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Exchange rate volatility and India's cross-border trade: A pooled mean group and nonlinear cointegration approach

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ABSTRACT

This paper offers first-hand commodity-level evidence regarding the effects of exchange rate volatility on India's cross-border trade with the U.S., Germany, Japan, and China. We used autoregressive conditional heteroscedasticity based models to estimate the volatility of the nominal exchange rate. To determine the short and long run relationships, we used pooled mean group estimators. The results show that, in the long run, nominal exchange rate volatility has a significant dampening impact on India's export rates to the U.S., Germany, and China along with imports from the U.S. and China. However, in the short run, the effects of the nominal exchange rate volatility on India's exports and imports were rather mixed. The study also tested the asymmetric effects of exchange rate volatility on India's trade using aggregated data. Although the results do not show much of an asymmetric effect, they do indicate that positive and negative effects differ in terms of their impact on trade volume. Policy recommendations are therefore suggested on the basis of these results.

1. Introduction

Since the end of the fixed exchange rate era in 1973, economists have become increasingly concerned with assessing the consequences of floating exchange rates on cross-country trade. Rooted in the seminal contribution by Clark (1973) and its subsequent refinement by Hooper and Kohlhagen (1978), economic theory suggests that exchange rate volatility negatively affects cross-border trade. However, the findings of empirical inquiries into this issue are largely inconclusive, with evidence of both positive and negative effects of exchange rate volatility on exports. For instance, earlier studies (e.g., Thursby and Thursby, 1987) have found a strong inverse association between volatility and a nation's exports. In latter studies (e.g., Eichengreen and Irwin, 1995), such a relationship is much weaker and sometimes even positive (Klein, 1990). Furthermore, recent works (e.g., Asteriou et al., 2016) have also failed to identify any robust adverse relationship between exchange rate volatility and export performance.

Given this conflicting evidence, it is therefore prudent to determine if the negative linkage between exchange rate volatility and cross-border trade holds in the context of a developing country. It may be expected that the volatile exchange rate will adversely affect both trade volume and export earnings, and thus impair economic growth. Furthermore, with limited access to export financing and hedging opportunities, the effects of exchange rate volatility on exports from developing nations would likely be much more significant in comparison to those in their developed counterparts (Haigh and Holt, 2000).

The main aim of this research is to inquire into the relationship between nominal exchange rate volatility and international trade between India, a country classified as a developing nation by the World Bank, and its four major trade partners: the U.S., Germany, Japan, and China. First, at the commodity level, we have explored the relationship between exchange rate volatility and India's international trade practices in a panel setting. While a majority of the literature has examined the volatility-trade nexus in a time series framework, limited attempts (with a noted exception of Senadza and Diaba, 2018) have been made in terms of panel analysis. Next, following the arguments of Choudhury and Hassan (2015) and Bahmani-Oskooee and Aftab (2017) that international trade volumes are likely to respond asymmetrically to exchange rate volatility, we have tested whether there is asymmetry in terms of India's export and import performances in response to nominal exchange rate volatility in a time series setting. While we have made use of commodity-wise data for panel analysis, aggregate export and import figures have been used for the time series analysis. The results of this study offer an additional dimension to the literature, specifically by examining the context of a developing

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country, and will verify to what degree the earlier findings can be confirmed by using relatively newer econometric methods of interpretation and analysis. It is also expected that deeper insights will be provided into India's international trade practices, thus leading to the development of guidelines that the government should follow with respect to making suitable policy decisions.

Regarding the choice of India, the selection is not random. India was not among the forerunners in cross-border trade after its independence from British colonization in 1947 and predominantly followed an import substitution policy rather than an export-oriented growth policy until 1991. Prior to 1991, India was a closed economy with average tariffs extending beyond 200 percent and heavy restrictions being placed on imports. However, since economic liberalization in 1991, the country has experienced tremendous growth on the export front, and India's exports during 2015–16 have been valued at US$ 262.30 billion (GoI, 2017). India exports close to 7500 commodities to nearly 190 destination nations, and imports about 6000 commodities from around 140 economies. In fact, India's foreign trade accounted for 40 percent of India's gross domestic product in 2016. This significant transformation makes India an interesting case to test the relationship between exchange rate volatility and cross-border trade in a developing economic context.

Our distinctive contribution to the literature is in the use of creative methodology. First, in the panel setting, we employ the pooled mean group (PMG) estimator of Shin et al. (2014) to assess the relationship between nominal exchange rate volatility and international trade volumes in both the long and short run. PMG estimation offers more flexibility over the alternative panel data approaches such as the mean group (MG) estimation approach and the dynamic fixed-effect (DFE) method. Under the MG approach, the model is independently fitted for each group and the coefficients are averaged, while DFE accounts for group-wise pooling of time series data and only allows the intercepts to vary across groups. In contrast, the PMG estimator permits the short run coefficients to change across groups (similar to the MG estimator); it also restricts the long run coefficients from being equal across groups (similar to the DFE estimator). Furthermore, the PMG estimator can be employed irrespective of the variables integrated at order one or zero. Although the use of the PMG approach has increased in popularity in the domain of environmental and energy economics (e.g., Asafu-Adjaye et al., 2016), its application in the literature exploring the influence of exchange rate volatility on cross-border trade is relatively new. Furthermore, by administering an error correction model, our study estimates the speed of adjustment of exports with respect to movements in the cointegrated independent variables.

Second, we employ the nonlinear autoregressive distributed lag (NARDL) model of Shin et al. (2014) to determine whether India's cross-border trade performances respond asymmetrically to exchange rate volatility. The NARDL model is an asymmetric extension of the ARDL proposed by Pesaran et al. (2001). NARDL simultaneously tests the short- and long run asymmetries via the positive and negative decomposition of the exogenous variables. Furthermore, NARDL is applicable irrespective of whether the variables are integrated of order zero, order one, or fractionally integrated. It is also applicable for analysis of the endogenous explanatory variables. While there is a thin yet growing body of literature on international trade that employs NARDL (e.g., Verheyen, 2013; Bahmani-Oskooee and Aftab, 2017), no analysis has yet been reported to date on the nonlinear relationship between India's cross-border trade and exchange rate volatility. Finally, we utilize both commodity-level panel data as well as aggregated time series data for analysis. Commodity-level data is a micro-level data, therefore, it is likely to provide more insights on the underlying relationship, while aggregated data helps in gauging the asymmetric effects. Importantly, we utilize monthly frequency of data for analysis that is conductive in capturing the effects of exchange rate fluctuations.

We should note that there is corroborative evidence on the inverse linkage between exchange rate volatility and international trade. In addition, we could isolate the short run effect from the long run effect regarding exchange rate volatility and bilateral trade. This study further tests the asymmetric effects of exchange rate volatility on India's trade using aggregated data. Although the results do not show much of an asymmetric effect, they do indicate that positive and negative effects differ in how they impact trade movement. This outcome is relevant for crafting appropriate policies for the augmentation of India's cross-border trade practices.

The remainder of the paper is arranged as follows. Section 2 briefly covers the extant literature on the association between exchange rate volatility and international trade. In section 3, we discuss how we have measured exchange rate volatility. Section 4 reviews the panel data analysis of commodities. In section 5, we discuss the time series analysis on aggregate data. Section 6 draws a conclusion, and the final section suggests possible policy implications.

2. Literature review

In one of the earliest attempts at exploring the influence of exchange rate volatility on international trade, Clark (1973) developed a simplistic model under the assumption of perfect competition with a single product where a firm receives its export earnings in foreign currency, and hence its revenue in domestic currency is very much determined by the volatility of the exchange rate. This fundamental model of Clark's establishes a negative influence of exchange rate volatility on cross border trade. The hypothesis of a negative association between exchange rate volatility and foreign trade continued to receive support from additional research until the early 1990s (e.g., Baron, 1976; Hooper and Kohlagen, 1978; Giovannini, 1988; Bini-Smaghi, 1991). The hypothesized outcome of a negative relationship was based precisely on the stringent assumptions of a perfectly competitive market, the non-use of relatively cheaper imported inputs, high risk aversion, and a lack of access to financial derivatives for hedging volatility in the exchange rate. However, a more flexible model proposed by Broll and Eckwert (1999) established a positive linkage between exchange rate volatility and international trade when firms have enough flexibility to react to exchange rate fluctuations and are therefore permitted to reallocate their goods among multiple markets. Furthermore, Viaene and de Vries (1992) argue that through access to financial hedging in the way of access to forward markets, firms may reduce the uncertainty caused by volatile exchange rates. In contrast, Obstfeld and Rogoff (1998) claim that while risk-averse firms opt for hedging against exchange rate uncertainties, hedging costs augment the export price, thus dampening the volume of cross-border trade. Therefore, as a result of these different findings, this theoretical debate on the link between exchange rate uncertainty and export rates is far from being conclusive.

On the empirical front, Arize (1997) suggests that exchange rate volatility has a significant negative impact on the real exports of seven industrialized nations, namely, Denmark, Germany, Italy, Japan, Switzerland, the U.K., and the U.S. In another study, the IMF (2004) has made a modest attempt at exploring the association between exchange rate volatility and cross-country trade through the employment of a gravity model. The IMF study suggests that if exchange rate volatility is to increase by one standard deviation, cross-border trade would decrease by seven percent. However, the relationship was not found to be robust. Arize et al. (2008) have provided evidence that volatility in the exchange rate carries a significant dampening impact on export rates in both the short and long run for Latin American countries. Along the same lines, Ozturk and Kalyoncu (2009) found that during 1980–2005, exchange rate volatility had a considerably adverse impact on cross-border trade for Pakistan, Poland, South Korea, and South Africa, but a boosting impact in the cases of Hungary and Turkey. Furthermore, Chit et al. (2010) assessed trade among five emerging East Asian nations including international trade with 13 developed nations. They found corroborative evidence for a significant dampening effect of exchange rate volatility on cross-border trade. Along similar lines, Bahmani-Oskooee and Harvey (2011) found that, in the short run, uncertainty in exchange rates has a