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Bivariate cointegration of major exchange rates, cross-market efficiency and the introduction of the Euro

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A B S T R A C T

The aim of this paper is to investigate whether the Euro–US dollar exchange rate cointegrates with other major exchange rates since the introduction of the Euro. In order to evaluate whether the introduction of a new currency, which has commonly replaced more and less established currencies, has generated common stochastic trends which are possibly linked to cross-inefficient markets, the results are compared with those of a cointegration analysis of the pre-Euro era.

We can show that after the introduction of the Euro two cointegration relationships arise among the Euro–US dollar and the four most important exchange rates, whereas the no-arbitrage condition is satisfied. Here, we discovered a new result: free floating exchange rates are cointegrated after the introduction of the Euro. The Euro–US dollar exchange rate cointegrates with the Australian dollar–US dollar and with the British pound–US dollar. In both cases the Euro–US dollar is weakly exogenous. The results coincide with comovements of important fundamentals which imply cross-market efficiency.

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1. Introduction

The cointegration analysis for long-run comovements of time series was applied to test market efficiency at the end of the 1980s. Granger (1986) argues that on a speculative market, a pair of prices cannot be cointegrated if the market is (informationally) efficient. Cointegration would signify the predictability of at least one price based on the past prices of other assets as indicated by the presence of an error correction term. This would contradict the weak form of market efficiency.

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MacDonald and Taylor (1989), Hakkio and Rush (1989), and Baillie and Bollerslev (1989) are the first authors to apply the argumentation of Granger (1986) to the foreign exchange market in order to investigate market efficiency. The first two contributions use the Engle–Granger approach and mostly could not find any cointegration relationship. In MacDonald and Taylor (1989) cointegration can only be detected for the exchange rate pair French franc/US dollar and Deutsche mark/US dollar. Baillie and Bollerslev (1989), however, find common stochastic trends in a sample of seven exchange rates, whereas, contrary to the two other authors, they apply the multivariate Johansen procedure.

Coleman (1990), Copeland (1991), Tronzano (1992), Lajaunie and Naka (1992), Diebold, Gardeazábal, and Yilmaz (1994), Lajaunie, Naka, and McManis (1996), and Rapp and Sharma (1999) cannot detect cointegration of exchange rates for periods up to the end of the 1990s. On contrary, Alexander and Johnson (1992), Masih and Masih (1994) and Crowder (1994) can find long-run relationships among exchange rates on a US dollar basis and Karfakis and Parikh (1994) on the basis of the Australian dollar. Some other contributions, such as Sephton and Larsen (1991), Norrbin (1996), Lajaunie and Naka (1997), and Barkoulas and Baum (1997), cannot provide a clear answer to the question of coin-tegrated exchange rates. As demonstrated by Sephton and Larsen (1991) and Barkoulas and Baum (1997), evidence favouring the rejection of no cointegration largely depends on the chosen period of observation.

In addition to this first strand in the literature concentrating on market efficiency, a second strand also applies the cointegration analysis to the foreign exchange market but has a different focus. Coin-tegration between two exchange rates expressed in the same currency (which are non-stationary as a necessary condition) automatically means that their cross-rate has to be stationary. In a monetary system with target zones, exchange rates expressed in a currency that does not belong to the system should be cointegrated. The cross-rates should therefore move within the defined ranges and exhibit mean-reverting behaviour. Consequently, a cointegration analysis can be taken to evaluate the stability within a monetary exchange rate system. By applying a multivariate framework, the exchange rates should share common stochastic trends, whereas their number declines if a high integration of the sys-tem is achieved. Particularly, with respect to the Exchange Rate Mechanism (ERM), a couple of authors tested for stability within the European Monetary System (EMS). Norrbin (1996), Woo (1999), Haug, MacKinnon, and Michelis (2000), Rangvid and Sørensen (2002), and Aroskar, Sarkar, and Swanson (2004) mostly find cointegration among the EMS currencies. In particular, strong evidence supporting long-run relationships between exchange rates is present in the period before the introduction of the Euro, in which parities were strongly fixed. In contrast, the evidence in favour of cointegration was less pronounced in the mid 1980s. Taking into account the realignments during that time, the evi-dence increases dramatically, as illustrated by Woo (1999). Hence, the explicit modelling of structural breaks is important for a cointegration analysis directed to exchange rates. Jeon and Seo (2003) and Phengpis (2006) specifically examine structural instabilities and investigate currency crises for market efficiency. Their results are mixed.

No paper has explicitly examined the foreign exchange market for cointegration since the estab-lishment of the European Monetary Union. Hence, the aim of this paper is to investigate whether the Euro–US dollar exchange rate cointegrates with other major exchange rates since the introduction of the Euro. The introduction of the Euro has changed the structure of the global foreign exchange market to the extent that the second most important currency in the world with the highest credibility on the foreign exchange market, namely the Deutsche mark, has merged into the Euro (Bank for International Settlements, 2007). Thus, we are interested in investigating whether the emergence of a new currency that has replaced more and less established currencies has generated common stochastic trends on the foreign exchange market. In order to evaluate the results and to ascertain whether the introduction of the Euro has resulted in (cross) inefficient markets, the results are compared with a cointegration analysis of the pre-Euro era.

The remainder is organised as follows: after a short introduction into the methodology of cointegra-tion and both the Johansen (1988, 1991) and the Gregory and Hansen (1996) approach in Section 2, the link between cointegration and market efficiency is discussed in the third section. In doing so, attention is drawn to a caveat concerning the role of common fundamentals. Since the literature mostly does not discuss the choice of the model underlying the estimation in detail, this is done more extensively in Section 4. The fifth section presents the empirical results of the cointegration analysis. In addition, it is