

The Impact of RMB Exchange Rate Fluctuations on China's Outward Foreign Direct Investment: An Empirical Analysis

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Abstract: Recently, the RMB exchange rate has experienced significant fluctuations. On May 13th, the spot exchange rate of onshore RMB against the US dollar fell below 6.8, depreciating by over 1000 basis points compared to the opening rate of 6.6985 on May 9th. Against this backdrop, this paper follows the research paradigm of Zhang Weifu (2008) to empirically examine the impact of RMB real exchange rate changes on Chinese enterprises' outward foreign direct investment (OFDI). Drawing on OFDI research frameworks for developed and developing countries, it first reviews theories of internal forces, external forces, and environmental support for China's OFDI, and discusses real exchange rate impacts on OFDI through the environmental support channel. A standardized microeconomic model is developed to show, under certain assumptions, that real exchange rates affect OFDI via export channels. An empirical model then tests these effects. Finally, policy recommendations are provided based on the theoretical and empirical results.

Keywords: Real exchange rate, OFDI, Exports.

1. Introduction

Since the 1990s, cross-border direct investment has become a major driver of economic globalization, surpassing international trade. Consequently, research on MNE motives, types, entry modes, operations, performance, risks, etc. has emerged, forming related theories. Early OFDI risk research focused on qualitative analysis of risk types, sources, influencing factors, etc. With developments in econometrics, quantitative studies proliferated, using countries' OFDI data to test influences on OFDI risks empirically. Existing literature has extensively studied factors influencing OFDI, e.g. Chen Lin (2020) summarized exchange rate OFDI impacts in three aspects: exchange rate level changes (appreciation/depreciation), volatility, and expectations. Regarding exchange rate level impacts on OFDI, three explanations exist: relative production cost theory, relative wealth hypothesis, and firm-specific asset theory. Kohlhagen (1977) et al. argued host country currency devaluation versus the home country attracts FDI by lowering relative production costs and raising foreign investor returns, while appreciation has the opposite effect. Froot and Stein (1993) empirically analyzed US FDI in 13 industries, finding USD devaluation lowered relative US asset prices, enhancing foreign companies' local production capacity and FDI inflows, confirming devaluation increases FDI inflows. Xing and Wan (2006) found competitive currency devaluation in host countries attracted more Japanese FDI in China, Indonesia, Malaysia, the Philippines and Thailand. Moreover, Blonigen (1997) argued host currency devaluation or home currency appreciation promotes M&A FDI seeking firm-specific assets in imperfect product markets, a hypothesis supported by studies like Buch and Kleinert (2008).

Conversely, other studies suggest host currency appreciation attracts FDI. Whitmore (1989) found host currency appreciation versus USD significantly drove FDI into emerging industrialized economies. Benassy (2001) et al.

argued exchange rate impacts on FDI depend on FDI market orientation; appreciation expands host markets and FDI if aimed at host markets.

Blonigen (1997) noted overseas firm-specific assets like patents are generally acquired through M&A. Host devaluation means foreign acquirers are better positioned for M&A, promoting asset-seeking FDI, especially M&As, which empirical studies largely confirm. Home currency appreciation facilitates OFDI.

Beyond levels, volatility also impacts FDI by indicating financial risks to risk-averse investors. High or volatile host rates are seen as detrimental by complicating information collection and increasing uncertainty, leading firms to wait rather than invest immediately. However, viewing trade and FDI as substitutes, volatility may increase FDI to avoid currency risks in trade. Cushman found positive correlation between US OFDI and volatility, since local production via FDI reduces currency risks compared to exports. Real options theory also sees FDI as a currency risk hedge, with higher volatility providing greater incentive to invest abroad.

For microevidence, Tian and Yu (2017) examined RMB impact and mechanisms on heterogeneous exporting firms' OFDI, specifically "export spillover" effects on trade-servicing FDI. Shen et al. (2018) looked at RMB impact on manufacturing firm performance via export revenues, import costs, and import competition after computing industry-level real effective exchange rates. Appreciation hurt performance by raising export prices in foreign currency, but helped by reducing import costs; it also intensified competition from cheaper imports. Beyond levels and volatility, exchange rate expectations also significantly influence FDI. McCulloch argued random walk exchange rates have no FDI impact, since expected future rates equal current rates, leaving discounted investment value unchanged. However, Chakrabarti and Scholnick proposed mean reversion means devaluation raises appreciation expectations, attracting investment, while appreciation delays investment pending

expected devaluation.

In summary, despite theoretical analysis and data evidence of exchange rates' OFDI impacts for various countries, research is still lacking on impacts in the current era of great changes and the post-pandemic world. As internationalization modes, trade and FDI interact, either substituting, complementing, or promoting depending on conditions. My research on real exchange rates and OFDI empirically tests a theoretical model to provide richer, more scientific conclusions and inform China's OFDI strategies including the Belt and Road Initiative and RMB internationalization.

2. Literature Review

Since the mid-late 20th century, cross-border direct investment has become a major driver of world economic growth. Consequently, research has emerged on MNEs' OFDI motivations, types, entry modes, operations, performance, risks, etc., forming related theories. Early OFDI risk research focused on qualitative analysis of risk types, sources, and influencing factors. With econometrics advancements, quantitative studies proliferated, empirically testing OFDI risk factors using countries' OFDI data. Existing references have extensively studied OFDI influencing factors. Zhang Weifu (2008) analyzed forces influencing China's OFDI theoretically - internal forces within investing firms, external forces in host countries, and external support environments for integrated international production. He argued MNEs only shift from trade to integrated international production when internal forces, host country attraction, and international support reach certain levels, i.e. firms only switch from trade to OFDI given these conditions. Recent RMB volatility means appropriately understanding currency risks facing China's MNEs and effectively safeguarding against OFDI crises is crucial, aligning with China's goals of high-quality trade development in the 14th Five-Year Plan at the macrolevel, and enabling MNEs' sustainable operations or survival despite volatility at the microlevel. This has important practical significance for steady economic development and enhancing enterprise competitiveness.

This paper will draw on developed and developing countries' OFDI research frameworks, referencing theories of internal forces, external attraction, and environmental support for China's OFDI (Zhang, 2008) to discuss real exchange rate OFDI impacts through the environmental support channel. After constructing a standardized microtheoretical model and deriving real exchange rate effects on OFDI through export channels under inherent assumptions, an empirical model will test these hypotheses, concluding with policy recommendations based on the theoretical and empirical results.

3. Theoretical Framework and Model Specification

Referencing Helpman et al. (2004), Tian (2007), Chen (2020) and others, this paper presents real exchange rate impacts on firms' OFDI.

To simplify the model, assume a firm only produces one product, with labor as the sole production input. Let the firm's productivity be φ so $1/\varphi$ is the labor required per unit of output. For OFDI from home country i to host j , fixed costs are f_{ofdi} , denominated in i 's labor. Let ε_{ij} be the bilateral nominal exchange rate, ω_i country i 's wage, and ω_j country j 's wage. The real exchange rate is $q_{ij} = \varepsilon_{ij}\omega_j / \omega_i$

Assume demand in j is Q units at price p_j . OFDI profit is:

$$\pi_{fdi} = p_j Q - \frac{\omega_j}{\varphi_{odi}} Q - \frac{f_{odi}\omega_j}{q_{ij}} \quad (1)$$

At zero OFDI profit, the productivity breakpoint for OFDI in j is:

$$\hat{\varphi}_{odi} = \frac{\omega_j Q q_{ij}}{p_j Q q_{ij} - f_{ofdi}\omega_j} \quad (2)$$

Taking the first derivative gives a negative relationship between real exchange rates and productivity breakpoints:

i.e. higher real rates \rightarrow lower productivity breakpoints \rightarrow more OFDI.

This gives the first hypothesis:

RMB appreciation promotes OFDI

Further, this paper examines real exchange rate OFDI mechanisms. Existing research shows exports may substitute or complement OFDI. Substitution occurs because: (1) Mundell (1957) argued OFDI increases global capital mobility, equalizing countries' endowments and prices, reducing trade incentives; (2) Rugman (1980) et al. noted OFDI may shift production overseas, directly replacing home country exports. However, unlike traditional theories focused on finished goods exports, Markusen (1995) argued OFDI may raise intermediate input imports from home countries, showing complementarity, a view also supported by Helpman and Krugman's (1985) new trade theory. Incorporating exports:

Assume trade costs for home exports to j are χ_{ij} per unit output ($\chi_{ij} > 1$), covering iceberg and tariff costs. Export fixed costs are f_e in i 's labor terms (since exports are produced domestically). Without local OFDI, additional communication costs $\eta_j\theta_j$ are needed per unit output. OFDI profit is:

$$\pi_e = p_j Q - \left(\frac{\chi_{ij}}{q_{ij}\varphi_e} + \eta_j \right) \omega_j Q - \frac{f_e \omega_j}{q_{ij}} \quad (3)$$

Similarly, the export productivity threshold for j is:

$$\hat{\varphi}_e = \frac{\chi_{ij}\omega_j Q}{(p_j - \eta_j)q_{ij}Q - f_e \omega_j} \quad (4)$$

Generalizing (3) to firms engaging in both OFDI and exports, avoiding communication costs, and paying both export and OFDI fixed costs, with exports as a share α of total sales:

$$\pi_{ei} = p_j Q - \frac{\chi_{ij}}{q_{ij}\varphi_{e'}} \omega_j \alpha Q - \frac{\omega_j}{\varphi_{ofdi'}} (1 - \alpha) Q - \frac{f_e \omega_j + f_{ofdi}\omega_j}{q_{ij}} \quad (5)$$

Since dual activity firms have lower OFDI productivity thresholds φ_{ofdi}' than pure exporters' φ_e , substituting (4) into (5) gives the threshold for joint OFDI-export firms:

$$\widehat{\varphi_{ofdi'}} = \frac{(1 - \alpha)\omega_j Q}{(1 - \alpha) \left(p_j Q - \frac{f_e \omega_j}{q_{ij}} - \eta_j \omega_j Q \right) - \left(\frac{f_{ofdi}\omega_j}{q_{ij}} - \eta_j \omega_j Q \right)} \quad (6)$$

Holding f_{ofdi} constant, higher exports, higher real rates, and lower productivity thresholds enhance OFDI engagement.

When $\frac{f_{ofdi}\omega_j}{q_{ij}} - \eta_j \omega_j Q > 0$, $\frac{\partial^2 \widehat{\varphi_{ofdi'}}}{\partial q_{ij} \partial \alpha} < 0$, i.e. higher exports reinforce real exchange rates' OFDI promotion.

This gives the second hypothesis:

Higher export shares strengthen real exchange rates' OFDI promotion. The above hypotheses will be empirically tested below.

4. Model and Data

4.1. Model

Following Wu (2015), Chen (2020) and others, the empirical model based on the theoretical analysis is:

$$\ln ofdi_{ct} = \alpha + \beta_1 \ln er_{ct} + \beta_2 ex_{ct} + \beta_3 \ln ex_{ct} \times \ln er_{ct} + \theta X_{ct} + \varepsilon_{ct} \quad (7)$$

where $\ln er_{ct}$ is the logarithm of the bilateral RMB exchange rate against country c's currency in year t versus 2012 (the base year); ex_{ct} is China's export share to country c in year t; X represents control variables including c's GDP, per capita GDP, resource endowment, and total tax rate in year t; $\beta_3 \ln ex_{ct} \times \ln er_{ct}$ captures the interaction of exports and exchange rates, indicating real exchange rates' export channel impacts on OFDI; ε_{ct} is the random error term. The model also includes export share and exchange rate interaction terms to measure exchange rate impacts on China's OFDI through the export channel.

4.2. Variable Selection

4.2.1. Dependent variable

The dependent variable is OFDI, denoted by OFDI. Panel data on China's OFDI to 124 countries and regions from 2012-2020 are used, obtained from the Ministry of Commerce, National Bureau of Statistics, and State Administration of Foreign Exchange's annual Statistical Bulletin of China's Outward Foreign Direct Investment. The natural logarithm is used for stationarity.

4.2.2. Explanatory variables

(1) Exchange rate, denoted ER_{ct}, represents the bilateral

nominal RMB exchange rate against country c's currency in year t (with 2012 as base year), calculated using the indirect quotation method. Data are from the World Bank. A value above 1 indicates RMB appreciation versus the base year, with larger values indicating greater appreciation; below 1 indicates depreciation, with smaller values indicating greater depreciation. The natural logarithm is used for stationarity.

(2) Export share, denoted EX, represents China's export dependence on a country, analyzing exchange rate effects on OFDI channels. It is measured by the share of China's exports to (imports from) that country in China's total exports (imports). Larger values indicate greater Chinese trade dependence on that country. Data are from the National Bureau of Statistics. The natural logarithm is used for stationarity.

4.2.3. Control variables

Following research on OFDI motivations (Wang et al, 2017), control variables are:

(1) Host country market size, measured by total GDP, which directly affects firms' OFDI decisions.

(2) Host country standard of living, measured by per capita GDP.

(3) Host country resource endowment, measured by fuel, metal and mineral exports as a share of total exports, since accessing energy resources is a key Chinese OFDI motive.

(4) Host country total tax rate, measured by total corporate taxes as a share of commercial profits, indicating the investment environment and economic freedom.

Data are from the World Development Indicators database.

(3) Descriptive Statistics

Panel data on China's OFDI and exchange rates with 124 countries from 2012-2020 are used, from the Statistical Bulletin of China's Outward FDI, World Bank World Governance Indicators, National Bureau of Statistics, World Development Indicators, IMF, etc. Summary statistics are presented in Table 1:

Table 1. Variable Descriptive Statistics

| Variable | Observations | Mean | Variance | Minimum | Maximum |
|-----------|--------------|----------|----------|-----------|-----------|
| InGDP | 1, 106 | 24.60927 | 2.228441 | 18.95786 | 30.69596 |
| Inex | 1, 116 | -7.13146 | 2.111994 | -13.43078 | -1.648266 |
| Inech | 1, 106 | .2351966 | .7935036 | -4.172919 | .950901 |
| Infdiflow | 1, 008 | 8.470501 | 2.386127 | 0 | 14.34501 |
| lnavGDP | 1, 106 | 8.656995 | 1.5564 | 5.430282 | 12.10275 |
| Intax | 905 | .8433988 | 1.460648 | -2.302585 | 5.553734 |
| Inburning | 900 | .9155311 | 3.08568 | -14.95072 | 4.605035 |
| Instone | 936 | 1.050314 | 1.731472 | -9.31961 | 4.459215 |

5. Empirical Results and Analysis

Joint significance tests for fixed and random effects are first conducted to determine if panel data models are needed. The null hypotheses for both individual and random effects are rejected at the 1% level, indicating individual and random effects should be considered.

Serial correlation tests cannot reject the null hypothesis at the 5% level, so classical Hausman tests are conducted to determine fixed or random effects models. The Hausman test cannot reject the null hypothesis at the 1% level, suggesting random effects models are preferable.

Column 1 in Table 2 tests real exchange rate level impacts on China's OFDI. The exchange rate variable coefficient is significantly positive at 1%, indicating real appreciation promotes OFDI, consistent with relative cost and wealth

theories that RMB appreciation raises firms' relative wealth in RMB terms, reducing relative fixed and labor costs for overseas production and facilitating OFDI. Regarding control variables, host country market size (GDP and per capita GDP) significantly promotes OFDI, confirming market-seeking motivations. With progressively more controls, per capita GDP effects change from positive to negative, possibly because higher host incomes often indicate higher wages, increasing firms' overseas HR costs. This may also reflect Chinese firms' tendency to seek lower-cost labor through OFDI. Negative total tax rate coefficients mean lower tax rates and better investment environments attract more Chinese OFDI.

Row 3 incorporates the interaction of exchange rates and export dependence. The significantly positive export share coefficient means more exports to a country increase China's

OFDI there, indicating export-FDI complementarity. The positive interaction term shows RMB appreciation's OFDI promotion is stronger for countries with higher Chinese export shares.

Although baseline regressions control many characteristics to mitigate omitted variable biases, endogeneity may still exist between exchange rates and FDI, with two-way causality, as exchange rates affect OFDI decisions while large

OFDI inflows influence RMB rates.

To address potential endogeneity, two-stage least squares with one-year lagged exchange rates as instrumental variables are used. Columns 1-3 show results remain similar with lagged explanatory variables, while columns 4-5 present two-stage least squares regression results. Exchange rate variable coefficients remain significantly positive at 1%, indicating regressions are robust to endogeneity concerns.

Table 2. Baseline Regression Results

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|-------------------|----------------------|---------------------|---------------------|---------------------|--------------------|--------------------|--------------------|
| VARIABLES | lnfdiflow | lnfdiflow | lnfdiflow | lnfdiflow | lnfdiflow | lnfdiflow | lnfdiflow |
| lnex | 0.041 *** (10.57) | 0.075*** (11.05) | 0.084*** (7.16) | 0.085*** (10.18) | 0.092*** (6.19) | 0.096*** (5.24) | 0.007*** (4.03) |
| lnexXlnex | | 0.699*** (11.86) | 0.673*** (10.46) | 0.703*** (10.06) | 0.714*** (9.38) | 0.421*** (3.06) | 0.421*** (3.05) |
| lnavGDP | 8.193*** | 13.158*** | 0.087 | 0.074 | 0.029 | -0.149 | -0.148 |
| lnGDP | | | (0.97) | (0.75) | (0.28) | (-1.22) | (-1.21) |
| lnburning | | | | -0.058 | -0.095 | -0.095 | -0.095 |
| lnstone | | | 12.220*** | (-0.75) | (-1.13) | (-1.12) | (-1.12) |
| | | | | | -0.006 | -0.008 | -0.007 |
| | | | | | (-0.20) | (-0.25) | (-0.22) |
| | | | | | | -0.118* | -0.119* |
| | | | | 12.534*** | | (-1.91) | (-1.92) |
| Constant | | | | | 13.016*** | 0.406** | 0.406** |
| | | | | | | (2.56) | (2.55) |
| Observations | (41.08) | (29.98) | (11.70) | (10.80) | (10.67) | 2.599 | 2.585 |
| | 1,097 | 1,097 | 1,088 | 1,010 | 892 | (0.60) | (0.59) |
| Number of country | 123 | 123 | 122 | 115 | 105 | 879 | 879 |
| | | | | | | 105 | 105 |

Although baseline regressions control many characteristics, endogeneity may still exist between exchange rates and FDI. Columns 1-3 incorporate one-year lagged exchange rates, while columns 4-5 present two-stage least squares results.

The exchange rate variable coefficients remain significantly positive at 1%, indicating results are robust to endogeneity concerns.

Table 3. Robustness Checks

| | (1) | (2) | (3) | (4) | (5) |
|-------------------|------------------------|---------------------|---------------------|---------------------|----------------------|
| VARIABLES | y | lnfdiflow | lnfdiflow | lnfdiflow | lnfdiflow |
| lnex | -0.231 *** (-10.82) | | 0.026*** (4.32) | 0.173 *** (7.54) | 0.402 *** (5.22) |
| lnexXlnex | | 0.746*** (12.31) | | 0.784*** (27.19) | 0.780*** (18.60) |
| Constant | 0.017 (0.22) | -0.013 (-0.17) | -0.016 (-0.20) | 13.785*** | 0.031 |
| | | -0.043 (-1.12) | | | (0.13) |
| Observations | 13.516*** (30.16) | 8.251*** (41.17) | 8.242*** (40.77) | (65.63) | 13.757*** (45.60) |
| R-squared | 976 | 977 | 976 | 976 | 976 |
| Number of country | 123 | 123 | 123 | 0.435 | 0.434 |

6. Conclusions and Policy Implications

A theoretical model first shows RMB appreciation

promotes OFDI, with stronger effects via host country export shares. Empirical analysis of China's 2012-2020 OFDI to 124 countries confirms:

First, RMB appreciation significantly increased China's OFDI, especially to countries comprising higher shares of China's exports, with complementary export-FDI effects.

As the Belt and Road Initiative progresses, accelerating China's "going out" strategy is crucial, requiring optimized openness structure and layout and faster RMB internationalization. China's "going out" faces new opportunities and challenges. Empirical results show complementary FDI-trade effects, so strengthening OFDI can improve China's international trade and economic globalization participation.

Second, since OFDI significantly promotes China's exports, especially net exports, OFDI can directly absorb domestic overcapacity and, by increasing net exports, address insufficient domestic demand causing overcapacity. Thus, promoting OFDI provides a solution for production overcapacity, weakening export growth, and downward economic pressure in China, while benefiting industrial upgrading and economic growth through production and export improvements.

Whether FDI-export complementarity holds globally merits further discussion. Theories suggest complementarity arises mainly from technology spillovers and market expansion effects, while FDI for low input costs in host countries more likely substitutes for exports. Different countries face varying situations requiring empirical analysis. For China, FDI-export relations may also evolve as rising domestic costs drive more FDI for lower host country costs, increasingly substituting for exports. Despite possible increases in host country intermediate input imports, the total impact on exports becomes ambiguous.

RMB appreciation, while hurting exports, can increase China's OFDI, especially for countries comprising higher Chinese export shares. Therefore, exchange rate impacts on exports and FDI should be jointly considered, with coordinated exchange rate policies. For countries with close China trade ties, bilateral rate changes doubly amplify investment impacts, requiring particular policy attention. More exchange rate marketization is needed, with financial products developed to mitigate volatility's negative FDI effects.

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