i.e., shocks originating in the goods market that require adjustments of the relative prices.<sup>2</sup> Yet this would not explain why the volatility of the real exchange rate systematically starts to increase upon switching from a regime of fixed to one of floating rates. It could also be argued that the choice of the exchange rate regime is endogenous, and that it is indeed those countries experiencing large real shocks that choose to switch to floating exchange rates.<sup>3</sup> The evidence on the change in volatility, however, is so overwhelming and extended over time that this does not seem a plausible explanation.<sup>4</sup> Nor can the whole set of facts be rationalized in international real business cycle models,

<sup>1</sup> Mussa (1986). We will refer to these as the “Mussa facts” throughout the paper.

<sup>2</sup> This is the theory postulated by Stockman in several papers. See Stockman (1983, 1988). According to this view real (e.g., preference) shocks affect the marginal rate of substitution between home and foreign goods and in turn the real and the nominal exchange rate. Therefore the feedback should work from the real to the nominal exchange rate whereas the opposite would be true in sticky-price models.

<sup>3</sup> This would be consistent with the traditional normative view (built on the Mundell–Fleming model) prescribing fixed exchange rates when monetary shocks are prevalent, and floating exchange rates when real shocks dominate.

<sup>4</sup> The example of Ireland is often reported as an argument against the endogeneity view (see Krugman, 1989; Obstfeld, 1997). Before Ireland joined the EMS, its real exchange rate was much more closely correlated with that of the UK than with that of Germany, but after joining the EMS the rank in the correlation reversed. This is a clear example of an exogenous change in the *nominal* regime affecting the dynamic properties of the real exchange rate.

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