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An Empirical study of the impact of the change in Real Effective Exchange Rate on China's inflow of Foreign Direct Investment

Mingyu Niu

Abstract

With the development of worldwide economic and globalization, China plays an important role in international trade. Since the "reform and openness" and "five years' plan", China's economy became the second largest in the world. During the period of economic development, Foreign Direct Investment became an important part of improving market socialism in China. In this paper, I use monthly data on foreign direct investment (FDI) in China and the index of real effective exchange rate (REER) of the Chinese RMB for the period from Jan 2008 to Nov 2017. I develop a statistical model to test the causality between FDI and REER in order to make reasonable recommendations based on the research findings from the perspective of the Chinese government.

1. Introduction

Since China reformed and conducted a more flexible economic policy, the country concentrated on speeding the construction of a new market economy and conducted a more “open-door” policy. Particularly, foreign direct investment became the essential part of the process of market economy construction. Since the late twentieth century, the Chinese economic system experienced an industrial revolution three times, the development of internet technology, and took its place in the rapid development of world economy, which made China become one of the most important countries for absorbing FDI. From 1985 to 2017, the Chinese capacity of absorbing FDI increased 67 times, from 1.956 billion (US dollars) to 131 billion (US dollars). With the stronger capacity of absorbing FDI, FDI became one of the main driving forces of development of the Chinese market economy.

However, the exchange rate of Chinese yuan has been somewhat volatile, which could affect the actual capacity of absorbing FDI. The exchange rate of Chinese yuan is not only affecting the development of domestic and international business, and the break-even of international trade, but it is also becoming one of the most important criteria of the risk of investment and the return of investment by foreign investors.

Besides, in 2005, China conducted an exchange rate revolution, which caused the yuan was affected by more marketing factors. It also improved the actual capacity of absorbing FDI. By doing the research and studying the fluctuation of Chinese exchange rate, it could provide useful suggestion to decision-makers and investors. It also could minimize the risk and side-effect during the process of absorbing FDI.

2. Research background

Recently, due to the ongoing revolution of China's exchange rate policy, the exchange rate of RMB has been increasing. Research on how exchange rates fluctuate and the effect of the fluctuations on FDI are helping the country to make sense of the trend of FDI. This type of research could also help us understand how exchange rates affect the macro-economy.

Since the 1970s, a number of international scholars have researched how exchange rates affect FDI, but, unfortunately, the literature has not made any significant progress. In the 1990s, people tend to believe that the depreciation of international currency would improve FDI, because currency depreciation means goods and services becomes cheaper, which could attract more international investors.

However, some scholars have the opposite opinions. Like Benassy(2001) who studied how diversity of exchange rates affect the flow of foreign investment. He concluded that the side-effect of exchange rates overacting could offset the positive effect brought by the deprecation of currency, which also offset the effect of attraction of foreign investment.

Also, scholars in China have their own opinions. Luoqi Xie and Shuangsheng Wang explained very detail about how does exchange rate affect FDI in their book of "RMB real exchange rate affecting FDI". They found out there is "Foot-In-The-Door" effect between exchange rate and FDI based on the empirical research. The "Foot-In-The-Door" effect means that when exchange rats becomes stable, they could attract FDI. Otherwise, if exchange rates keep fluctuating than the maximum value (Foot in the door). It will lower the level of FDI.

3. Foundation of research and data selection

3.1. Related concept

3.1.1. Foreign direct investment

Generally, FDI is a method of investment that a particular country is gaining consistent revenue from outside the company or the country. In other words, FDI is making money by controlling the right of management and operation. In Chinese law, any overseas business, organization, or individual must obey laws to operate any sole proprietorship enterprise. Any business activities between overseas organization and Chinese enterprise is one of the main method of FDI. With the development of economic, the method of FDI is diverse with the enlarging of investment field.

3.1.2. RMB nominal exchange rate

The RMB nominal exchange rate is the rate we use RMB to buy another currency. However, nominal exchange rate has hard time to indicate country's value for money and purchasing power affected by inflation and other factors.

3.1.3. RMB Real exchange rate

The real exchange rate is a final exchange rate after considering lots of factors, such as inflation. There are several advantages of using the real exchange rate as the variable of interest. Particularly, it includes the fluctuations of nominal exchange rate for both side. On the other hand, it minimizes the effect of inflation. Its formula could be represented by $REER = (R * P_F) / P_d$. R could be defined as nominal exchange rate. P_F could be defined as the price level in foreign country. P_d represents the domestic price level. It is necessary to dive in to REER. The trend and cycle of REER are affecting FDI, which also is the highlight of this paper. Due to lots of advantages, we apply RMB REER as the variable of interest.

3.2. Description of model

This thesis is therefore based on RMB real exchange rate and FDI, to test these variables performance at the national level, the basic regression equation is estimated as Eq.(1)

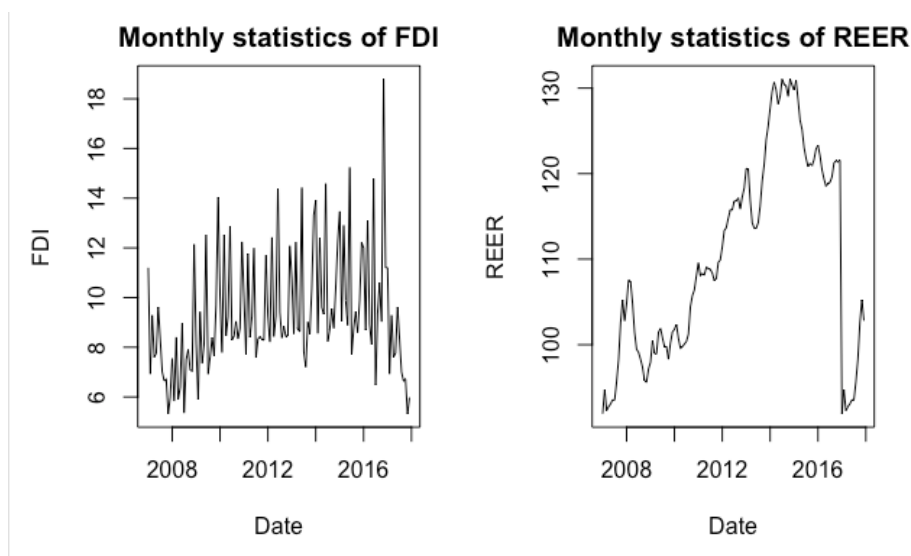
$$\ln FDI_t = \beta_0 + \beta_1 \ln REER_t + \mu_t \quad (1)$$

In this model: $\ln FDI_t$ is the natural logarithm of FDI, $\ln REER_t$ is the natural logarithm of real effective exchange rate of RMB and μ_t is the residual term.

By using several models to analysis, the main model we used to analyze data is vector error correction model (VECM). We also included the knowledge of time series, co-integrated and vector autoregressive model (VAR). And we will use R Studio as analysis software.

3.3. Description of data

We estimate a model based on the monthly data of foreign direct investment (FDI) in China and the index of the real effective exchange rate (REER) of RMB during Jan 2008 to Dec 2017. Data of FDI come from data of EastMoney website while data of real effective exchange rate are index data from the Bank for International Settlements. The graph of these time-series data shown as graph 1.



Graph 1: Monthly statistics of FDI and REER

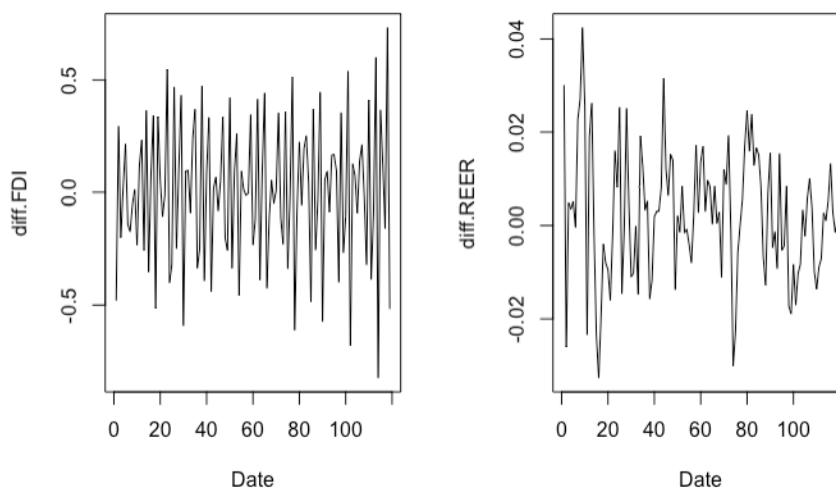
4. Effect of exchange rate on inflow of FDI

4.1. Stationary analysis

In the actual analysis, since most of the economic variables are not stable, we may get spurious regression if we continue to apply the classical regression model to these variables. Therefore, we must do the stationary and cointegration test for these time series variables before we using the error correction model. This thesis will use the ADF (Augmented Dickey-Fuller Test) method to test the stability of the variable, that is, test the time series characteristics of the data. We test the stationary of FDI and REER on log level as well as log differential level. The results show as following. We can find that FDI and REER are non-stationary at the log level but stationary on log differential level. And we also draw the graph for FDI and REER on log differential level showing in figure 2. It can be find that FDI and REER are stable, comparing with figure 1.

Table 1 ADF test result

Critical values for test statistics:			
	1pct	5pct	10pct
tau1	-2.58	-1.95	-1.62
	ADF - test	Conclusion	
LN(REER)	1.0245	I (1)	
LN(FDI)	-0.132	I (1)	
$\Delta \ln \text{REER}$	-6.0214	I (0)	
$\Delta \ln \text{FDI}$	-19.0125	I (0)	



Graph 2: FDI and REER in log differential level

4.2. Johansen cointegration analysis

From the results above, we know FDI and REER are both integrated at same level, however, we must perform the Johansen cointegration test next. Johansen cointegration test is a cointegration likelihood ratio test based on a coefficient matrix tests, mainly including trace test and maximum eigenvalue test. To show the long-term co-integration relationship between sequence $\ln FDI_t$ and $\ln REER_t$. But we must determine the lag order of the VAR model first before the cointegration test. There are several ways to determine the maximum lag order which are AIC, HQ, SC and FPE by using R studio. And the result shows as following.

Table 2: result for lag selection

AIC(n)	HQ(n)	SC(n)	FPE(n)
5	5	3	5

Therefore, we do the Johansen co-integrate test choosing lag length as 5 and the test results shown in table 3.

Table 3: Johansen test result

	T-test	10% CV	5% CV	1% CV
$r \leq 1$	3.51	7.52	9.24	12.97

r=0 16.87 13.75 15.67 20.2

We can find that we have strong evidence reject H0: r=0 which they are not cointegrate at the 5% critical level. So lnFDI and lnREER are cointegrated, which means there is a long-term relationship between RMB exchange rate and FDI.

4.3. Vector error correction model and results analysis

Because the Johansen cointegration test above prove that there is a strong relation between RMB exchange rate and FDI, we continue to analyze the dynamic effect process of the change of RMB real effective exchange rate against FDI by establishment of VECM. According to the result above, we choose lag length as 5 and the estimated results are shown as Table 4. The estimated results are listed by Eq. (2)

$$\Delta \ln FDI_t = \underbrace{-0.839}_{1.16e-14***} \Delta \ln FDI_{t-1} + \underbrace{2.284}_{0.11927} \Delta \ln REER_{t-1} - \underbrace{0.369}_{0.8189} \Delta \ln REER_{t-2} - \underbrace{1.761}_{0.2575} \Delta \ln REER_{t-3} + \underbrace{3.980}_{0.0048**} \Delta \ln REER_{t-4} - \underbrace{0.57948}_{0.000459***} ecm_{t-1} \quad (\text{Eq.2})$$

In which, ***denotes statistical significance at all level and **denotes significance at 1% level. According to Eq.(2), the coefficients of variables $\Delta \ln FDI_{t-1}$ and $\Delta \ln REER_{t-4}$ are obvious at the 1% as well as all levels. So, we can say that inflow of FDI_t is significantly affected by FDI_t-1 and REER_t-4.

The coefficient of ecm is -0.579, which indicates that the gap between the actual FDI inflows and long run equilibrium value is adjusted about 57.9% in each period. In other words, inflows of FDI take a relatively short time to recover from short-term deviation to long-term equilibrium.

Table 4: Result for VECM

```

Call:
lm(formula = lnFDI.d ~ ect1 + lnFDI.dl1 + lnREER.dl1 + lnFDI.dl2 +
    lnREER.dl2 + lnFDI.dl3 + lnREER.dl3 + lnFDI.dl4 + lnREER.dl4 -
    1, data = data.mat)

Residuals:
    Min       1Q   Median       3Q      Max
-0.32478 -0.11567  0.00657  0.12719  0.51562

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
ect1         -0.57948    0.16022  -3.617 0.000459 ***
lnFDI.dl1    -0.83928    0.09357  -8.970 1.16e-14 ***
lnREER.dl1    2.28418    1.45442   1.571 0.119277
lnFDI.dl2    -0.81564    0.12739  -6.403 4.27e-09 ***
lnREER.dl2   -0.36916    1.60840  -0.230 0.818909
lnFDI.dl3    -0.38312    0.14994  -2.555 0.012035 *
lnREER.dl3   -1.76070    1.54676  -1.138 0.257553
lnFDI.dl4    -0.68515    0.15415  -4.445 2.17e-05 ***
lnREER.dl4    3.97987    1.38168   2.880 0.004806 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.1884 on 106 degrees of freedom
Multiple R-squared:  0.6644,    Adjusted R-squared:  0.6359
F-statistic: 23.32 on 9 and 106 DF,  p-value: < 2.2e-16

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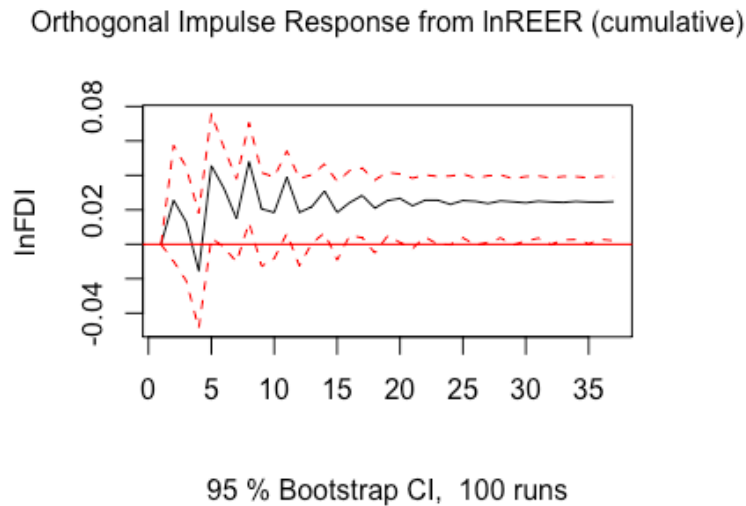
4.4. Impulse response function analysis

The impulse response function describes the impact of each endogenous variable on itself and other endogenous variables. Based on endogenous variable cointegration test and error correction model, we estimate the impulse response functions to analyze the dynamic characteristics, rank and direction of different variables changing by other factors. This thesis makes the impulse response function for first 36 months and the results of impulse response analysis are shown in figure 3.

From the figure 3, when the impulse is RMB real exchange rate, the response of the FDI inflows has an obvious fluctuation at first 15 months. It is a positive effect at beginning, negative effect for a while but positive effect continuing. There is peak positive effect on the 5th month, lowest negative effect on 4th month. After 15 months, the response of FDI inflows has a smooth

fluctuation, which means that it is not a significant effect of change of RMB real exchange rate against FDI inflows.

Graph 3: Impulse response function analysis



5. Conclusion and recommendation

5.1. Conclusion

In summary, a positive shock to RMB results in a positive influence to FDI, which means when the RMB against Dollar increases, the inflows of FDI subsequently improves. Also, this effect occurs in the short term, but the influence is not significant at the longer term. It can be shown that RMB exchange rate is not the only factor affecting FDI. We need to add more possible factors to analyze the model and results. In the long term, this positive effect will gradually steady. This also suggests that the RMB exchange rate is not the only factor affecting FDI after the first year.

5.2. Recommendation

First, my results show that gradually expanding flexibility of exchange rate might have appositve effect on FDI. From the analysis above, RMB against Dollar increasing will not reduce

the inflows of FDI; in fact, the opposite might be true. From the point of Chinese government, gradually expanding the value of the exchange rate and keeping the RMB exchange rate stable with weak volatility will not only attract more FDI, optimize industrial structure; but also build a harmonious international environment for China's economic development in the future.

Next, I would suggest regulators pay attention to introducing the scale and structure of FDI and gradually improve the quality of inflows for FDI. In the recent years, the proportion of FDI was high. In the future, we could combine the inflows of FDI and economic growth to improve the quality of FDI and make a fair competition environment, from the goals of expanding employment as well as increasing exports. To encourage the FDI investment in the central western part and promote the optimization of industrial structure.

Also, it might also be important to improve the domestic investment environment. To further simplify the administrative examination and approval procedures, an improvement in the domestic administrative environment, and intensify protection of intellectual property rights to protect the legitimate rights and interests of foreign business is necessary.

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