

# A structural time series test of the monetary model of exchange rates under the German hyperinflation

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## Abstract

In this paper some structural time series evidence is presented for the monetary model of exchange rates under the German hyperinflation. The results show that the money supply and the expected rate of change of the exchange rate played a dominant role in the determination of the exchange rate of the mark against the US dollar. The results also support the property of proportionality between the exchange rate and the money supply. Furthermore, evidence is found for the validity of the constituent components of the monetary model, PPP and the quantity theory. © 2000 Elsevier Science B.V. All rights reserved.

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## 1. Introduction

The flexible-price monetary model of exchange rate determination was developed in the 1970s by Frenkel (1976), Mussa (1976) and Bilson (1978). This model is based on two pillars: the quantity theory of money and purchasing power parity. According to this model the exchange rate is determined by the supply and demand for money, such that a rise in the domestic money supply leads (via the quantity

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theory) to a proportional rise in the price level and (via purchasing power parity) to a proportional rise in the exchange rate. The effect of other variables on the exchange rate is supposed to be transmitted via monetary changes.

The empirical evidence has not been supportive of this model under normal conditions, except perhaps in the very long run.<sup>1</sup> However, the model was found to work well under hyperinflation as the results obtained by Frenkel (1976) revealed.<sup>2</sup> The objective of this paper is to shed more light on this issue by testing the monetary model under the German hyperinflation over the period 1919–1923.

This study is based on a different model specification and different econometric methodology. Similar studies (for example, Frenkel, 1976) are based either on a dynamic bivariate model relating the exchange rate to the money supply, or on a regression equation explaining the exchange rate in terms of the money supply and the expected inflation rate. This specification is justified on the grounds that under hyperinflation the effect of the domestic money supply dominates and overwhelms the effect of other explanatory variables (such as income, interest rate and foreign variables).<sup>3</sup> The model used in this paper is different in at least two aspects. The first is that it incorporates an additional explanatory variable, the expected rate of change in the exchange rate, to allow for the possibility of currency substitution. This possibility is not normally allowed for in the conventional flexible-price model. The second difference is that the effect of other variables is not assumed away but rather it is tested for. This is done by specifying a stochastic trend for the exchange rate that partly reflects the effect of these variables whose significance can be judged by the statistical significance or otherwise of the trend. The specification and estimation of the monetary model in this paper is based on Harvey's structural time series model (Harvey, 1989).

This paper is organised as follows. Following this introduction, the model is specified and the methodology of estimation is discussed briefly. This is followed by a description of the data and the presentation of the empirical results. The paper ends up with some concluding remarks.

## **2. Model specification**

One variant of the monetary model of exchange rate determination is based on a demand for money function that specifies the demand for real money balances to be determined by real income, interest rate and (to allow for currency substitution)

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<sup>1</sup> See, for example, MacDonald and Taylor (1991).

<sup>2</sup> For a survey of the empirical evidence, see MacDonald and Taylor (1992) and Taylor (1995).

<sup>3</sup> Frenkel (1976) puts forward this point strongly by suggesting that “during hyperinflation domestic (German) influences on the exchange rate dominate those occurring in the rest of the world”. He also describes the episode of German hyperinflation as providing “an opportunity to examine the asset approach to a situation in which it is clear that the source of disturbances is monetary”. For more on the German hyperinflation, see Holtfrerich (1986).

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