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Exchange-rate return predictability and the adaptive markets hypothesis: Evidence from major foreign exchange rates

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A B S T R A C T

This study examines return predictability of major foreign exchange rates by testing for martingale difference hypothesis (MDH) using daily and weekly nominal exchange rates from 1975 to 2009. We use three alternative tests for the MDH, which include the wild bootstrap automatic variance ratio test, generalized spectral test, and Dominguez–Lobato consistent tests. We evaluate time-varying return predictability by applying these tests with fixed-length moving sub-sample windows. While exchange rate returns are found to be unpredictable most of times, we do observe a number of episodes of statistically significant return predictability. They are mostly associated with the major events such as coordinated central bank interventions and financial crises. This finding suggests that return predictability of foreign exchange rates occurs from time to time depending on changing market conditions, consistent with the implications of the adaptive markets hypothesis.

1. Introduction

One of the earliest and most enduring questions in economics and finance is whether prices of financial assets are predictable. The efficient market hypothesis (EMH) of Samuelson (1965) and Fama (1965) states that asset prices fully and instantaneously reflect all available and relevant information.

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Since price adjustment to a new piece of information is instantaneous and accurate, the returns cannot be predicted. As a result, prices in an efficient market follow a random walk or a martingale process.[1] Under the weak-form efficiency where the information set consists of past prices and returns, future prices and their returns are purely unpredictable based on past price information. Most of the studies for the EMH on financial markets have tested whether the returns follow a martingale difference sequence (MDS), where the returns are uncorrelated with the past values. If the foreign exchange market is weak-form efficient, the nominal exchange rate follows a martingale sequence and its returns are purely unpredictable based on past price and return information. For these reasons, the return predictability has been an important issue related to the market efficiency in the weak-form.

There are several alternatives explanations for predictability in foreign exchange markets: (i) the prices in these markets do not quickly adjust to the new information (Fama, 1970; Melvin, 2004); (ii) the exchange rates are not set at the equilibrium level due to distortions in the pricing of capital and the valuing of risk (Smith et al., 2002); (iii) the emergence of a parallel/black market due to the existence of the exchange rate controls and resulting divergence between the equilibrium rate and the official rate (Diamandis et al., 2007); (iv) the exchange rate regime and regulatory arrangements, as they may affect the degree of foreign banks to access the foreign exchange markets and products; (v) the overshooting or undershooting phenomenon of exchange rates (Liu and He, 1991); and (vi) the central bank intervention (Dominguez and Frankel, 1993; Yilmaz, 2003; Beine et al., 2009).[2]

There have been numerous studies that tested the MDH in major foreign exchange rates. Since Meese and Rogoff (1983) showed that the structural models of exchange rate determination provide inferior out-of-sample forecasts to those implied by an MDS, many studies strived to uncover the empirical regularities in exchange rate behavior. In the literature, several alternative methods have been used to test for martingale behavior, including autocorrelation tests (Box and Pierce, 1970; Ljung and Box, 1978), variance ratio tests (Lo and MacKinlay, 1988, 1989), and spectral tests (Durlauf, 1991; Hong, 1996) and their improved modifications.[3] These methods have been used in many empirical applications on foreign exchange rates: see Hsieh (1988), Liu and He (1991), Fong et al. (1997), Wright (2000), Lobato et al. (2001), Yilmaz (2003), Kuan and Lee (2004), Escanciano and Velasco (2006) and Escanciano and Lobato (2009a, 2009b), among others. However, the results are overall mixed and scattered over numerous studies that use different sample periods (often outdated), methods (often one type of methodology) and data frequencies (weekly or daily).

Recently, Lo (2004, 2005) proposed the adaptive markets hypothesis (AMH), which gives a framework to reconcile the EMH with the notion of bounded rationality.[4] An important implication of the AMH is that return predictability may arise time to time, due to changing market conditions (cycles, bubbles, crashes, crises …) and institutional factors. For the foreign exchange markets, a number of studies found that changing market conditions, caused by the events such as coordinated central bank intervention (LeBaron, 1999; Jeon and Lee, 2002; Yilmaz, 2003), Asian financial crisis (Jeon and Seo, 2003; Ahmad et al., 2011; Al-Khazali et al., 2011, 2012), and the global financial crisis (Ahmad et al., 2011), can affect

[1] See Escanciano and Lobato (2009b) for a distinction between random walk and martingale process.

[2] Note that no consensus has been reached on the effect of central bank's intervention. For some, the impact of intervention vanishes after a few minutes or a day (Dominguez, 2006). For others, it lasts several days or weeks (Fratzscher, 2006). Yilmaz (2003) and Szakmary and Mathur (1997) document that exchange rates can deviate from the martingale property and produce profitable trading returns during times of coordinated central bank interventions. On the other hand, Neely (2002) provides evidence that central bank intervention does not generate technical trading profits. See Menkhoff (2010) for a discussion on foreign exchange interventions.

[3] See Escanciano and Lobato (2009b) for a discussion on testing the MDH.

[4] The AMH is developed by coupling the evolutionary principle with the notion of bounded rationality (Simon, 1955). A bounded rational investor is said to exhibit satisfying rather than optimal behavior. Optimization can be costly and market participants with limited access to information or abilities to process information are merely engaged in attaining a satisfactory outcome. Lo (2004, 2005) argues that a satisfactory outcome is attained not analytically, but through an evolutionary process involving trial error and natural selection. The process of natural selection ensures the survival of the fittest and determines the number and composition of market participants. Market participants adapt to constantly changing environment and rely on heuristics to make investment choices (Kim et al., 2011). Based on the evolutionary perspective, profit opportunities do exist from time to time. Though they disappear after being exploited by investors, new opportunities are continually being created as groups of market participants, institutions and business conditions change.