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Does exchange rate volatility deter Japan-China trade? Evidence from pre- and post-exchange rate reform in China☆

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ABSTRACT

This paper is an empirical investigation of the effect of RMB-JPY volatility on Japan-China trade with a special emphasis on the impacts of the reform of the RMB exchange rate regime implemented on July 21, 2005. We estimated two types of volatility measures (one based on the ARCH model and the other the usual standard deviation) utilizing daily data from Jan. 2002 through Dec. 2011 and examined both short-run and long-run effects of this volatility on exports of each country to the other with an ARDL approach. The results indicate that Japan's exports to China are not affected by the exchange rate volatility, but China's exports to Japan are negatively influenced during the reform period. Furthermore, the level of the exchange rate has no influence on Japanese exports, but it has a significant impact on Chinese exports. This asymmetric result may be due to differences in the depth of financial markets and in the maturity of exporters of the two countries.

1. Introduction

On July 21, 2005 China scrapped the *de facto* dollar peg and adopted a managed floating system linked to a basket of major currencies. At the time of this reform, the maximum daily rate of change in the RMB-USD exchange rate was set at 0.3% per day, but it was expanded to 0.5% on May 21, 2007 and further to 1.0% on April 16, 2012. These expansions in the admissible range of exchange rate changes lead to potentially higher volatility which may have adverse effects on future uncertainty to export/import industries. Hence arises a question whether this has deterred Japan-China trade.

The purpose of this paper is to analyze the effects of exchange rate volatility on trade[2] between Japan and her largest trading partner, China.[3] This is carried out in relation to the reform of the exchange rate regime of July 2005. We are especially interested in investigating whether or not the reform made the effects of volatility on trade stronger. There is a massive body of literature which analyzes empirically as well as theoretically the relationship between the exchange rate volatility and trade. Major results of theoretical analyses include: (1) a rise in the exchange rate volatility increases the firm's cost of risk bearing, reducing trade if the firm does not have a sufficient means of hedging opportunities in a futures market (see e.g. Clark, 1973; Ethier, 1973; Hooper and Kohlhagen, 1978); (2) if the exchange rate volatility lowers future profitability, the firm may attempt to compensate by increasing production and sales, resulting in a larger quantity of trade (see e.g. Franke, 1991; Sercu and Vanhulle, 1992); (3) the effects of exchange rate volatility on trade are dependent on interactions among many different variables such that the final result is indeterminate (see e.g. De Grauwe, 1988; Dellas and Zilberfarb, 1993). Thus, there are a wide and conflicting variety of theoretical results and there is apparently no consensus at all on the theoretical relationship between the exchange rate volatility and trade. It is a generally accepted view that "the direction and magnitude of the impact of exchange rate volatility on trade becomes an empirical issue." (Chit et al., 2010, p. 243).

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[2] For the year 2011, Japan's export to China stood at 12.902 trillion Japanese yen (109.63 million US dollar), accounting for 19.7% of the total exports. Japan's import from China is 14.641 trillion Japanese yen (183.49 million US dollars) which is 21.5% of the total imports. China's share ranks number one both in terms of export and import of Japan. Number 2 is the U.S. which accounts for 15.3% of Japan's exports and for 8.7% of Japan's imports. The data were drawn from the website of JETRO (Japan External Trade Organization): http://www.jetro.go.jp/en/reports/statistics/.

[3] 'China' in this paper is defined to be the mainland China excluding Hong Kong, Taiwan, and Macau.

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Empirical studies have devised various measures of exchange rate volatility, utilized different sets of data such as aggregate trade data, bilateral trade data, and sectoral trade data, and applied various statistical methods, e.g. OLS, co-integration analysis, error correction model, panel analysis, among others. Empirical results are also very diverse, producing no unified view on the issue.[4]

Most empirical works have so far involved advanced economies, but recently researchers have chosen to study developing as well as emerging countries. Poon et al. (2005) examine aggregate export data of five Asian countries (Indonesia, Japan, South Korea, Singapore, and Thailand) and report that the exports of Indonesia and Thailand are positively affected by the exchange rate volatility in the long run and that the export of Singapore is also positively affected in the short run. According to Choudhry (2008), the exchange rate volatility exerts a significantly positive effect on the real export by Canada, Japan, and New Zealand to the U.K. On the other hand, Arize et al. (2008) conclude that the exchange rate volatility has a significantly *negative* effect on the export by eight Latin American countries both in the short and the long run. Similarly Chit et al. (2010) produce evidence on the negative effect of volatility on trade in five emerging East Asian Countries (China, Indonesia, Malaysia, the Philippines and Thailand). Hall et al. (2010) looked at ten emerging market countries and eleven developing countries with the result that export of developing countries is negatively impacted by exchange rate volatility, but that there was no significant relationship between export and volatility in emerging market countries.

After all there seem to be many studies reporting a significantly negative relationship between exchange rate volatility and trade (Arize et al., 2000, 2003; Doganlar, 2002; Baak et al., 2007). However, there are some with the opposite result (McKenzie and Brooks, 1997; Doyle, 2001; Bredin et al., 2003) and there are yet others with ambiguous results (Aristotelous, 2001; Tenreyro, 2007). Thus, we need to gather more evidence on this relationship by examining specific countries and industries.

We focus on the bilateral trade between Japan and China which has been rarely studied so far.[5] An analysis of the bilateral data has a few advantages relative to that of the aggregated data. Firstly, aggregate data may cloud the picture by summing over different responses, namely positive and negative relationships may cancel each other out in the aggregate data. Use of bilateral trade data is free from such an aggregation bias. Secondly, when a country's trade with the rest of the world is analyzed, the effective exchange rate of this country is adopted, but this also tends to ignore changes in individual exchange rates. The bilateral exchange rate can be exploited if one looks at the bilateral trade, which will give a more precise result on the effect of volatility on trade, enabling us to draw more specific implications from the analysis.

Papers which examine the effect of exchange rate volatility on the bilateral trade between Japan and China are An and Huang (2009) and Nishimura (2010). The former collected quarterly data from 1994.Q1 to 2009.Q1 and applied Johansen co-integration tests to analyze the long-run relationship between the RMB-JPY (number of RMB per JPY) volatility and real exports/imports. Their analysis indicates that an increase in the exchange rate volatility exerts a negative effect on bilateral trade in the long run. The latter employs monthly data from January 1999 to June 2008 and estimated an error correction model to analyze the effect of RMB-JPY volatility on China's real exports to Japan. His result is that China's export to Japan is not affected by the changes in the exchange rate in the short run, but that its volatility has a negative impact on trade.[6]

In relation to the preceding studies summarized above, this paper has possibly three areas of contribution. In the first place, the new contribution lies in the focus on the reform of the exchange rate regime initiated in July 2005. Almost all the past studies examining China (see footnote 4) do not consider the effects that this reform may have had on her trade. An empirical analysis of these effects would provide important background information to the future liberalization and internationalization of RMB.

In the second place, we analyze both the short-run and long-run effects of the exchange rate volatility on trade. An and Huang (2009) examine only the long-run relations, while Nishimura (2010) analyzes only the short-run effects. Others who analyze both short-run and long-run relationships often report conflicting results on different time spans. In this paper we adopt the Autoregressive Distributed Lag (ARDL) approach which is capable of carrying out co-integration tests irrespective of the order of integration. Consequently we can carry out both the short-run and long-run analyses of the effects of the RMB-JPY exchange rate on Japan-China trade.[7]

Thirdly, since available data was in short supply so far in this field of study, most economists have used aggregated trade data between one country and the rest of the world (McKenzie, 1999). Studies with sectoral trade data are relatively few, thus our analysis with such data constitutes an important contribution to the literature.

This paper is structured as follows. In Section 2, the model specification of this paper is laid out. Section 3 explains derivation of two exchange rate volatility measures. Section 4 is an exposition of the ARDL approach and we present the estimation results in Section 5. Section 6 concludes the paper.

2. Model specification

Various model specifications have been proposed in the study of the effect of exchange rate volatility on bilateral trade.[8] The most common specification is to explain export in terms of partner country's income, relative price (or real exchange rate),

[4] Important survey articles in this area are Cote (1994), McKenzie (1999), and Bahmani-Oskooee and Hegerty (2007).

[5] However, there are quite a few studies which examine China or Japan individually. Literature which analyzes Japan includes Choudhry (2008) who concluded that the exchange rate volatility has a significantly positive impact on Japan's real export to the U.K.; Bahmani-Oskooee and Hegerty (2008) who examined trade data on 117 specific commodities traded between Japan and the U.S. with a result that no significant effect was found in many commodities. Studies on China are the following. Chou (2000) analyzed China's total export and export of four sectors (food stuffs, industrial materials, manufactured goods and mineral fuels) to give evidence on negative effects on total exports, manufactured goods and mineral fuels sectors. Bahmani-Oskooee and Wang (2007) utilized data on 88 specific commodities traded between China and the U.S. and conclude that many of China's exports to the U.S. are influenced negatively and that many of the U.S. exports to China are influenced positively by the real RMB-USD volatility. Wesseh et al. (2012) did not find any significant relationship between South Africa's export to China and RMB-ZAR volatility at the aggregate level, but their analysis of sectoral data produce evidence of significantly positive and negative relationships. None of these studies, however, focus on the effects of the reform of the exchange-rate regime in July 2005.

[6] Nishimura (2010) applied unit root tests to relevant variables and found that all the variables are $I(1)$ except the exchange rate volatility which turned out to be $I(0)$. Thus, he did not carry out a long-run analysis (i.e. Johansen tests) involving volatility.

[7] There can be an alternative approach which adopts the JPY-USD and/or RMB-USD rates since most of the Japan-China trade is billed in US dollars. However, the relevant price computed by an importer in China (Japan) is the Japanese (Chinese) local price divided (multiplied) by the RMB-JPY exchange rate which obviously implies one should use the RMB-JPY rate as an important factor in Japan-China trade.

[8] These model specifications are summarized in detail in McKenzie (1999), Table 2 (pp. 80–83), Bahmani-Oskooee and Hegerty (2007), Table 2 (pp. 226–230), Table 3 (pp. 238–241), Table 4 (pp. 247–249). If a panel data set is used to analyze multiple countries, the researcher tends to adopt a gravity model which takes into account two countries' proximity to each other or common borders.