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Gold, currencies and market efficiency

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HIGHLIGHTS

- Efficiency of 142 currencies is studied.
- An adjusted Efficiency Index (EI) is utilized.
- The most liquid currencies are among the least efficient ones.
- Further discussion of results is provided.

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ABSTRACT

Gold and currency markets form a unique pair with specific interactions and dynamics. We focus on the efficiency ranking of gold markets with respect to the currency of purchase. By utilizing the Efficiency Index (EI) based on fractal dimension, approximate entropy and long-term memory on a wide portfolio of 142 gold price series for different currencies, we construct the efficiency ranking based on the extended EI methodology we provide. Rather unexpected results are uncovered as the gold prices in major currencies lay among the least efficient ones whereas very minor currencies are among the most efficient ones. We argue that such counterintuitive results can be partly attributed to a unique period of examination (2011–2014) characteristic by quantitative easing and rather unorthodox monetary policies together with the investigated illegal collusion of major foreign exchange market participants, as well as some other factors discussed in some detail.

1. Introduction

For decades, the efficient market hypothesis (EMH) has been a building block of financial economics. In his fundamental paper, Fama [1] summarizes the then-current empirical findings following the theoretical papers of Fama [2] and Samuelson [3]. Fama [4] then recalls various issues of the hypothesis and reviews the newer literature on the topic. The capital market efficiency is standardly parallelized with the informational efficiency so that the markets are efficient as long as all the available information is fully reflected into market prices [1]. Depending on the level of information availability, the EMH is usually separated into three forms — weak (historical prices), semi-strong (public information), and strong (all information, even private) [4]. The theory has been challenged on both theoretical [5] and empirical [6] grounds regularly, yet still it remains a popular and fruitful topic of financial research.

The empirical testing of capital markets efficiency has a long history across various assets. The already-mentioned review study of Fama [1] focuses mainly on stock markets. In commodity markets, Roll [7] and Danthine [8] are among the first ones

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to study their efficiency arriving at contradicting results. In the same timeline, foreign exchange rates are investigated as well [9,10]. The termination of the Bretton Woods system in 1971 made the detachment of gold and currency prices interesting for research of the separate phenomena [11]. Nonetheless, the two still remain tightly connected. Koutsoyiannis [12] focuses on the efficiency of gold prices and argues that the market efficiency cannot be refuted. Nevertheless, the author finds a tight connection between gold prices and the strength of the US dollar as well as the inflation, interest rates and a general state of the US economy. The gold prices and foreign exchange rates are thus found to be firmly interconnected, which is supported by another early study of Ho [13]. Frank and Stengos [14] further suggest that simple linear testing of the gold (and silver) market efficiency need not be sufficient.

The efficiency studies of foreign exchange rates are quite unique compared to the mentioned stocks and commodities as the foreign exchange rates pricing has solid macroeconomic foundations such as the balance of payment theory, the purchasing power parity, the interest rate parity, the Fisher effect and others [15–17]. These theories lead to different ways of efficiency treatment and testing.

Charles et al. [18] examine the return predictability of major foreign exchange rates between 1975 and 2009. Using various tests, the authors show that the exchange rates are unpredictable most of the time. Short-term inefficiencies are attributed to major events such as coordinated central bank interventions and financial crises. The crises perspective is further studied by Ahmad et al. [19] who focus on the Asia-Pacific region. They argue that the 1997–1998 Asian crisis was more disturbing compared to the 2008–2009 global financial crisis. In addition, the floating currency markets are found to be more resilient than the countries with managed currencies. Al-Khazali et al. [20] further examine the Asia-Pacific region using the random walk and martingale definitions of the market efficiency. Out of 8 studied currencies, only three (Australian dollar, Korean won and Malaysian ringgit) are found to be efficient while the other exchange rates offer profitable trading opportunities.

Olmo and Pilbeam [21] review the literature on the foreign exchange rate efficiency testing based on the uncovered interest rate parity. They suggest that the rejection of efficiency in this area of research may be due to significant differences in volatilities of the logarithmic changes of exchange rates and the forward premium, in addition to conditional heteroskedasticity of the data. The authors introduce a set of profitability-based tests of market efficiency based on the uncovered interest rate parity and they show that the foreign exchange rates are much closer to market efficiency than usually claimed. Chen and Tsang [22] inspect whether interest rates structure (yield curve) can be used for foreign exchange rate forecasting. They show that it is the case on time horizons between one month and two years. They also argue that these results can help explaining the uncovered interest rate parity puzzle by relating currency risk premium to inflation and business cycle risks. Bianco et al. [23] further discuss the potential of using economic fundaments for foreign exchange rates forecasting. Their fundamentals-based econometric model for weekly euro–dollar rates is shown to beat the random walk model for time horizons between one week and one month. Engel et al. [24] construct factors from exchange rates and they use their idiosyncratic deviations for forecasting. Combining these with the Taylor rule, and monetary and purchasing power parity models, they improve the forecasting power of the model compared to the random walk benchmark for the periods between 1999 and 2007 but not for earlier periods down to 1987.

Chaboud et al. [25] inspect the effect of algorithmic trading on efficiency of the foreign exchange markets in the high-frequency domain. They show that algorithmic trading improves market efficiency in two aspects — triangular arbitrage opportunities and autocorrelation of high-frequency returns. On the contrary, they argue that this may impose higher adverse selection costs on slower traders.

Studies of the foreign exchange rates efficiency, in the same way as of the other assets, primarily focus on testing whether a given currency or a set of currencies may or may not be considered efficient. To reflect this point, Kristoufek and Vosvrda [26] introduce the Efficiency Index (EI) which can be used to rank assets according to their efficiency. In addition, the index is very flexible and it can incorporate various measures of the market efficiency. In the original study, Kristoufek and Vosvrda [26] study 41 stock indices and find the Japanese NIKKEI to be the most efficient one. From a geographic perspective, the most efficient indices are localized in Europe and the least efficient ones in Asia and Latin America. Kristoufek and Vosvrda [27] further focus on the index specification and show that approximate entropy adds a significant informative value to the index. Kristoufek and Vosvrda [28] then study efficiency across various commodity futures and uncover that energy commodities are the most efficient ones whereas the livestock commodities such as cattle and hogs are the least efficient ones. Here we focus on efficiency ranking of the gold market with respect to a currency used for the purchase, and we also contribute to the discussion on statistical properties of the Efficiency Index.

2. Methods

Coming back to the roots of the efficient market hypothesis in 1965, the treatment has been split into two main branches — based on the random walk hypothesis [2] and following the martingale specification [3]. We follow the latter approach as it is less restrictive and it assumes the returns of the efficient market to be only serially uncorrelated and with finite variance. This straightforward treatment enables us to use various measures of market efficiency and use them to construct the Efficiency Index, which allows to rank financial assets according to their efficiency. In this section, we briefly describe the Efficiency Index, its components and its statistical treatment. Introducing a procedure to assess statistical features of the Efficiency Index is an important and novel contribution to this line of research.