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On the asymmetric effects of exchange rate volatility on trade flows: New evidence from US-Malaysia trade at the industry level

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ABSTRACT

All previous studies that assessed the impact of exchange rate volatility on trade flows assumed that the effects are symmetric. In this paper, we open a new path in the literature by arguing that indeed the effects of exchange rate volatility on trade flows could be asymmetric. The asymmetric effects are mostly due to the change in expectations of traders when a currency depreciates as compared to a case when that currency appreciates. We demonstrate the asymmetric effects by using monthly data from 54 Malaysian industries that export to the U.S. and from 63 Malaysian industries that import from the U.S. The application of the nonlinear Autoregressive Distributed Lag (ARDL) approach of Shin et al. (2014) supports short-run as well as long-run asymmetric effects in almost 1/3rd of the industries. The approach identifies industries that are affected when volatility increases versus those that are affected when volatility declines.

1. Introduction

Since the advent of floating exchange rates in 1973, the literature on the impact of exchange rate uncertainty on the trade flows has been growing rapidly, theoretically and empirically. Both groups support the notion that exchange rate uncertainty measured by a measure of exchange rate volatility could have negative or positive effects on the trade flows. De Grauwe (1988) suggests that a trader's response to exchange rate risk depends on her risk attitude. The risk averse trader will avoid trade in response to an increase in exchange rate fluctuations, while in response to a similar situation, the risk tolerant trader will increase trade today to reduce any loss of income in the future. Therefore, it is the overall dominance of risk averse or risk tolerant traders, which decides the ultimate impact of exchange rate uncertainty on trade flows.[2]

Empirical literature on the effects of exchange rate uncertainty on trade flows has followed three distinct paths in search of strong support for the theory. Some have used trade flows between one country and the rest of the world and some have used aggregate trade flows between two countries. Suspecting that they suffer from aggregation bias, some have adhered to trade flows between two countries at the commodity level. All empirical studies that have been reviewed by Bahmani-Oskooee and Hegerty (2007), indeed, support both views that exchange rate volatility could have positive and negative effects on the trade flows and are country specific.[3] Since this study concerns Malaysia, a short review is in order, so that we can distinguish the contribution of this paper from previous literature.

Like general literature, those who have considered the impact of exchange rate uncertainty on Malaysian trade flows, have employed data at a different aggregation level. Doroodian (1999) considered the response of only export volume of India, South Korea, and Malaysia to exchange rate uncertainty and reported adverse effects of volatility on exports of all three countries. Export volume of 13 developing countries, including Malaysia, was the subject of analysis by Arize et al. (2000) who also found negative effects of exchange rate volatility on exports of all 13 countries including Malaysia. Doganlar (2002) is another study which considered export volume of five developing countries including Malaysia. While he also reported negative effects of exchange rate volatility on the export volume of each country, since he did not test for the significance of exogenous variables, clearly we cannot arrive at a firm conclusion. While all of these studies used aggregate export volume of Malaysia with the rest of the world, none considered the impact of exchange rate uncertainty on Malaysian imports. Bahmani-Oskooee and Harvey (2011) is the most compre-

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[1] The valuable comments of six anonymous referees as well as those of the editor are greatly appreciated. Remaining errors, however, are our own.
[2] For a theoretical derivation of the link between trade flows and a measure of exchange rate volatility see Peree and Steinherr (1989).
[3] Some recent studies since the review are Hall et al. (2010), Baek (2013), Hooy et al. (2015), and Asteriou et al. (2016).

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hensive study on the issue in that not only did they consider Malaysian exports but also her imports. Furthermore, they consider trade flows at the bilateral level between Malaysia and one of her major trading partners, the U.S. Additionally, in an effort to identify industries that could benefit from exchange rate uncertainty versus those that could be hurt, they disaggregate the Malaysia-U.S. trade flows by industry and consider sensitivity to exchange rate volatility of 101 Malaysian importing industries from the U.S. and 17 Malaysian exporting industries to the U.S. While exchange rate volatility was found to have significant short-run effects on the trade flows of most industries, short-run effects lasted into the long run effects only in 38 Malaysian importing industries and 10 Malaysian exporting industries. Indeed, some industries were affected positively and some negatively in both groups in the long run.

A common feature of the above studies related to Malaysia or any other country is the assumption that exchange rate volatility has symmetric effects on trade flows, either at the aggregate level or at the commodity level. The symmetry assumption implies that if increased volatility hurts the trade flows by X%, decreased volatility should boost them by the same X%. Or if increased volatility promotes the trade flows by X%, decreased volatility should reduce trade flows by X%. How valid is this assumption? Clearly, traders could have a different reaction when exchange rates become more volatile as compared to when they become less volatile, mostly due to changes in their expectations and new information. They then chose to trade less when a currency is more volatile and trade much more when it is less volatile. Put it differently, if increased volatility is to hurt trade by 2%, if traders become more confident in the ability of a central bank to stabilize the exchange rate and reduce the volatility, they may increase trade by much more than 2%, hence asymmetric effects. Furthermore, it has been demonstrated that not only domestic prices respond to exchange rate changes in an asymmetric manner (Delatte and Lopez-Villavicencio, 2012), so do import and export prices (Bussiere, 2013) as well as imports and exports measured by the trade balance (Bahmani-Oskooee and Fariditavana, 2016). Therefore, if exchange rate changes do have asymmetric effects on traded goods prices and their volume, we should expect the same to be true for the exchange rate volatility.

Therefore, it is the main purpose of this paper to investigate the impact of exchange rate volatility on commodity trade flows between Malaysia and the U.S. one more time by addressing the asymmetric effects of exchange rate volatility. Malaysian external trade has been the dominant source of its success as an Asian tiger among the emerging East Asian economies. The origins of such achievement lie in a variety of initiatives among the Association of East Asian Nations (ASEANs) that include regional connectivity and market integration. Such endeavors have promoted the vertical intra-industry trade[4] (VIIT) among the firms making them very competitive. Therefore the production competitiveness is a core strength of many ASEANs firms. However, among other challenges, exchange rate risk is an important issue for the firms while trading internationally. Using Malaysia as a reference country for ASEANs and the United States as a representative of another region, this study examines the effect of exchange-rate volatility on the industry-specific bilateral trade. To this end, we introduce the models and estimation methods in Section 2. We then present our empirical results in Section 3. Section 4 then provides a summary. Finally, data definition and sources are cited in an Appendix A.

2. The models and methods

Previous studies that have assessed the impact of exchange rate volatility on trade flows have basically included a scale variable such as real income, a relative price term measured by the real exchange rate, and a measure of exchange rate uncertainty constructed as volatility of the real exchange rate. Therefore, following many of these studies (e.g., Bahmani-Oskooee and Harvey, 2011) we begin with the following standard specifications:

$$LnX_{i,t}^{MY} = \alpha_o + \alpha_1 LnIP_t^{US} + \alpha_2 LnREX_t + \alpha_3 LnV_t + \varepsilon_t \quad (1)$$

$$LnM_{i,t}^{MY} = \beta_o + \beta_1 LnIP_t^{ML} + \beta_2 LnREX_t + \beta_3 LnV_t + \mu_t \quad (2)$$

where $X_{i,t}^{MY}$ and $M_{i,t}^{MY}$ are Malaysian real exports of commodity i to the U.S. and its real imports of commodity i from the U.S., respectively. Since data that will be used are monthly, as scale variables we include IP_t^{US} and IP_t^{ML} which are defined as industrial production indices of the U.S. and Malaysia, respectively. REX_t is defined as the real bilateral exchange rate which is measured in such a manner that an increase reflects a depreciation of the Malaysian ringgit (Appendix A). Finally, V_t is a measure of real exchange rate volatility that is based on Generalized Autoregressive Conditional Heteroskedasticity (GARCH) approach described in the Appendix A. Theoretically, estimates of α_1 and β_1 are expected to be positive, implying that increased economic activity in both countries should promote trade. If a real depreciation of ringgit is to increase Malaysian exports and decrease its imports of commodity i, we also expect an estimate of α_2 to be positive but that of β_2 to be negative. Finally, as discussed before, since exchange rate volatility could have positive or negative effects on trade, estimates of α_3 and β_3 could be negative or positive.

The next step in our modelling approach is to introduce the dynamic adjustment mechanism into (1) and (2) so that we can distinguish the short-run effects of exchange rate volatility on trade flows from its long-run effects. Again, we follow the literature and rely upon Pesaran *et al.*'s (2001) ARDL bounds testing approach and specify (1) and (2) as error-correction models as in (3) and (4) below:

$$\begin{aligned}\Delta LnX_{i,t}^{MY} &= a_1 + \sum_{j=1}^{n1} a_{2j}\Delta LnX_{t-j}^{MY} + \sum_{j=0}^{n2} a_{3j}\Delta LnIP_{t-j}^{US} + \sum_{j=0}^{n3} a_{4j}\Delta LnREX_{t-j}\\ &\quad + \sum_{j=0}^{n4} a_{5j}\Delta LnV_{t-j} + \theta_1 LnX_{t-1}^{MY} + \theta_2 LnIP_{t-1}^{US} + \theta_3 LnREX_{t-1}\\ &\quad + \theta_4 LnV_{t-1} + \varepsilon_t \end{aligned} \quad (3)$$

$$\begin{aligned}\Delta LnM_{i,t}^{MY} &= b_1 + \sum_{j=1}^{n5} b_{2j}\Delta LnM_{t-j}^{MY} + \sum_{j=0}^{n6} b_{3j}\Delta LnIP_{t-j}^{MY} + \sum_{j=0}^{n7} b_{4j}\Delta LnREX_{t-j}\\ &\quad + \sum_{j=0}^{n8} b_{5j}\Delta LnV_{t-j} + \rho_1 LnM_{i,t-1}^{MY} + \rho_2 LnIP_{t-1}^{MY} + \rho_3 LnREX_{t-1}\\ &\quad + \rho_4 LnV_{t-1} + \varepsilon_t \end{aligned} \quad (4)$$

In error-correction models (3) and (4) short-run effects are reflected in the estimates of coefficients assigned to first-differenced variables and long-run effects by the estimates of θ_2-θ_4 normalized on θ_1 in (3) and $\rho_2 - \rho_4$ normalized on ρ_1 in (4). However, for these long-run effects to be valid, we must establish cointegration. To this end, Pesaran et al. (2001) suggest applying the F test to establish joint significance of lagged level variables as a sign of cointegration. However, the F test in this application has new critical values that they tabulate. Since they account for integrating properties of variables in producing critical values, there is no need for pre unit root testing under this method and indeed variables could be a combination of I(0) and I(1). It is this feature of this approach which makes it attractive since almost all macro variables are either I(0) or I(1).[5]

Entire literature that has relied upon different variants of the above models has assumed that the impact of exchange rate volatility on trade flows is symmetric. As discussed in Section I this needs not to be the

[4] VIIT is a mode of competitiveness where a lengthy production process is segmented to different units situated across different countries across the region. This helps firms to utilize their competitive advantage.

[5] An I(d) variable is a variable that achieves stationarity after being differenced d times. Thus, an I(0) variable is a variable that is already stationary and an I(1) variable is a variable that needs to be differenced once to become stationary.