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Evidence of information transmission across currency futures markets using frequency domain tests

Satish Kumar*

Department of Finance, IBS Hyderabad, (ICFAI Foundation for Higher Education), Survey Number 156/157, Dontanpally Village, Shankarpally Mandal, R.R. District, Hyderabad, Telangana 501203, India

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ABSTRACT

In this article, I examine the returns and volatility spillovers in the currency futures market incorporating the recently developed frequency domain tests. Such analysis allows differentiating between permanent (long-run) and transitory (short-run) linkages among the currency futures markets by investigating the causality dynamics at low and high frequencies respectively. I detect significant informational linkages between USD, EUR, GBP and JPY futures contracts in the Indian currency futures market. Evidence of innovations from USD futures market to other markets is the most significant for returns spillover and for volatility spillover, EUR is found to be the most significant compared to other currency futures contracts. The results would have implications for the market participants and policymakers.

1. Introduction

Examining the relation between currency markets is an important issue and has received considerable attention from various stakeholders in the market such as academic researchers, practitioners and regulators for at least two reasons. First, the behavior of comovement between exchange rates can be useful to determine the level of policy coordination among international monetary authorities. For example, Fratzscher (2005) argues that the exchange rate interventions by the central banks are coordinated internationally, consistent with the information transmission across currency markets. Second, the comovement among exchange rates could have wide implications for portfolio managers in terms of designing the portfolio allocation and risk mitigation strategies.

A number of studies have been conducted to examine the linkages among major exchange rates for volatility spillovers since Engle, Ito, and Lin (1990). Among other studies in this field, Asimakopoulos, Ayling, and Mahmood (2000) examine the return spillover across currency futures markets and report the evidence of nonlinear causality. Elyasiani, Kocagil, and Mansur (2007) explore the linkages between currency futures contracts using a variance decomposition analysis and report significant dependencies. From the viewpoint of volatility spillovers, Nikkinen, Salhstrom, and Vahamaa (2006) examine the linkages using implied volatilities from currency options prices and show significant influence of EUR on GBP and CHF. Inagaki (2007) provides an evidence of unidirectional volatility spillover from EUR to GBP. Kitamura (2010) finds strong evidence of intraday volatility spillovers from EUR to GBP and CHF. Kearney and Muckley (2008) investigate the volatility

* Mobile: +91 9951707097.
E-mail address: satishwar1985@gmail.com

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spillover among four Asian currency rates using multivariate GARCH models and suggest that the Asian currencies can be successfully linked to Japanese yen, along with their traditional pegs with the US dollar.

Most of the existing studies have employed conventional empirical methodologies such as correlation coefficient (see, e.g., Brooks & Del Negro, 2004), co-integration approach (Arouri, Jouini, & Nguyen, 2011), error correction models, copula theories (Aloui, Aïssa, & Nguyen, 2011; Samarakoon, 2011) and ARCH/GARCH models (Conrad & Lamla, 2010; Lin, Engle, & Ito, 1994; Theodossiou & Lee, 1993; Aloui et al., 2011) to examine the co-movement in stock markets. These empirical approaches, despite their recognized utility, offer mixed results and fail to capture the frequency domain of co-movement, which the portfolio managers are more concerned with (Aloui & Hkiri, 2014). Building on these arguments, my primary objective is to empirically examine the dynamic linkages among major exchange rates in the Indian currency futures market. In particular, I provide evidence on both return and volatility spillovers between currency pairs USD–INR, EUR–INR, GBP–INR and JPY–INR[1] futures contracts traded on the National Stock Exchange of India (NSE). To do so, I consider frequency domain analysis, which allows detecting the chronological specifications for financial and economic variables particularly, the decomposition into sub-time series and the localization of the interdependence between time series. Using this approach allows us to decompose the information content of causality analysis and test for permanent and transitory dependency separately. In particular, I compute test statistics and near-zero frequency to detect long-term information transmission among currency futures markets, which could be deduced as permanent shock. In contrast, I also compute test statistics at higher frequencies to identify short-term linkages, which could be interpreted as transitory shock. In addition to price linkages, I also test for volatility spillovers. Volatility has to be estimated since it is latent. I estimate conditional volatility series using a GARCH model since this framework closely computes the underlying volatility process (Ciner, 2011).

Since markets consist of traders operating in different time horizons who can behave differently depending on different times for which they stay invested in the market (daily, monthly, and weekly); from the time horizon point of view of portfolio diversification, a portfolio manager requires knowledge of co-movement at higher frequencies unlike a retail investor who is concerned with lower frequencies or long-term co-movement. This means short-term investors are interested in currency returns at higher frequencies, that is, short-term fluctuations; medium-term investors at medium frequencies and the long-term investors are interested in the relationship at lower frequencies, that is, long-term fluctuations. Therefore, it is worthy to investigate the currency market co-movement at more than two frequencies to analyze the multi-scale dynamics of time series for portfolio management exercise, for which the frequency domain analysis appears useful for traders.

This study contributes to the literature in many ways. First, I examine the scantly studied area of co-movement in exchange rates using frequency domain tests, which allows me to analyze frequency-wise co-movement of the exchange rates time series. To the best of my knowledge, there is no study that investigates the linkages in currency pairs using recently developed frequency domain tests (Breitung & Candelon, 2006) in the Indian currency futures market. Second, in contrast to previous studies like Beirne and Gieck (2014) that rely on a single statistic using conventional time domain analysis, I make use of the frequency domain approach which allows investigating causality dynamics at different frequencies. The time domain analysis which is usually conducted within the framework of a VAR model, assumes that a single statistic is sufficient to explain the relation among the variables at all frequencies; however, it does not differentiate between the shocks at higher and lower frequencies. I cover the most important issue in risk management: the interdependence of exchange rates over different timescales. Finally, my study analyze the currency futures contracts traded on NSE which introduced USD–INR futures trading in India only in August, 2008, and therefore, the market is still very much unexplored.

The results indicate no evidence of cointegration between the currency futures similar to Ciner (2011). On the basis of causality tests, I argue that USD is the most influential in terms of return spillovers indicating that the causality runs from USD to all other currency futures contracts. However, it is worth noticing that USD is impacted by the EUR at low frequencies in a feedback relation. As far as volatility spillovers are concerned, results show strong dependencies, supporting the notion of shocks across currency futures markets. Contrary to the return spillover tests, the results of volatility spillover suggest high influence of EUR since there is permanent and transitory causality running from EUR to other currency futures contracts.

The rest of the paper has been organized as follows: Next section provides the data and statistical methodology; Section 3 discusses the empirical results; and finally, Section 4 concludes the paper.

2. Data and methodology

2.1. Data

The data for all the currency futures series has been taken from National Stock Exchange of India (NSE) which represent the daily settlement prices. The first trade in the currency futures in India started on August 29, 2008 when NSE introduced the USD–INR currency pair. Riding on the huge success of the USD–INR futures trading, later, in 2010, NSE launched the contracts for other currency pairs (for example, EUR–INR, GBP–INR and JPY–INR) as well. Therefore, the data for all currencies starts from February 1, 2010 to December 29, 2015; that is, a total of 1430 daily observations.

[1] Indian rupee (INR).