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Exchange Rate Movements and Structural Break on China FDI Inflows

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ABSTRACT

The aim of the study is to explore the short-run and long-run dynamic relationships between exchange rate fluctuations and foreign direct investment (FDI) inflows in China. The justification is that the undertaken topic is preeminent for devising strategies to promote economic development, thus, a course that carries much at stake not only for China but also for other developing countries. Methodology used in the study consists of co-integration tests, vector error correction models, Wald tests and impulse responses. Monthly time series data from the National Bureau of Statistics of the People's Republic of China are analyzed. The main empirical results indicate that a change in exchange rates negatively affects FDI inflows in the long run while there exists no evidence of short-run dynamics and reciprocal feedback between exchange rate fluctuations and FDI inflows. Furthermore, a structural break occurs during the 2007-2009 global financial crisis shock to FDI inflows in China. In conclusions, this research expands knowledge of factors that affect FDI inflows. To generalize the results obtained from this study, recommendations for future research include studies encompassing different economies where data are available. Such research will contribute towards improving our understanding of exchange rate systems and responses in each market.

KEY WORDS:

exchange rates; foreign direct investment; cointegration; vector error correction; impulse responses; China.

JEL Classification: F21, F31, G11, G18, O24.

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1. Introduction

Constantly changing exchange rates affect the cost of foreign direct investment (FDI) in international assets. International investors would be prudent to evaluate multiple factors when they make FDI decisions. Similar issue affects companies that operate internationally. These factors include, but are not limited to trade policies, taxes, interest rates, country credit ratings, and other economic issues such as repatriation of earnings and exchange rates. Currency risks such as sovereign financial debt and austerity measures in countries, and exchange rate fluctuations i.e. weaker dollars, higher

or lower euros have been on the forefront of economic discussions for several years. Currency strengthening plays a role, as companies tend to invest when the domestic currency is stronger. Likewise, companies import more goods or services in other countries when the currency is weaker. Thus, exchange rate fluctuations can potentially affect FDI decisions.

Furthermore, other considerations such as tax benefits, market size, political stability and the freedom of the economic activity are believed to attract FDI into a country. Conventional wisdom suggests that the knowledge of the causal relationship between exchange rates and FDI has significant implications, especially, from the viewpoint of recent large cross-border movement of funds and investments. Therefore, it is worthwhile to research the real impact of exchange rate

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fluctuations on FDI flows in order to attract a steady inflow of foreign investment. Accordingly, the dynamic relationship between exchange rate fluctuations and FDI flows is of interest to policy makers, international investors, business managers and academics as well. To advance the existing literature on this line of research, this paper seeks new evidence regarding the short-run and long-run dynamic relationships between exchange rate fluctuations and FDI inflow in China.

2. Literature Review and Hypotheses

In the literature, exchange rate level, volatility and regimes are often discussed since exchange rate movements significantly distort relative wealth and costs for multinational corporations and higher exchange rate volatility poses additional risks to foreign investors. Therefore, three predominant views of the impact of exchange rates on FDI flows in this section can be divided along the lines of: the level of exchange rates, exchange rate volatility and exchange rate regimes on FDI flows.

2.1. The Level of Exchange Rates on FDI Flows

For the impact of the level of exchange rates on FDI, there are two channels how exchange rate fluctuations affect FDI flow: relative production cost channel (Cushman, 1985) and wealth effect channel (Darby, 1987). The relative production cost channel refers to devaluation in the currencies of FDI recipient countries that induces a reduction in local production costs and raising profit of export-oriented foreign investors. As such, higher return attracts more FDI inflows. The wealth effect channel refers to the relative wealth of foreign investors to domestic investors that rises after the devaluation. From the point of view of foreign investors having capitals measured in foreign currencies, all production inputs such as labor, land, machines and assets in FDI recipient countries become less expensive after the devaluation, encouraging foreign investors to acquire more assets in the market. For this reason, the currency depreciation of recipient or host countries eases up multinational firms to purchase assets of the host country (Blonigen, 1997). Using data from a developing country during the years 1990–2012, Mensah et al. (2017) confirm that FDI increases as a result of the depreciation of the local currency. Exchange rate fluctuations affect location

choices of risk-averse firms and hence the degree of specialization of countries (Goldberg & Kolstad, 1995). In essence, exchange rate fluctuations influence the foreign investment behavior of multinational firms, in particular, the level of exchange rate changes have an impact on the entry of firms into foreign markets. In other words, the exchange rate fluctuation can influence a firm's decision to invest in a particular country (Buch & Kleinert, 2008).

Among various factors, exchange rates have significant influence on the competition among FDI recipient countries (Xing & Wan, 2006; Xing, 2006). A recipient country with a relative currency appreciation can lose FDI inflow in their country and divert foreign investment to rival countries. The empirical findings based on the Autoregressive Distributed-lag (ARDL) bounds test suggest that there is evidence of long-run cointegration relationships between FDI and exchange rate for the case of Malaysia, Singapore, and the Philippines with all countries (except Thailand) recording that the depreciation of the host country currency induces FDI inflows (Lily et al., 2014). The mechanism of how exchange rate fluctuations affect FDI has been investigated in previous studies e.g. Cushman (1985, 1988); Froot and Stein (1991); Barrell and Pain (1998); Brahmasrene and Jiranyakul (2002) and Combes et al. (2012). The results of these studies generally show that depreciation in the exchange rate in the recipient country induces more FDI inflows.

Moreover, an appreciation of Japanese yen against Chinese yuan leads to an increase of Japanese production in China, so that the appreciation of Japanese yen improves profits of Japanese firms in China (Xing & Zhao, 2008). On the other hand, exchange rate level changes affect FDI inflows significantly while a weak U.S. dollar discourages FDI inflows into the U.S. (Alba et al., 2010). These studies show that an appreciation of the currency of FDI origin countries increases FDI outflows as relative prices of foreign assets can be reduced. On the contrary, Tan (2009) argues that the level of exchange rate change has a negative impact on FDI flows due to wealth and cost effects. As it happens, a depreciation of the currency of FDI origin countries has discouraged FDI outflows in the case of bilateral FDI moving from Canada, Japan and European countries to the U.S. during the period 1979-1991 (Klein & Rosengren, 1994). Japanese yen

depreciation against FDI recipient countries such as Asian countries for the period 1987-2008 decreases FDI outflows substantially from Japan (Takagi & Shi, 2011).

In the context of currency devaluation, previous research such as Chakrabarti and Scholnick (2002) discovered that the currency devaluation of FDI recipient countries has a positive impact on FDI inflows in the case of bilateral FDI moving from the U.S. to 20 OECD countries. The cumulative devaluation of the Chinese yuan since 1989 has played a critical role in boosting FDI inflows in China. In addition, the devaluation of Chinese yuan against Japanese yen substantially induces FDI inflows from Japan, and the response of FDI flows to exchange rate fluctuations is elastic. Thus, the currency depreciation in FDI recipient countries eases foreign firms' purchases of assets in the host country (Blonigen, 1997).

There are strong positive relationships between the devaluation of the national currency of FDI recipient countries and FDI inflows (Gottschalk & Hall 2008). The results of these studies suggest that the strength of national currencies of FDI origin countries have an important role in location choices for multinational corporations for the case of bilateral FDI moving from the U.S. and Japan into four Asian countries such as Indonesia, Malaysia, the Philippines and Thailand. Most of the aforementioned studies reach the conclusion that the currency devaluation of FDI recipient countries stimulates FDI inflows, while conversely, an appreciation leads to a reduction in FDI inflows.

2.2. The Exchange Rate Volatility on FDI Flows

Turning to exchange rate volatility, its impact on FDI flows is mixed as well. Exchange rate volatility increases uncertainty surrounding overseas investments and raises the variance of expected costs and profits faced by multinational corporations. Nominal and real volatility strongly deter foreign investments. Output and exchange rate volatility matter in particular for the decision whether to invest in a foreign country in the first place (Cavallari & d'Addona, 2013). An increase in uncertainty has been thought to suppress FDI inflows as multinational corporations are dealing with an opportunity cost of not waiting (Campa, 1993). By employing a panel data analysis of 56 developed and developing countries for the period of 1995-2012 (country and industry level), Deseatnicov and Akiba

(2016) report that MNCs are less likely to tolerate exchange rate risk in developing countries. The change in FDI flows in response to exchange rate volatility is robust and persistent in Korea (Lee & Min, 2011) while the effect of exchange rate volatility on capital flow has been limited (Kim & Yang, 2009). Further, the nonlinearity between exchange rate volatility and FDI flow provides some explanations for why existing literature continues to show mixed results regarding the relationship between exchange rate volatility and FDI flow (Kim & Yang, 2009; Al-Abri & Baghestani, 2015). Darby et al. (1999) argue on the value of the option to wait in a situation of uncertainty and sunk costs. Despite such an option, exchange rate volatility affects FDI flows in various ways. Mensah et al. (2017) indicate a positive relationship between exchange rate volatility and FDI. Exchange rate volatility has a positive impact on outward FDI (Cushman, 1988). The capacity share abroad increases as exchange rate volatility rises using bilateral FDI flows between the U.S. - Canada, and Japan - the United Kingdom. However, these effects are generally neither large nor for the most part statistically significant, and any relationship is highly dependent on a high elasticity of demand for investment assets (Goldberg & Kolstad, 1995).

In contradiction, Campa (1993) finds a negative link between exchange rate volatility and FDI. Exchange rate volatility is detrimental to FDI flows so that the increased volatility of exchange rates has discouraged FDI flows (Bénnassy-Quéré et al., 2001). Accordingly, exchange rate volatility has a significant negative impact on FDI outflow in the case of bilateral FDI moving from the U.S. and Japan to other countries for the period 1990-2000 (Kiyota & Urata, 2004). There is also a negative relationship between exchange rate volatility and inward FDI in East Asia (Thorbeckem, 2008) and China (Lee & Wang, 2018).

When a country's deviations from the purchasing power parity are not significant, high exchange rate volatility increases changes in FDI flows (Qin, 2000). Besides, the motives of foreign firms for investment are the major factor that affects FDI flow so that the effect of exchange rate volatility on FDI flow is quite limited (Lin, Chen, & Rau, 2010). Though these aforementioned studies give different results regarding the impact of exchange rate volatility on FDI flows, they reveal that there is a significant relationship

between exchange rate volatility and FDI flows.

2.3. *The Impact of Exchange Rate Regimes on FDI Flow*

Economic growth has traditionally been attributed to the accumulation of human and physical capital and the increased productivity arising from technological innovation. The quest to attract physical capital led to the design and implementation of policies and the building of institutions by governments to create a congenial investment environment to attract foreign investors. Multinational corporations operating in developing countries take advantage of cross-country indicators of governance i.e. regulatory quality on FDI flows as found in developing countries (Abotsi, 2018), Poland (Piszewski, 2007), China (Lee & Zhao, 2014; Lee & Wang, 2018; Whalley, 2012), Kazakhstan (Lee, 2009; Lee, Baimukhamedova, & Akhmetova, 2010), and Korea (Lee, 2015), among others.

When currency-union countries pair with another currency-union or floating exchange rate countries, the FDI flow increases dramatically. If two countries both have fixed or floating exchange rate policies, the effect on the bilateral FDI flow is to be ambiguous (Abbott & de Vita, 2011). For those country-pair regimes, the effect on FDI flow is less satisfactory than a currency-union and currency-union pairing.

Exchange rate regimes are classified into two categories: de jure or de facto, meaning declared or in factual (Hammond & Rummel, 2005). Those who adopt de jure classification perform better in terms of inflation and economic growth than those who adopt de facto classification. Regarding exchange rate regimes and FDI flows to developing countries in terms of attracting and absorbing FDI inflows, developing countries who adopt de facto fixed or intermediate classification significantly outperform those who adopt a flexible exchange rate regime (Abbott, Cushman, & de Vita, 2012). Based on the monthly data of FDI in China and the index of real effective exchange rate (REER) of RMB during 1997 to 2012, the empirical test reveals that the appreciation of RMB promotes FDI after the reforms in the exchange rate regime in 2005 (Jin & Zang, 2013). Additionally, as the era of the planned economy has vanished, most European countries adopt floating exchange rates, while Estonia, Latvia, Lithuania and Bulgaria maintain pegged

exchange rates. In order to better understand how different exchange rate regimes affect countries' FDI flow, Hegerty (2009) finds that the standard deviation of FDI flows in three fixed exchange rate countries, including Estonia, Latvia and Lithuania, are relatively small, which implies a low volatility and low country risk. Nevertheless, Bulgaria shows opposite results. Interestingly, Bulgaria is the only country of those four in which domestic credit experiences growth.

Rahman and Mustafa (2015) examine a triangular dynamic causal relationship of exports, exchange rates, and FDI flows between India and the United States. A high positive association between the bilateral exchange rate and exports from India to the United States has been observed. However, there is only a moderate association between India's FDI inflow and its bilateral exchange rate with the United States. This implies that some other factors can weaken this relationship. The relationship between exchange rate regimes and FDI flow can be explained by either case of three classes of theories: the production flexibility school, the risk-aversion arguments and the exchange rate sheltering hypothesis (Nyarko et al., 2011). Arguments based on these three theories address very different possible causal relationships between FDI inflow and exchange rate regimes because of different points of view.

Previous studies have suggested a significant relationship between exchange rates and FDI flows whether empirically or theoretically, but the results have been mixed for the sign and causal direction between exchange rates and FDI flows. Therefore, further study is necessary to elucidate the causality between exchange rates and FDI flow in the short-run and long-run. Hence, the following hypotheses are proposed:

Hypothesis 1: Fluctuations in the exchange rate are likely related to FDI flow dynamics in the long-run.

Hypothesis 2: Fluctuations in the exchange rate are likely related to FDI flow dynamics in the short-run.

Additionally, some economies were able to accelerate their growth while other countries suffered from turbulences through financial innovations and financial globalization, which were reinforced and transferred internationally through the volatile financial markets (e.g. Bulsara, et al., 2015; Rangelova,

2014; Wilczyński, 2011). The process of international financial contagion makes the case for global financial governance, particularly during the global financial crisis period of 2007-2009 (Czarniawska, 2012; Hofmarcher, & Hornik, 2013; Wilczyński, 2011). Borowiec (2010) reported that the global financial crisis was a very big challenge, especially for the Polish banking and financial sector during the crisis period of 2008-2009. Further, some researchers debate the dynamic market linkages between the global financial crisis and major developing countries, including China, Brazil, Russia, and India (Popkova et al., 2016), and the inter-connections between the U.S. economy and major Asian economic regions, namely, Japan, China, and ASEAN (e.g. Estrada, 2014).

A global crisis generates economic uncertainty for many types, including exchange rate uncertainty, and thus potentially distorts FDI flow. For example, during the creation of the Mercosur between Argentina, Brazil, Paraguay and Uruguay in Latin American countries, this process led to local currency devaluation. These exchange rate movements have substantial negative impact on the respective FDI flows (Allegret & Sand-Zantman, 2009; Alvarez-Plata & Schrooten, 2004; Camarero et al., 2006). As such, the global financial crisis of 2007-2009 can cause a structural break in the trend of FDI inflow into China. The global financial crisis can introduce some changes in the implementation of monetary policy in China, and this would introduce substantial instability in the system. This leads to the following hypothesis:

Hypothesis 3: The global financial crisis of 2007-2009 likely affects a structural break in FDI inflows in China.

3. Data and Methodology

This section describes the data and outlines the methodology used in the selection of indicators and the normalization of data. The empirical analysis will focus on the effect of exchange rates on FDI flows using national level aggregated data. The sample is restricted to the period from January 1999 to May 2010, in which monthly data are available for 137 observations. All of the monthly time series data are collected and retrieved from the National Bureau of Statistics of the People's Republic of China.

3.1. Variables

There are two main categories of variables. Endogenous variables include foreign direct investment, selected foreign exchange rates and macroeconomic variables while an exogenous variable is a dummy variable used to capture the impact of the global financial crisis.

Foreign Direct Investment (FDI). Foreign direct investment refers to the gross inflows of new investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital and short-term capital as shown in the balance of payments. This series shows new investment inflows in the reporting economy from foreign investors. Data are in increments of one thousand U.S. dollars.

Foreign Exchange Rates. Based on the volume of international trade with China, four major or dominant currencies are selected: U.S. dollar (USD), Euro (EUR), Japanese yen (JPY) and Korean won (KRW). Time series data are a monthly-adjusted average. In effect, USD, EUR, JPY and KRW are the logarithm of the nominal exchange rate of Chinese yuan per U.S. dollar, Euro, Japanese yen and Korean won, respectively.

Macroeconomic Variable. Export (EXP) is included in the model to represent a proxy for real economic activity of the economy while the consideration of the other conventional determinants of the log of real effective exchange rate (RER) does not impact the hypothesis of the relationship between RER and FDI across countries (Biswas et al., 2014). Other studies that employ trade variable includes Whalley (2012) on trade imbalance and Grancay et al. (2015) on export specialization.

The Global Financial Crisis Shock. A dummy variable is adopted to examine the impact of the global financial crisis of 2007-2009 (see Elliott, 2011; The Economist, 2013; Thakor, 2015) on the FDI inflows to China. An exogenous variable is assumed not to be systematically affected by changes in the endogenous variables. A dummy variable with a value of 0 will cause the variable's coefficient to disappear while a value of 1 will cause the coefficient to act as a supplemental intercept in the regression model. As such, the global financial crisis shock variable equals 1 if the period falls between August 2007 and December 2009, and otherwise 0.

Descriptive statistics of above variables are presented in Table 1.

Table 1. Descriptive Statistics

Variables	Minimum	Mean	Maximum
FDI	183,200.000	3,149,981.956	9,239,544.000
USD	6.81800	7.89299	8.28000
EUR	6.99631	9.25508	11.15341
JPY	0.06196	0.07109	0.08051
KRW	0.00469	0.00704	0.00852
Export	110.000	599.642	1,363.500

Table 2. Results of Unit Root Tests

Variable	Augmented Dickey-Fuller test		Phillips-Perron test	
	Level	1st difference	Level	1st difference
FDI	-1.392	-2.944**	-2.252	-24.155***
USD	0.808	-3.827***	1.383	-11.163***
EUR	-1.524	-12.633***	-1.524	-12.635***
JPY	-1.257	-10.748***	-1.573	-10.553***
KRW	-1.563	-5.897***	-1.453	-8.178***
Export	-0.686	-12.149***	-1.510	-13.478***

Note: Probability values for rejection of the null hypothesis of a unit root are employed at the 0.05 level (**, $p < 0.05$ and ***, $p < 0.01$).

3.2. Normalization of the Time Series Data

The normalization of the data is necessary to transform values to the same unit of measurement since FDI inflow is presented in thousand U.S. dollars while exchange rates are presented in Chinese yuan. Log transformations are a preferred method since each resulting coefficient in the regression equation represents elasticity that is the ratio of the incremental change of the logarithm of a function with respect to an incremental change of the logarithm of the argument.

3.3. Unit Root Test

To ascertain the order of integration of the variables, this study applies the augmented Dickey-Fuller (Dickey & Fuller, 1981) unit root test and the Phillips-Perron (Phillips & Perron, 1988) test. The augmented Dickey-Fuller test assumes the errors to be independent and have constant variance, while the Phillips-Perron test allows for mild assumptions about the distribution of errors. The two unit root tests are carried out to test the null hypothesis of the unit root in the level and the first difference. All test equations are tested by the method of least squares, including an intercept without time trend included in the model. In the unit root tests, an optimal lag is automatically selected based on Schwarz info criterion, while the lag length is automatically selected based on the Newey-West estimator using the Bartlett kernel function.

Table 2 reports the results of the two unit root tests. Table 2 indicates the null hypothesis of a unit root cannot be rejected at level, but all null hypothesis of a unit root is rejected in the first difference. The results in Table 2 unanimously confirm that all variables are integrated of order one or $I(1)$.

3.4. Cointegration Test

Time series variables may be cointegrated if there are one or more linear combinations among the variables. If these variables are cointegrated, there exists long-run equilibrium among the variables. In other words, if the variables are cointegrated, there is a long-run relationship and there exists a force to converge into long-run equilibrium. For this purpose, there are two test methods: the Engle-Granger single equation test method (Engle & Granger, 1987) and

the Johansen cointegration test (Johansen, 1988). The Johansen cointegration test represents each variable as a function of all the lagged endogenous variables in the system. The Johansen procedure uses two ratio tests: a trace test and a maximum eigenvalue test. Both can be used to determine the number of cointegrating vectors present, although they do not always indicate the same number of cointegrating vectors. If trace statistics and maximum eigenvalue statistics yield different results, the result of the maximum eigenvalue test is preferred due to the benefit of carrying out separate tests on each eigenvalue.

Table 3 reports the results of the Johansen cointegration test. The test equation was tested by the method of least squares. The regression model allows for a linear deterministic trend in the data and includes an intercept, but no trend in the vector autoregressive model. The trace test indicates at least four cointegrating equations exist at the 0.05 level, while the maximum eigenvalue test indicates at least two cointegrating equations exist at the 0.05 level. Therefore, the null hypothesis of no cointegration is rejected at the 5 percent significance level. The results indicate that a cointegrating relationship exists among the variables at the 0.05 level.

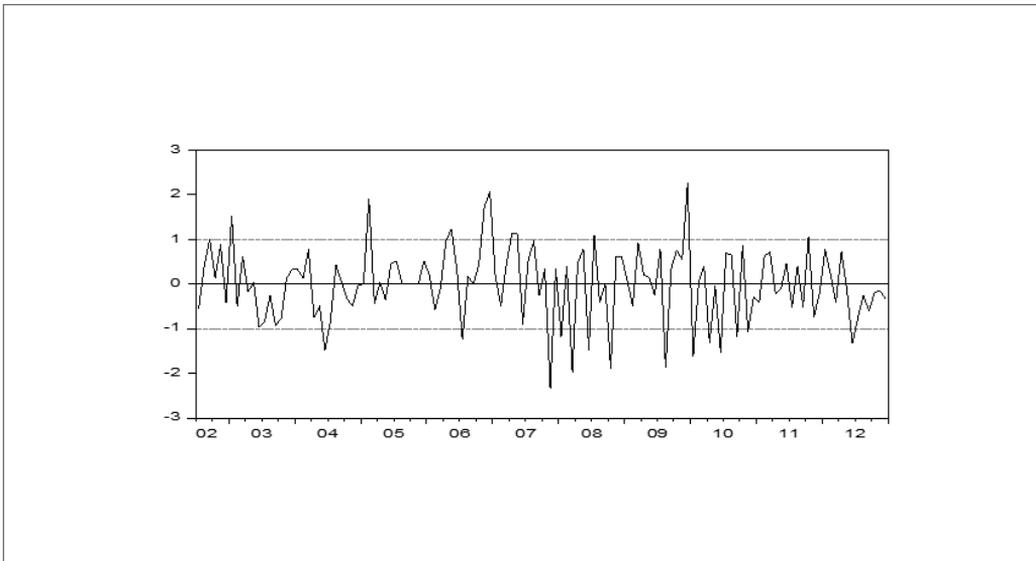
4. Empirical Results

The results of the Johansen cointegration test in Table 3 reveals that there is a long-run equilibrium relationship between foreign exchange rates and FDI flows in China. In this case, an unrestricted vector autoregressive model would not be an effective option for testing short-run and long-run dynamics. Engle and Granger (1987) suggest that if two or more variables are cointegrated, there is always a corresponding error correction representation in which the short-run dynamics of the variables in the system are influenced by the deviation from equilibrium. Thus, a vector error correction (VEC) model is formulated to reintroduce the information lost in the differencing process, thereby allowing for long-run as well as short-run dynamics. The VEC model indicates that changes in one variable are a function of the level of disequilibrium in the cointegrating relationship, as well as changes in other explanatory variables. Therefore, the VEC model is useful for capturing both the long-run

Table 3. Results of Johansen Cointegration Test

Regression model	FDI = f(USD, EUR, JPY, KRW, Export)	
Number of cointegration (r)	Trace statistic	Maximum Eigen statistic
r = 0	146.566***	50.960***
r ≤ 1	95.606***	37.290**
r ≤ 2	58.316***	27.444
r ≤ 3	30.871**	14.264
r ≤ 4	8.958	6.026
r ≤ 5	1.239	1.239

Note: Probability values for rejection of the null hypothesis of no cointegration are employed at the 0.05 level (**, $p < 0.05$ and ***, $p < 0.01$).

**Figure 1.** Graph of standardized residuals.

and the short-run dynamics when the variables are cointegrated. The lagged error correction term (ECT_{t-1}) contains the long-run dynamics information derived from the cointegrating relationship. In effect, the significance of the Chi-square statistics of the Wald test of ECT_{t-1} implies the long-run dynamics. The short-run dynamics in the VEC model are determined by the block exogeneity Wald test. The block exogeneity Wald test in the VEC model provides Chi-square statistics of coefficients on the lagged endogenous variables that point to the statistical significance of the coefficients of the endogenous variables.

Table 4 reports the results of VEC estimates, model diagnostic tests, and residual diagnostic tests. Histogram normality Jarque-Bera test (null hypothesis: residuals are multivariate normal) is not rejected. Skewness of the series is not significantly different from a normal distribution. Breusch-Godfrey serial correlation Lagrange multiplier test (null hypothesis: no serial correlation at lag order 2) is not rejected. Heteroskedasticity test (null hypothesis: no autoregressive conditional heteroscedasticity or ARCH effect at lag order 1) is not rejected. Hence, the model yields acceptable results from the model and residual diagnostic tests. In addition, there are considerably fewer outliers and the fluctuation bands are smaller (Figure 1).

Table 4 reports the results of Wald tests and gives the VEC estimates. The optimal lag of the endogenous variables is tested up to lags 4 and the numeric values in cells are Chi-square statistics of the Wald test, which are used to interpret the statistical significance of coefficients of the long-run and the short-run dynamics.

In testing hypothesis 1 that fluctuations in the exchange rate are likely related to FDI flow dynamics in the long-run, the results in Table 4 indicate that the null hypothesis (no long-run dynamics) can be rejected at the 0.01 level ($p < 0.01$). This suggests that there exists long-run dynamics from exchange rate fluctuations to FDI inflow in China.

In testing hypothesis 2 that fluctuations in the exchange rate are likely related to FDI flow dynamics in the short-run, Table 4 indicates the null hypothesis (no short-run dynamics) cannot be rejected at the 0.05 level ($p > 0.05$). All told, there exists no

short-run dynamics from exchange rate fluctuations to FDI inflows in China. Therefore, the nominal exchange rates of Chinese yuan per the four foreign currencies show no impact on FDI inflow dynamics in the short-term.

In testing hypothesis 3 that the global financial crisis of 2007-2009 likely affects a structural break in FDI inflows in China, Table 4 indicates that the null hypothesis (no effect of structural break) can be rejected at the 0.01 level ($p < 0.01$). In other words, there exists some evidence of a structural break from the 2007-2009 global financial crisis shock to FDI inflows in China. If a structural break affects changes in the endogenous variables and causes instability in the cointegrating vector in the VEC model, including the structural shock exogenous variable as a dummy variable in Table 4, it would be sound practice to incorporate this external shock.

In addition, the numeric values in the columns of VEC estimates in Table 4 are coefficients of regressors that represent the short-run and long-run elasticity. In the FDI inflow model (Table 4), a change in the Chinese yuan against foreign currencies negatively affects FDI inflow in the long-run in China and it is statistically significant at the 0.01 level. It means that the nominal exchange rate of Chinese yuan against the four foreign currencies eventually has a negative effect on FDI inflow in the long-term, as the FDI inflow from foreign countries eventually plunged when the Chinese yuan appreciated against the home origin currencies. For the short-run elasticity, the nominal exchange rate of Chinese yuan against the four foreign currencies has neither a positive nor a negative effect on FDI inflow in the short-term ($p > 0.05$). At the end, the nominal exchange rate of Chinese yuan against foreign currencies has no effect on FDI inflow in the short-term.

Corresponding to the hypotheses, the impulse responses are implemented in impact determination. A shock to the j -th variable not only directly affects the j -th variable, but also transmits to all of the other endogenous variables through the dynamic (lag) structure of the vector autoregressive. The effects of the shocks on the endogenous variables are assessed by testing impulse responses and variance decomposition functions. An impulse response function traces the effect of a one-time shock to one

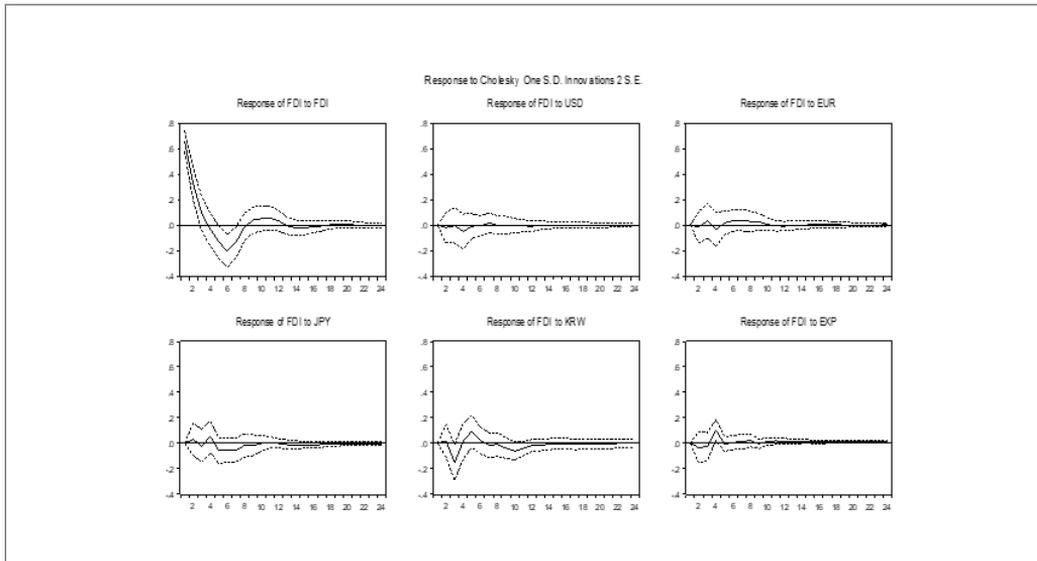


Figure 2. Impulse responses of FDI to innovations of each of exchange rate variables.

of the innovations on current and future values of the endogenous variables. Innovations are usually correlated and may be viewed as having a common component that cannot be associated with a specific variable. To make it uncorrelated when interpreting the impulses, a transformation is applied to the innovations. Among other transformation methods, the Cholesky transforming method uses the inverse of the Cholesky factor of the residual covariance matrix to orthogonalize the impulses. For a stationary vector autoregressive model, the impulse responses should decline to zero and the accumulated responses should asymptote to some constant.

Figure 2 presents the results of the impulse responses of FDI inflows to Cholesky one standard deviation innovations of each endogenous variable. The graphs of U.S. dollar, Euro, Japanese yen and Korean won show that the response of FDI inflows to each shock begins having either a positive or a negative impact to some extent in the short-run, with less impact after six months, and finally subsides after 12 months. After 12 months, the FDI inflow's impulse responses to the shocks of exchange rates are not significant, and the effect of each shock

on FDI inflow has reduced to zero.

5. Discussion and Policy Implications

A central premise of how exchange rate fluctuations affect foreign direct investment (FDI) inflows to host countries in this study focuses on China. Based on the theoretical contributions provided by prior studies, the research framework of this study classifies the testing factors into three categories: the short-run and long-run dynamic relationships between exchange rate fluctuations and foreign direct investment (FDI) inflows, and a structural break during the 2007-2009 global financial crisis shock to FDI inflow in China. Overall, this research contributes to the existing literature in three main aspects.

First, the study finds evidence of long-run dynamics from exchange rate fluctuations to FDI inflows in China. This implies that a change in the nominal exchange rate of Chinese yuan against foreign currencies negatively affects FDI inflows in the long run. For example, when Chinese yuan appreciates against dominant foreign currencies, it eventually leads to a reduction in FDI inflows in China. In turn, the inward FDI from foreign countries finally plunges.

Table 4. Results of Vector Error Correction (VEC) Estimates and Wald Tests

Endogenous variables: Optimal lag order in ()		VEC estimates Coefficient t-statistics in []	Wald tests Chi-square statistics Degree of freedom in ()
Long-run dynamics	ECT_{t-1}	-0.987[-5.769]***	38.282(df.1)***
Short-run dynamics	FDI(t-1)	0.439[2.920]***	10.960(df.4)**
	USD(t-1)	-21.067[-0.936]	5.941(df.4)
	EUR(t-1)	-1.091[-0.461]	6.368(df.4)
	JPY(t-1)	1.412[0.468]	1.012(df.4)
	KRW(t-1)	3.121[1.036]	6.823(df.4)
	Export(t-1)	-0.767[-0.638]	5.576(df.4)
Exogenous variables	Constant	-0.243[-2.612]**	
	Structural shock dummy	0.440[2.305]**	
Model diagnostic tests	Dependent variable	FDI(t)	
	R-squared	= 0.457	
	Adjusted R-squared	= 0.323	
	F-statistic	= 3.410***	
Residual diagnostic tests	Histogram normality test	Jarque-Bera test statistic = 4.017	
	Breusch-Godfrey serial correlation LM test	F-statistic (2, 103) = 2.277	
	Heteroscedasticity test: ARCH effect	F-statistic (1.129) = 0.386	

Note: The probability value for rejection of the null hypothesis is employed at the 0.05 level (** $p < 0.05$ and ***, $p < 0.01$).

It is essential to jog the readers' mind that the Chinese government has maintained a conventional U.S. dollar pegging system until 2004, and has begun moving to a managed floating exchange rate system since 2005. At last, the current Chinese yuan not only links to the U.S. dollar, but also to a basket of foreign currencies. In due course, the Chinese government has widely opened their market to solicit better FDI inflows with greater

capital account openness since 2005. In the meantime, the government has reinforced the managed floating exchange rate system since then and until now, which could enable the economy to attract larger FDI inflows than before, despite international business cycles. The government believes that, given the "go global" drive of the Chinese currency, it is necessary to move to a free-floating exchange rate system so that the regulation

of capital accounts should be fully lifted in the future.

Second, the findings of this study do not manifest sufficient empirical support for short-run dynamics from exchange rate fluctuations to FDI inflows in China. Essentially, a change in the nominal exchange rate of Chinese yuan against foreign currencies has no effect to FDI inflow in the short-term. This confirms that there is no reciprocal feedback between exchange rate fluctuations and FDI inflows in the short run in China. As far as foreign investors are concerned, the Chinese government substantially restricts portfolio investment inflows, even though FDI inflow may include disguised portfolio investments. It is possible to persuade foreign investors to behave differently. Over the long haul, a large majority of FDI inflows into China is predominantly directed towards export-oriented manufacturing. During the sample data period, the FDI inflows to China depended largely on the economic benefits of FDI that the economy offered.

Third, this research provides new insights as the findings reveal different patterns of a structural break from the global financial crisis to FDI inflows in China. Consequently, it appears that the FDI inflows in China before and after the crisis cannot completely escape from the widespread of the global financial crisis. According to National Bureau of Statistics of China (2007 & 2011), in 2006 prior to the 2007-2009 financial crisis, the top three FDI inflow into China from ASEAN countries include Japan (\$4,598 millions), South Korea (\$3,895 millions) and Singapore (\$2,260 millions). In 2010, the position changed since Singapore led the pack (\$5,428 millions) followed by Japan (\$4,084 millions) and South Korea (\$2,692 millions).

This study bears both substantive and practical implications for policy and decision makers. To take full account of the findings of this study, managers and policy makers are able to enhance their understanding of the long-term and the short-term movements of exchange rates and FDI flow dynamics. The understanding about dynamic relationships between exchange rates and FDI flows enables managers and policy makers to make informed decisions. FDI origin country's investors are interested in the future stream of revenues and returns denominated in their own currency. As to policy makers who want to maintain a stable flow of inward FDI, it is

important to understand that inward FDI responds to a large extent to current and expected changes in exchange rates of their currency. In sum, a better way to interpret these findings is that exchange rate fluctuations in the short-term might not generate much unwanted effect, but sharp fluctuations in exchange rates can exacerbate FDI inflow. Therefore, managers and policy makers should react rationally to exchange rate fluctuations in the short-term. To this end, managing an erratic course of exchange rate fluctuations i.e. through a pegged or managed floating system) may lessen erratic movements in FDI inflows.

It is noteworthy that the financial crisis during 2007-2008 in the United States and the debt crisis during 2009-2010 in Europe adversely influenced financial markets. During that period, the two crises led to depreciation of the US. Dollar and Euro respectively, so that most European and North American companies withdrew their investments, otherwise temperately regulated their foreign investment activities to help domestic market recovery. Faced with many challenges, it would be beneficial for governments to pursue stabilizing macroeconomic and monetary policies, as a stable exchange rate usually goes hand in hand with stable domestic economic factors and monetary policy.

6. Conclusions and Future Research

The results from this research expand knowledge of factors that affect FDI inflows. This study finds that there exists long-run dynamics from exchange rate fluctuations to FDI inflows, and a change in exchange rates negatively affects FDI inflows in the long run. However, a change in exchange rates has no effect to FDI flows in the short run. Finally, a structural break from the global financial crisis of 2007-2009 to FDI inflows in China has occurred. This is preeminent for devising strategies to promote economic development, thus, a course that carries much at stake not only for China but also for other developing countries.

To generalize the results obtained from this study, recommendations for future research include studies encompassing different economies where data are available. Such research will contribute towards improving our understanding of exchange rate systems and responses in each market. The economic viability from macroeconomic factors and monetary

policy, as well as other factors may be considered since exchange rate fluctuations and FDI flow dynamics can be influenced jointly by these factors.

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