Int. Fin. Markets, Inst. and Money 33 (2014) 1–27

Contents lists available at ScienceDirect

Journal of International Financial Markets, Institutions & Money

journal homepage: www.elsevier.com/locate/intfin

The dynamics of exchange rate volatility: A panel VAR approach

Axel Grossmann[a,*], Inessa Love[b], Alexei G. Orlov[c]

[a] Georgia Southern University, PO Box 8152, Statesboro, GA 30460, United States
[b] University of Hawaii at Manoa and World Bank, Honolulu, HI, United States
[c] Radford University, Radford, VA, United States

ARTICLE INFO

Article history:
Received 14 January 2014
Accepted 19 July 2014
Available online 29 July 2014

JEL classification:
F31
C14
C33
F37

Keywords:
Exchange rate volatility
Spectral analysis
High-frequency components of volatility
Financial variables
Panel VAR estimation and simulation

ABSTRACT

This paper employs a panel vector autoregressive model (PVAR) to study the dynamics of the overall exchange rate volatility. PVAR estimation results, based on panel data for 29 economies, are used in simulating impulse response functions. Since economic shocks may affect high-frequency and low-frequency components of volatility differently, using a conventional time-domain approach to study volatility may lead to spurious results. Accordingly, the paper also studies the dynamics of the most destabilizing (high-frequency) components of exchange rate volatility, which are isolated using spectral methodology. While our investigation reveals interesting dynamic interrelationships between macroeconomic as well as financial variables and exchange rate volatility, we find little evidence of significant difference in the responses of macroeconomic and financial variables to the overall volatility vis-à-vis the high-frequency components thereof. The feedback effects from exchange rate volatility to macroeconomic and financial variables are found to be much stronger for developing countries relative to developed economies. These findings are confirmed by variance decompositions and are largely immune to several robustness checks.

* Corresponding author. Tel.: +1 9124785512.
E-mail address: agrossmann@georgiasouthern.edu (A. Grossmann).

http://dx.doi.org/10.1016/j.intfin.2014.07.008
1042-4431/

1. Introduction

There is a general consensus that exchange rate volatility is harmful to the economy (e.g., Obstfeld and Rogoff, 1998), with relatively higher welfare cost for developing countries. Higher exchange rate volatility increases the risk factor of domestic firms trading internationally, which may lead to increased prices to hedge against the additional risk premium (Giannellis and Papadopoulos, 2011). One of the advantages of a monetary union, for example, is the mitigation or elimination of such exchange rate risk (Fratzscher, 2002; Bartram and Karolyi, 2006), and countries are more likely to join a common currency area the more stable their currency becomes (Giannellis and Papadopoulos, 2011). Therefore, it is important for policymakers to know which factors influence exchange rate stability, especially in developing countries.

The literature provides ample evidence with respect to the variables that may impact the overall volatility (e.g., Kanas, 2002; Devereux and Lane, 2003; Hausmann et al., 2006; Ganguly and Breuer, 2010; Giannellis and Papadopoulos, 2011; Berganza and Broto, 2012). However, the overall volatility consists of different components: the high-frequency components that are associated with short-term trading activity and can change within several days or a few weeks, and medium- and low-frequency components (sometimes referred to as business-cycle and trend components) that evolve over longer periods of time such as several months and years. The high-frequency volatility can be thought of as capturing the "jitters" in foreign exchange trading, which are likely to be a reflection of the heightened uncertainty and noise-trading and can have more destabilizing impact on financial markets and the rest of the economy than low-frequency volatility. Orlov (2006, 2009) shows that studying volatility using a conventional time-domain approach (i.e., variance or standard deviation) may lead to spurious results if the effect on various components of volatility is not uniform. It is likely that various economic shocks affect high-frequency and low-frequency components of volatility differently, and in turn, the different components of volatility could have different feedback effects on the macroeconomy. However, the dynamic links between these different components of exchange rate volatility and macroeconomic variables, as far as we know, have not been studied in the prior literature. Our paper aims to fill this gap.

The purpose of this paper is to explain the dynamic interrelationships between the exchange rate volatility on the one hand and financial and macroeconomic variables on the other. In addition to studying the overall volatility of bilateral US dollar exchange rates, the paper also examines the dynamics of the high-frequency components thereof, which are isolated using spectral methodology. As suggested by the previous research (e.g., Orlov, 2006), high-frequency portion of financial volatility may influence – and be influenced by – macroeconomic and financial variables differently than the overall volatility. This hypothesis is not confirmed by our data: we find that high-frequency components of exchange rate volatility are as important for the macroeconomy as the overall volatility. We also find, that the feedback effects from exchange rate volatility to macroeconomic and financial variables are much stronger for developing countries relative to developed economies.

Specifically, we apply the panel Vector Autoregression (PVAR) methodology to the data on bilateral USD exchange rates in 29 developed and developing economies over the 1987 to 2011 period. Our PVAR model contains four key macroeconomic and financial variables that are most likely to affect exchange rate volatility and, in turn, be affected by it. In addition to the volatility of exchange rates, we include real GDP growth, foreign reserves, interest rates, and equity index. We first show that the model produces sensible results with respect to the key relationships between the macroeconomic and financial variables. Then, we contrast and compare the results of the model with overall volatility, measured using the standard deviation of daily exchange rates over the annual period, and the model with high-frequency volatility, measured using spectral analysis that isolates high-frequency components of volatility with cycles less than 1, 2 or 4 weeks.

Over the past several decades spectral analysis has been used to study volatility of macroeconomic and financial time series, including stock prices and exchange rates (e.g., Bertoneche, 1979; Hasbrouck and Sofianos, 1993; Andersen and Bollerslev, 1997; Gerlach, 1988; Andersen et al., 2000; Grossmann and Orlov, 2014). Bollerslev and Wright (2001) show, theoretically as well as empirically, the