# Effect of Exchange Rate Volatility on Imports: Evidences from Chinese Firms

Li, Yifan and Miao, Zhuang

Department of Economics, McGill University, School of International Trade and Economics, Central University of Finance and Economics

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# Effect of Exchange Rate Volatility on Imports: Evidences from Chinese Firms *

Yifan Li† Zhuang Miao‡

**Abstract**

The effect of exchange rate movement on trade has been studied widely for a long history. Most literatures focus on its impacts on firms' export performances, and the performances usually refer to the intensive and extensive margins of export. Adding to the existing studies, we explore how firms adjust their imports in response to varying levels of exchange rate volatility using Chinese customs data. Our contributions include points: (i) we are the first one to test this issue using the Chinese firm level data; (ii) besides the intensive and extensive margins, we also detect how firms adjust the number of import varieties; and (iii) our study detects the role of financial constraints on the effect of the exchange rate risk. Our empirical estimations find that firms reduce their import value, varieties, and import probability from the origin country with relatively high level of exchange rate volatility. The last finding is different from the existing literature.

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Key words: Exchange Rate Volatility; Import Performance; Firm-level Evidences; China

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†yifan.li4@mail.mcgill.ca,(corresponding author), Department of Economics, McGill University, Leacock Building 414, 855 Sherbrooke St. West, Montreal, QC, Canada H3A 2T7.

‡zhuang.miao@mail.mcgill.ca, School of International Trade and Economics, Central University of Finance and Economics, 39 South College Road, Haidian District,Beijing, P.R.China 100081

# 1 Introduction

How exchange rate risk plays role in the firms' export has been widely discussed in recent years. However, very few literature studies how the exchange rate risk affects the firms' import decisions. The importance of the latter issue relays on two points: firstly, a vast number of literatures have shown that import of the intermediate inputs and capital goods impoves firms' export performances, i.e., the firms' productivity, the quality of products, and the export scope (Amiti and Konings, 2007; Kasahara and Rodrigue, 2008; Halpern, Koren, and Szeidl, 2011; Gopinath and Neiman, 2011; Fan et al. 2015; Amiti and Khandelwal, 2013; Goldberg et al., 2010; Li and Miao, 2017; Li and Miao, 2018); secondly, the firms decisions on import have been proved to correlate with the exchange rate movements with the Chilean data (López and Nguyen, 2015), but the relevant study is still incompleted in many aspects. Firstly, to the best of our knowledge, the evidences from Chinese importers are still missing. Considering China has become the largest trading country and her import composition is quite different from Chile, it is necessary to add the evidences from China. Secondly, the previous literatures study the intensive and extensive margins of import, but they fail to study how the financial constraint plays the role on the effect of the exchange rate volatility. To fill these gaps among the existing studies, we re-do the estimations of López and Nguyen (2015) using the Chinese firm level data, and expand their works by adding the analysis on imported varieties and the role of firms' financial capacity. Compared with López and Nguyen (2015), our study is also superior in the data set. López and Nguyen (2015) doesn't have the firm-origin level exchange rate data. Instead, they compute a specific exchange rate volatility at the industry level. However, in our data set, we can observe the firm-variety-origin level information on import. This good feature allows us to detect the effect of exchange rate volatility more accurately.

As indicated by Héricourt and Poncet (2013) and then theoretically proved by Li and Miao (2017), the mechanism for the negative effect of exchange rate volatility is that rising of the market uncertainty is equivalent to increase firms' variable and fixed costs. Firms face the the risk of wasting their sunk cost when the market realizes a bad condition. Consistent with the

theoretical prediction, we obtain the following empirical findings: (i) firms reduce their import volume, probability to import, and the number of import varieties from the countries with high level of exchange rate volatility; (ii) the negative effect is more effective on the firms with tighter financial constraints. We also provide a potential explanation for the second empirical finding.

The main content of this paper is arranged in the following order. Section 2 reviews some key literatures; section 3 describes the data in our study; section 4 presents the empirical methods and results; and section 5 summarizes the main findings and contributions of our research.

## 2 Literature reviews

Next we will review some key literatures regarding our study in detail. For convenience, we categorize these literatures into two groups. The first group studies how firms adjust their export or import scopes in response to varying market conditions. The second group focus on the study of the effect of market uncertainty on firms' export performances.

Among the first group of studies, we find five key literatures, López and Nguyen (2015), Héricourt and Poncet (2013), Sauer and Bohara (2001), Qiu and Yu (2014), and Berthou and Fontagné (2013). The work of López and Nguyen (2015) is mostly closed to our study. Using the Chilean firm-level import data, they find a negative effect of exchange rate volatility on intensive margin of import, but insignificant on extensive margin (decision to import). Our study repeat most works of López and Nguyen (2015) using the Chinese firm-level data. Adding to this literature, we also detect the firms' decision on number of imported varieties, and role of the financial constraints. In addition, we find a significantly negative effect on firms' extensive margin, while López and Nguyen (2015) find this effect is insignificant using a different sample set.

Both Héricourt and Poncet (2013) and Sauer and Bohara (2001) study how the exchange rate volatility affects firms' export performances. These performances include product's price, quality, and the firm's investment strategies. Between them, the study of Héricourt and Poncet (2013)

is more closed to ours. Héricourt and Poncet (2013) studies how the Chinese firms adjust their export volumes, scopes, and destinations in response to varying levels of exchange rate volatility among the destination countries. There are two main findings in Héricourt and Poncet (2013): (i) the exchange rate risks have negative effects on the firm's market-entry decision, the export volume, and export scope; and (ii) such negative effects are more significant among firms that suffering tighter financial constraints. In another paper, Berthou and Fontagné (2013) use the introduction of the Euro as the market shock to French firms in deciding their export scope. They find a positive effect of trade liberalization on the export scope. Similarly, Qiu and Yu (2014) finds the firms with low management costs will expand their export scope in response to a trade liberalization using the Chinese firm-level export data.

The papers that study the firms' export behavior and market uncertainty include Chen and Juvenal (2016), Berman et al. (2012), Nguyen (2012) and Békés et al. (2017). Chen and Juvenal (2016) find that when the exchange rate fluctuates, the price of the high-quality products changes dramatically but the volume changes insignificantly. Berman et al. (2012) find a similar result as Chen and Juvenal (2016) using the French firm-level data. Nguyen (2012) attempts to provide a theoretical explanation for the stylized fact that the firms enter into some foreign markets shortly but then leave the market later on. He finds the uncertainties existing in the new markets force the firm to make its entry decision before making the output supply decision for that market.

Among the rest of literatures that study the individual market conditions and firm's export performances, the works by Bastos and Silva (2010), Manova and Zhang (2012), and Lugovskyy and Skiba (2016) are most closely related to ours. Using the Portuguese firm level data, Bastos and Silva (2010) find that the plants tend to charge higher f.o.b. prices to the more distant countries. Contrarily, using the Chinese data, Manova and Zhang (2012) find the f.o.b. export price decreases in the distance with the sample of the poor destinations, but the relation turns out to be positive with the rich destinations. In another paper, Lugovskyy and Skiba (2016) find contrary results to the findings by Manova and Zhang (2012) with the firm level data from nine Latin American countries, i.e. the distance elasticities of export price is positive for the

poor destinations but negative for the rich destinations. The other related papers concerning the impacts of the characteristics of the destinations on the export strategies include Brambilla and Porto (2016), Gorg et al. (2017), and Comite et al. (2014). With the multi-national data, Brambilla and Porto (2016) find that the high-income countries prefer to import products from the plants with high average wage, indicating that the rich countries prefer high-quality products. Gorg et al. (2017) reach the same conclusion from the empirical evidence with the Hungarian firm level data. Comite et al. (2014) prove that the consumers in different countries have different preferences on the same variety, and thus we will observe the price of the same products varies across countries.

# 3 Data & empirical approach

In this section, we will provide firm level evidences on the effects of trade cost and exchange rate volatility on firms' decision on their export scopes using the Chinese firm-product-level data. Firstly, we introduce our data set and discuss some stylized facts we find from the data; secondly, we construct estimation models to explore our research question; lastly, we summarize and briefly explain our empirical findings. In section 3, we explain our empirical findings using a conventionally theoretical framework.

[To insert table 1 here]

Table 1 summarizes the statistic features of our main variables, including import scope, exchange rate volatility, exchange rate, tariff rate, distance, GDP, and GDP per capita. The data cover the years 2002 to 2006. All firm level data are collected from the National Bureau of Statistics. The data for GDP and GDP per capita are collected from the website of world bank. The data for the distance between two countries is from the website of the CEPII. Lastly, the tariff data is from the World integrated Trade Solutions (WITS) Tariff Schedule.

Following Héricourt and Poncet (2013), we specify our estimation model for the effect of the

trade cost on import performance as follows.

$$Import_{\iota jt} = \alpha \times exchange\_rate\_volatilaty_{jt} + Z_{jvt} \times \beta + \lambda_{\iota t} + \varepsilon_{\iota jt}$$

where $\iota$ , $j$, $v$ and $t$ denote each individual firm, origin country, industry (HS2 code) and the time respectively. All variables are in logs except the exchange rate volatility. $Import_{\iota jt}$ indicates the firms' import performances, which include the import value, scope and status from country j. Among which, the import scope is computed as the (log) number of the varieties (HS8 code) by the firm-country-year level. The key explanatory variable is the real effective exchange rate (REER) of country j, i.e., $exchange\_rate_{jt}$. $Z_{jvt}$ controls for the macro characteristics of country $j$ and the tariff rate at country-industry level, which includes the distance between China and origin country j, i.e., $ln(distance_j)$; the import-tariff rate imposed by China, i.e., $ln\left(tariff\_rate_{jvt}\right)$; the GDP of the origin country, i.e., $GDP_{jt}$ ; and the CPI of the origin country, i.e., $CPI_{jt}$. Exchange rate volatility is computed as the yearly standard deviation of the exchange rate for country $j$ at year $t$ using the monthly data; the distance to the home country is computed as the log of distance between the largest city in country $j$ and the largest city in China; and the tariff rate is measured at industrial level (HS2 code). $\lambda_{\iota t}$ controls for the firm-year level fixed effects.

Among previous relevant studies, some of them rely on the real effective exchange rate (REER), e.g., Aizenman and Marion (1999), and Héricourt and Poncet (2013), while others study the effect of the nominal exchange rate, e.g. Schnabl (2008). Following their method, we use the REER in our main regression, which is computed as the weighted average of exchange rate of a country's currency in terms of a basket of currencies with adjusting the inflation of the country. To check the robustness of our main regressions, we also run the model with the nominal exchange rate against Chinese yuan for each orgin country's currency. All these estimation results are consistent with our main model.

# 4 Empirical results

The results for the effect of exchange rate volatility on firms' import intensive margin presents in table 2. Following the method of Héricourt and Poncet (2013), we use the monthly REER with controlling for the origin countries' CPI to compute the exchange rate volatility for each country-year pair. In addition, the fixed effects are controlled at firm-country and year levels, just the same as Héricourt and Poncet (2013). After controlling for the origin country's characteristics, we observe a significantly negative coefficient on exchange rate volatility. Similarly, the tables 3-5 illustrate the significantly negative effect of exchange rate volatility on firms' import scope and extensive margin. Table 3 uses the HS6 code to distinguish the variety while table 4 uses the HS8 code. Table 7 shows that if the firm faces a tighter financial constraint, it will be more vulnerable to the exchange rate risk. We observe a significantly negative coefficient on the interaction of financial constraint level and the exchange rate volatility.

Table 2. Exchange Rate Volatility and the Import Value

| Dependent Variable: Import Value at Firm-country-year Level | | |
|---|---|---|
| *exchange_volatility* | -0.339 | -0.755*** |
| | (0.230) | (0.232) |
| *ln* (*exchange_rate*) | 0.020*** | -0.049*** |
| | (0.004) | (0.006) |
| Fixed Effects | Firm-country and Year | |
| Country Level Controls | NO | YES |
| Observations | 1,767,074 | 1,767,074 |
| Adj R-squared | 0.789 | 0.789 |

Standard errors are clustered at firm level

*** p<0.01, ** p<0.05, * p<0.1

*Notes*: * p<0.10, ** p<0.05, *** p<0.01. Robust standard errors in parentheses and are corrected by clustering variables at the firm level. This table report regression results for Exchange Rate Volatility and the Import Value between 2000-2006. Exchange rate volatility in Panel A is computed in real terms accounting the changes of prices in destination countries only to avoid

data quality issues in Chinese CPI data, while in Panel B Exchange rate volatility is computed accouting the change of prices of both destination countries and China. Dependent variable is firm-destination level import value in natural log form. Firm-Destination level controls include annual real GDP, CPI and physical distance between China and export destinations in natural log forms.

Table 3. Exchange Rate Volatility and Import Varieties (HS6)

| Dependent Variable: Number of Varieties (HS6) at Firm-country-year Level | | |
|---|---|---|
| *exchange_volatility* | -1.264*** | -1.390*** |
| | (0.081) | (0.084) |
| *ln* (*exchange_rate*) | 0.015*** | -0.023*** |
| | (0.002) | (0.002) |
| Fixed Effects | Firm-country and Year | |
| Country Level Controls | NO | YES |
| Observations | 1,767,074 | 1,767,074 |
| Adj R-squared | 0.789 | 0.79 |

Standard errors are clustered at firm level

*** p<0.01, ** p<0.05, * p<0.1

*Notes*: * p<0.10, ** p<0.05, *** p<0.01. Robust standard errors in parentheses and are corrected by clustering variables at the firm level. This table report regression results for Exchange Rate Volatility and the Import Value between 2000-2006. Exchange rate volatility in Panel A is computed in real terms accounting the changes of prices in destination countries only to avoid data quality issues in Chinese CPI data, while in Panel B Exchange rate volatility is computed accouting the change of prices of both destination countries and China. Dependent variable is the Number of Varieties (HS6) at firm-country-year level in natural log form. Firm-Destination level controls include annual real GDP, CPI and physical distance between China and export destinations in natural log forms.

Table 4. Exchange Rate Volatility and Import Varieties (HS8)

| Dependent Variable: Number of Varieties (HS8) at Firm-country-year Level | | |
|---|---|---|
| *exchange_volatility* | -1.250*** | -1.379*** |
| | (0.082) | (0.085) |
| *ln* (*exchange_rate*) | 0.015*** | -0.025*** |
| | (0.002) | (0.002) |
| Fixed Effects | Firm-country and Year | |
| Country Level Controls | NO | YES |
| Observations | 1,767,074 | 1,767,074 |
| Adj R-squared | 0.789 | 0.789 |

Standard errors are clustered at firm level

*** p<0.01, ** p<0.05, * p<0.1

*Notes*: * p<0.10, ** p<0.05, *** p<0.01. Robust standard errors in parentheses and are corrected by clustering variables at the firm level. This table report regression results for Exchange Rate Volatility and the Import Value between 2000-2006. Exchange rate volatility in Panel A is computed in real terms accounting the changes of prices in destination countries only to avoid data quality issues in Chinese CPI data, while in Panel B Exchange rate volatility is computed accouting the change of prices of both destination countries and China. Dependent variable is the Number of Varieties (HS6) at firm-country-year level in natural log form. Firm-Destination level controls include annual real GDP, CPI and physical distance between China and export destinations in natural log forms.

Table 5. Exchange Rate Volatility and the Import Status

| Dependent Variable: Firm-Country Import Dummy | | |
|---|---|---|
| *exchange_volatility* | -0.103*** | -0.411*** |
| | (0.028) | (0.015) |
| *ln* (*exchange_rate*) | -0.003*** | -0.001*** |
| | (0.000) | (0.000) |
| Fixed Effects | Firm-country and Year | |
| Country Level Controls | NO | YES |
| Observations | 3,595,104 | 3,595,106 |
| Adj R-squared | 0.506 | 0.504 |

Standard errors are clustered at firm level

*** p<0.01, ** p<0.05, * p<0.1

*Notes*: * p<0.10, ** p<0.05, *** p<0.01. Robust standard errors in parentheses and are corrected by clustering variables at the firm level. This table report regression results for the change in export quality using long difference sample between 2001-2006. Dependent variable is firm-destination-product (HS6) level export scopes in natural log form. Dummy for Import Status is constructed as a change of import status at the firm-country level; it takes the value 1 when a firm imports from country j at time t but did not at time t–1. Initial firm productivity takes the estimated revenue based productivity in 2001 using Olley-Pakes methods. Both firm and destination country level control variables are the 5-year long difference between 2001 and 2006. Firm Destination-level controls include annual real GDP, CPI and physical distance between China and export destinations in natural log forms.

[To insert table 6 here]

# 5 Conclusion remarks

How exchange rate risk affects firms' export/import performances is a widely studied issue among the literatures. However, the empirical evidences on the relation between the exchange rate volatility and firms' import behavior is still incomplete. In this paper, we re-explore this

popular issue using the Chinese firm-level import data. Generally, our study expands the existing literature by: (i) using a new country sample with a better quality of data set; and (ii) detecting the role of financial constraints on the effect of exchange rate volatility. Our empirical estimations reach the following main findings: (i) firms reduce their import volume, probability to import, and the number of import varieties from the countries with high level of exchange rate volatility; (ii) the negative effect of exchange rate volatility is more pronounced on the firms with the tight financial constraints.

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