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The Impact of Economic Factors on the Foreign Exchange Rates between USA and Four Big Emerging Countries: China, India, Brazil and Mexico

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Abstract

This study examines the impact of macro-economic factors on the foreign exchange rates between USA and four big emerging countries: India, Mexico, Brazil and China for the period of 2005 to 2014. This study uses Enter and Stepwise multiple regression methods to investigate the impact of market fundamental on the exchange rates. The empirical findings reveal that the macro-economic factors significantly predict and influence the exchange rates between USD/CNY (US dollar/Chinese yuan), USD/INR (US dollar/Indian rupee), USD/BRL (US dollar/ Brazilian real), and USD/MNX (US dollar/Mexican pesos). It is crucial to emphasize that the macroeconomic policies have to be implemented in order to stabilize and reduce the exchange rates volatilities.

Keywords: Exchange rate, Emerging markets, Macro-economic factors, Enter and stepwise regression models

1. Introduction

Understanding the impact of economic factors affecting on the US foreign exchange policy toward other countries is very crucial for MNCs (Multi-National Corporations), investors, and practitioners. It is widely accepted that the U.S. foreign exchange policy is an indispensable part of the U.S Monetary Policy to maintain its leading international position. As Rangarajan & Prased (2008) stated "with an open economy and large capital inflows, management of the exchange rate becomes an independent concern." The U.S. could be regarded as the center country for the international monetary system (Dooley, Folkerts-Landau, & Garber, 2004).

US dollar is the most accepted and commonly used currency in international trade and was considered as the dollar standard for a long period of time (Haberler, 1972; Genberg & Swoboda, 1977; Ross, 1983; McMichael, 1996; McKinnon & Schnabl, 2003; Devereux, Shi & Xu, 2007; Chunwei, 2008; Bracke & Bunda, 2011). According to the Bank for International Settlements, 86% of all foreign exchange transactions that took place in the month of April 2007 were against the U.S. dollar. Besides, the U.S. dollar is still the world's reserve currency even though it is no longer backed by gold. Additionally, US dollar could be considered as the worldwide instrument to report currency and monetary by international banks and countries (Laurent, 1974; Avery et al., 1987; Porter & Judson, 1996; Feige, 1996; Orphanides & Porter, 2000; Eichengreen, 2000). Virtually all interbank transactions, by market participants domestic and abroad, involve a purchase or sale of dollars for a foreign currency (Kubarych, 1983). Ehrmann, Fratzscher, & Rigobon (2011) underlined "the dominance of US markets as the main driver of global financial markets: US financial markets explain, on average, more than 25% of movements in euro area financial markets, whereas euro area markets account only for about 8% of US asset price changes."

In addition, the U.S. dollar is the most common currency for international reserves to maintain the American interest rate low because of its liquidity (Conerly, 2013). Central banks are one of the major players in foreign exchange markets and when they intervene the U.S. dollar used as an intervention currency to stabilize the money supply and demand (Krugman, 1984).

However, from 2005 to 2015 that US dollar has faced with many challenges because of heated international events such as the global crisis in 2008, the debt crisis of the European Zone in 2010s, the global oil crisis, the wars in Ukraine, Libya, and the problems in the ASEAN zone and especially the strong emerging of Asian and Latin American economies and currencies in China, India, Mexico and Brazil. Within a decade, the U.S. dollar could be replaced as the world's reserve currency (Halligan, 2014). When the European Central Bank starts operating in 1999 and the single currency is issued in 2002, important shifts were expected in the reserve portfolios of central banks. It was believed that the advent of Euro would create an integrated monetary and financial zone larger than the United States (Hartmann, 1996; Bergsten, 1997; Schinasi, & Prati, 1997; Greenspan, 2001; Gaspar, 2004; Papaioannou, Portes & Siourounis, 2006; Chinn & Frankel, 2007; Cohen, 2012). Moreover, it was expected that it would quickly come to rival and even surpass the dollar as the leading

reserves by the central banks (Eichengreen, 1998).

After the depreciation of Euro to deal with the debt and banking crisis as contagious effects, other currencies were held the central banks as reserves such as Chinese yuan (Akram, Fatima, Mukhtar, & Alam, 2011). Besides, Indian rupee, Brazilian real and Mexican peso have been becoming stronger and these three countries' GDP often dominate in the top 20 largest economies in the world (source: http://data.worldbank.org/).

Therefore, because of economic integration among countries, it is worth to explore affecting macro-economic factors on the foreign exchanges between USA and four emerging countries, China, India, Brazil and Mexico to understand why exchange rates fluctuate. The empirical findings reveal that the macro-economic factors statistically significantly predict and influence the exchange rates between USD/CNY, USD/INR, USD/BRL and USD/MNX. The results of this study could be utilized how the macroeconomic policies can be implemented in order to reduce the exchange rates movements.

The rest of the study is organized as follows. Section 2 examines literature review, Section 3 presents the methodology, Section 4 discusses the findings, and Section 6 concludes the study.

2. Literature Review

2.1 Chinese Yuan

Since the initiation of economic reforms, trade liberalization and lifting trade restrictions on the international trade a couple decades ago, China has been one of the world's fastest-growing economies and has emerged as a major economic and trade player (Morrison, 2009). The exchange rate system reform in July 2005 was considered as a historical regime switching in China (Ogawa & Sakane, 2006). It ended the decade-long fixed nominal exchange rate of the renminbi vis-à-vis the US dollar (Goldstein & Lardy, 2009). Chinese yuan has been allowed floating in a narrow margin around a fixed base rate determined with reference to a basket of world currencies. It is the result of exchange rate policy that promoted the rebalancing, which made China's goods and services become significantly more competitive in global markets (Goldstein, & Lardy, 2009).

According to the IMF's (International Monetary Fund) national economic output in real terms of goods and services, China ranked 1st with $17.6 trillion, slightly higher than USA with $17.4 trillion. Rising US indebtedness combined with China's rising economic and financial skills have led some analysts to forecast the Chinese yuan would become the third reserve currencies after dollar and euro (Jaeger, Lanzeni, & Mayer, 2010).

Based on the linear model of Chen, Peng, & Shu (2009), the renminbi's share in the total world reserves is 10%. This would provide benefits not only for China and also for the other countries. Chinese yuan will be an alternative for countries seeking to accumulate foreign currency reserves other than in dollar and euro (Eichengreen, 2011). Besides, the emergence of Asia, in particular Chinese economy, has been one of the most important features reshaping the world economy and providing an important source of global production and

demand (Lee, 2014). Trade and foreign investment flows have been major factors in China's booming economy (Morrison, 2009). According to the United States Census Bureau, China ranked 2nd in trading with USA for a longtime (http://www.census.gov/). Moreover, Alicia and Koivu (2009) showed empirically that China's trade balance is sensitive to the fluctuations in the real effective exchange rate. As a result, examining macro-economic factors having an impact on foreign exchange rate between USA and China is important to reduce exchange rate movements.

2.2 Indian Rupee

Besides China, India is also considered as one of the largest and fastest growing economies in the world, which have been relatively less affected by the 2007-2008 global financial crises. Ranjan & Prakash (2010) claimed that "against the backdrop of volatile capital flows, cautious movement towards internationalizing the rupee is in order as the size of the country in terms of GDP, volume of trade as also the turnover in the foreign exchange market when compared with global dimensions is small." Before 2005, Indian rupee is effectively pegged to the U.S. dollar (Patnaik, 2004). After 2005, India has a managed float foreign exchange policy with effective interventions of the Central Bank, Reserve Bank of India (RBI) (Goyal & Arora, 2010; Lin, 2011).

During 2007 financial crisis, the Indian exchange rate channel was underutilized to reduce inflation (Goyal, 2012). However, Indian rupee has depreciated sharply against the dollar since July 2011 because of the recent fall in current account balance, and reduction in capital inflows (Rangarajan & Mishra, 2013).

Another study conducted by Mirchandani (2012) using Pearson Correlation analyses to explore Indian exchange rate volatility from 1991-2010 showed that there are significant correlations between the volatility of rupee and interest rate, inflation rate, GDP and FDI. In addition, Kumar (2010) utilized autoregressive distributed lag (ARDL) modelling approach and found that among the identified variables chosen a priori based on theoretical arguments as determinants of real exchange rate, productivity differential, external openness, terms of trade and net foreign assets turn out to be statistically significant. Another research conducted by Shylajan, Sreejesh, & Suresh (2011) utilized Johansen-Juselius procedure of cointegration analysis and Vector Error Correction Model (VECM) revealed that there are significant relationships between the rupee-dollar exchange rate and money supply, index of industrial production (IIP) and interest rate. Therefore, capturing macro-economic factors affecting to rupee-dollar exchange rate is crucial to support the long-term trade viability and both sides, the U.S. and India will benefit (Joshi, Mohan, Sood, Rajagopalam, Lohman, & Scissors, 2013).

2.3 Brazilian Real

According to Forbes, Brazil's economy is the largest in Latin America and the second largest in the western hemisphere (Blankfeld, 2010). Brazil is also another member of BRICS, which makes up 40 percent of the world's population, 25 percent of the world's landmass, and about 20 percent of global GDP and control some 43 percent of global foreign exchange reserves

(Van Agtmael, 2012).

Since 1999, Brazil has a floating exchange rate regime (Campa, Chang, & Refalo, 2002; Tabak, 2006). Although the float is often described as free, but given the extent of recent reserve accumulation it would not qualify as a free float as understood by most economists (Williamson, 2010). Particular emphasis was placed on the specific microstructure of the Brazilian financial and currency markets, the existing inflation targeting regime with an officially floating exchange rate, and the operations of the BCB (Brazilian Central Bank) as ultimate provider of liquidity (Kaltenbrunner, 2011).

During the 2007 financial crisis, the cutoff of dollar funding lines to Brazilian corporations and banks in September and October 2008, led the BCB to introduce an array of foreign exchange liquidity easing measures in response to stresses in different markets (Stone, Walker, & Yasui, 2009). Consequently, early in 2009, Brazil did get the initial impact of the international financial crisis absorbed and the Brazilian economy, as a result, increased 7.5% in 2010 (Moreira, Prates, & Ferrari-Filho, 2011). Specifically, Brazil focuses more actively on state promotion of domestic industries and economic actors within the international trade system (Santos, 2012).

However, the Brazilian currency, the real, experienced one of the world's largest exchange rate depreciations during the recent international financial crisis. This depreciation resulted from Brazil's rising international financialization (Kaltenbrunner, 2010). Understanding exchange rates trends between USA and Brazil appears to be vital for international trade. Nassif, Feijó, & Araújo (2011) showed that the evolution of the Brazilian real exchange rate from 1999 to 2010 has been characterized by highly volatile and overvalued. According to Moura, Lima, & Mendonça (2008), the exchange rate in Brazil is linked with current and future economic fundamentals and does not follow a random walk. Felisoni, Eunni, & Manoel (2010), two-stage least squares (TSLS) regression was employed to show that exchange rates of Brazil did emerge significant to explain FDI inflows into Brazil during 2000-2007. Another study of Bahmani-Oskooee, Harvey & Hegerty (2013) examined bilateral export and import flows between the United States and Brazil from 1971 to 2010 by using cointegration analysis to explore that exchange-rate volatility supported international commodity trade in long-run.

2.4 Mexico Peso

Mexico is the U.S. third-largest trading partner. Mexico ranks third as a source of U.S. imports, after China and Canada, and second, after Canada, as an export market for U.S. goods and services. The U.S. is the largest source of foreign direct investment (FDI) in Mexico (Villareal, 2015). A full 40% of the content in U.S. imports from Mexico is actually produced in the United States. This means that forty cents of every dollar spent on imports from Mexico comes back to the U.S. (Wilson, 2011). Mexico has taken advantage of its relatively inexpensive labor to attract U.S. manufacturing firms and expand its exports with more than 70% of Mexico's exports go to the U.S. and the U.S. is Mexico's main trading partner for agricultural products (Bahmani-Oskooee & Hegerty, 2009). Morevoer, Mexico pursues a policy of trade liberalization with the support of joining WTO (World Trade

Organization) as a strategy for economic growth in itself (Santos, 2012).

During the 2007 financial crisis, Mexico had faced two considerable shocks not only the global economic recession, particularly due the U.S. led to a drop in Mexico's exports and a deterioration in its terms of trade but also the climate of extreme risk aversion among international investors and the global deleveraging process significantly constrained access to international financial markets (Sidaoui, Ramos-Francia, & Cuadra, 2010). The real exchange rate of Mexico changed in response to a set of economic fundamentals has several policy implications in terms of the link between the exchange rate, and the capital flows, managing of the capital transactions (López Villavicencio & Raymond Bara, 2008).

Kutty (2010) showed that stock prices lead exchange rates changes in the short run, and there is no long run relationship between them from 1989 to 2006. Loría, Sánchez, & Salgado (2010) by using a cointegrated SVAR model proved that there was robust short and long-run relationships between the Mexican monetary aggregates and the exchange rate, which ultimately responds to what Bilson's variant of MAER predicts. Another research by Ibarra (2011) showed that not only portfolio investment but also FDI can strongly appreciate the recipient Mexico's currency from 1988 to 2008.

Therefore, this paper examines macro-economic factors affecting the exchange rates between the U.S. and four big emerging economies, China, India, Brazil and Mexico, which are the major international trading partners with the U.S. and have significant influences on the development of U.S. economy. Understanding the trends of foreign exchanges could stimulate not only the international trade, but also promote the potential opportunities of international investing in the future.

3. Methodology

3.1 General Model

This paper uses the following regression equation to test the impact of macro-economic

factors on the exchange rates:

$$EXCH = \alpha + \beta 1INF + \beta 2SIN + \beta 3LIN + \beta 4TRBALANCE + \beta 5TRIM + \beta 6TREX + \beta 7PUBD + \beta 8INTRE + \beta 9FDITRANS + \beta 10FDIINCOME + \beta 11GDP + \varepsilon$$

Where, EXCH is the foreign exchange of USD, Chinese yuan, Brazilian real, Indian rupee and Mexican pesos from 2005 to 2014 quarterly, α is the constant, β1 to β11 are the parameters to be estimated, INF is the inflation rate, SIN and LIN is the short-term and long-term interest rate respectively, TRBALANCE is the trade balance, TRIM is the import, TREX is the export, PUBD is the public debt rate to GDP, INTRE is international reserves, FDITRANS is the foreign direct investment for financial transaction, FDIINCOME is the foreign direct investment for Income, GDP is the growth rate, ε is the random error term.

3.2 Data

The sample period for this paper on the impact of macro-economic factors on the exchange rates extends from January 2005 to December 2014 based on quarterly data. Following the

previous studies, this study uses following macro-economic factors: inflation, interest rate, trade balance, public debt, international reserves, foreign direct investment, divided in two components-financial and income and GDP to examine the foreign exchange rate movements between USA and four big emerging countries, India, Mexico, Brazil and China. The data on the macro-economic are obtained from IMF, Worldbank, and the Unites States Census Bureau Websites.

4. Empirical Findings

4.1 Descriptive Statistics

Table 1 summarizes the descriptive statistics of the variables used in this research paper. There are totally 11 independent variables, which represent for 7 macro-economic factors, inflation, interest rate, trade balance, public debt, international reserves, and foreign direct investment (FDI) and gross domestic product (GDP). Besides, there are four dependent variables, USD/BRL, USD/MXN, USD/CNY and USD/INR, which are collected quarterly from January 2005 to December 2014.

Table 1. Descriptive of variables

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
Financial China	40	-1007	1961	270.35	606.458	1.024	1.957
FinancialIndia	40	-323	616	188.08	230.689	-.184	.121
FinancialMexico	40	-2309	3636	340.45	1078.654	.205	1.807
FinancialBrazil	40	-2761	2810	133.40	980.899	.422	3.159
IncomeChina	40	-20	368	76.55	100.348	1.940	2.846
IncomeIndia	39	-30	151	78.51	47.962	-.468	-.594
IncomeMexico	39	-30	902	443.85	240.226	.190	-.661
IncomeBrazil	35	-58	155	17.43	41.980	.960	2.082
GPD	40	-.032	.069	.03591	.024258	-1.400	2.055
Inflation	40	-.0163	.0530	.022955	.0141429	-.514	.972
Long	40	.001133	.054233	.01864250	.020724670	.716	-1.226
Short	40	.016433	.050700	.03332838	.010146494	.022	-1.177
PublicDebt	40	.6007	1.0330	.818400	.1691114	-.150	-1.752
Reserve	40	64473	153771	109835.88	35850.572	-.154	-1.929
USD/BRL	40	1.5960	2.6615	2.025900	.2737871	.185	-.894
USD/MXN	40	10.3100	14.3600	12.171200	1.1426076	-.139	-1.366
USD/CNY	40	6.1180	8.2770	6.944563	.7159548	.614	-1.034
USD/INR	40	39.4915	62.1665	48.878088	6.6848968	.774	-.485
TradeBalance China	40	-96785.00	-42005.00	-68374.7750	13511.31861	-.122	-.743
ImportChina	40	51008.30	127674.80	89599.1450	19826.27845	.087	-.880
ExportChina	40	9003.80	39158.60	21224.4450	7584.65712	.358	-.623
TradeBalanceIndia	40	-6771.00	-560.00	-3295.9000	1535.83911	-.391	-.413

ImportIndia	40	4336.70	11805.50	7620.7650	2389.91880	.421	-1.275
ExportIndia	40	1796.30	6220.20	4325.0125	1358.99636	-.508	-1.008
TradeBalanceBrazil	40	-2544.00	4797.00	1315.0750	2229.76784	-.333	-1.086
ImportBrazil	40	4724.40	9105.60	6823.8550	1134.10430	.232	-.725
ExportBrazil	40	3382.50	12340.90	8138.8700	2694.49433	-.256	-1.345
TradeBalanceMexico	40	-21419.00	-9706.00	-15065.2750	2522.50346	-.076	-.069
ImportMexico	40	38774.30	75445.70	57918.8525	11087.80061	-.032	-1.251
ExportMexico	40	28141.60	61118.20	42853.6650	10898.94478	.352	-1.442
Valid N (listwise)	34						

Notes. 11 predictors, which represent for 7 macro-economy factors: Inflation, Interest Rate, Trade Balance, Public Debt, International Reserves, Foreign Direct Investment (FDI) and Gross Domestic Product (GDP). 4 outcomes are USD/BRL, USD/MXN, USD/CNY and USD/INR. All of the variables are collected in quarterly from January 2005- December 2014.

4.2 China

The assumption of variables type was met because the outcome USD/CNY and 11 predictors are continuous. The independence of observation was also assumed. The assumption of Non-Zero variance was met because there are standard deviations of the predictors are unequal to 0. Based on the Figure 1, the assumption of Normally-distributed errors was met. Because the histogram followed the normal distribution and the Normal P-P plot followed a straight line.

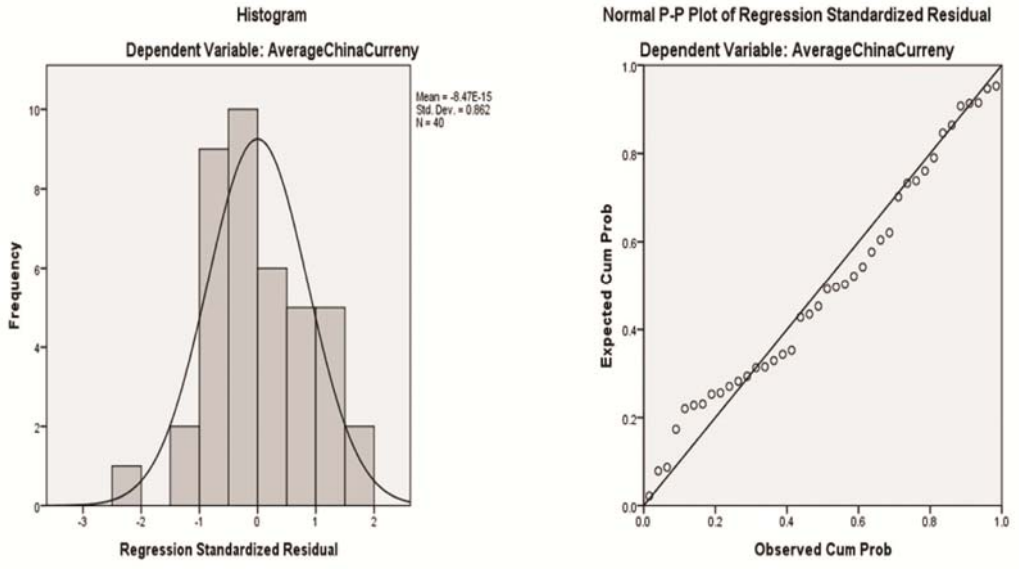

Figure 1. Histogram and normal P-P plot of the outcome USD/CNY

Table 2 shows that income FDI, long-term interest rate, short-term interest rate, public debt, national reserve, trade balance, export and import have a strong relationship with the USD/CNY exchange rate. However, public debt, national reserve, export and import have a negative correlation.

Table 2. Pearson correlations among variables of USD/CNY

Pearson Correlation	USD/CNY	Financial FDI China	Income FDI China	GPD	Inflation	Long	Short	Public Debt	Reserve	Trade Balance China	Export China	Import China
USD/CNY	1	-0.307	-0.541	0.396	0.403	0.865	0.884	-0.934	-0.861	0.73	-0.889	-0.838
Financial FDI China	-0.307	1	0.162	-0.031	-0.085	-0.301	-0.374	0.349	0.365	-0.26	0.396	0.328
Income FDI China	-0.541	0.162	1	0.065	-0.179	-0.375	-0.42	0.562	0.434	-0.643	0.636	0.681
GPD	0.396	-0.031	0.065	1	0.617	0.377	0.253	-0.202	-0.119	-0.012	-0.07	-0.019
Inflation	0.403	-0.085	-0.179	0.617	1	0.512	0.386	-0.453	-0.373	0.119	-0.279	-0.188
Long	0.865	-0.301	-0.375	0.377	0.512	1	0.864	-0.914	-0.902	0.484	-0.748	-0.616
Short	0.884	-0.374	-0.42	0.253	0.386	0.864	1	-0.904	-0.854	0.648	-0.795	-0.746
Public Debt	-0.934	0.349	0.562	-0.202	-0.453	-0.914	-0.904	1	0.957	-0.692	0.906	0.818
Reserve	-0.861	0.365	0.434	-0.119	-0.373	-0.902	-0.854	0.957	1	-0.641	0.843	0.759
Trade Balance China	0.73	-0.26	-0.643	-0.012	0.119	0.484	0.648	-0.692	-0.641	1	-0.746	-0.967
Export China	-0.889	0.396	0.636	-0.07	-0.279	-0.748	-0.795	0.906	0.843	-0.746	1	0.891
Import China	-0.838	0.328	0.681	-0.019	-0.188	-0.616	-0.746	0.818	0.759	-0.967	0.891	1

Notes. The foreign exchange USD/CNY has strong relationship with most of the macro-economy factors except for FDI (Financial), GDP and Inflation. USD/CNY also has a negative relationship with FDI, Public Debt, National Reserve, Export and Import.

4.2.1 Macro-economic Determinants of USD/CNY

The Multiple Regression excluded the import due to its too high VIF and Tolerance. In Table 3, there is a statistical significance of the regression model because of p-value = 0 (< 0.01). It suggests that selected macro-economic factors have 98% explanatory power on USD/CNY exchange rate movements.

Table 3. Model summary and ANOVA of multiple regression of USD/CNY

Model Summary				ANOVA					
R	R Square	Adjusted R Square	Std. Error of the Estimate		Sum of Squares	df	Mean Square	F	Sig.
.990[a]	0.98	0.973	0.1180331	Regression	19.587	10	1.959	140.592	.000[b]
				Residual	0.404	29	0.014		
				Total	19.991	39			

Note. The multiple regression model with the method ENTER reflected 99% the correlation between the observed values of the fluctuations of USD/CNY and the values predicted by the model for 10 years in quarterly. Besides, the regression model of 10 variables also explained 98% (effect size) of the total variance of the predictors.

Based on the results of Table 4 and Table 5, GDP, inflation rate, public debt, trade balance and export have statistically significantly impact on USD/CNY exchange rate (p-value <0.05). The results indicated that 98% of the total variance of the exchange rate can be explained by the five predictors. GDP is statistically significantly positively related to USD/CNY exchange rate, $\beta = 0.36$, $t(38) = 8.64$, $p < 0.001$. Inflation rate is statistically significantly negatively related to USD/CNY, $\beta = -0.20$, $t(38) = -4.85$, $p < 0.001$. Public debt has a statistically significantly negatively impact on USD/CNY, $\beta = -0.65$, $t(38) = -3.28$, $p < 0.001$. Trade balance is statistically significantly positively related USD/CNY, $\beta = 0.13$, $t(38) = 2.59$, $p < 0.05$. However, export is statistically significantly negatively related to USD/CNY, $\beta = -0.26$, $t(38) = -3.29$, $p < 0.05$. Maximum Cook's distance was 0.22 with a maximum standardized residual of 1.67 (from one subject) suggesting that there is a relatively high level of accuracy in the regression model.

Table 4. Coefficient results of the multiple regression of USD/CNY

Coefficients								
Coefficients	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**	**Correlations**		
	B	**Std. Error**	**Beta**			**Zero-order**	**Partial**	**Part**
(Constant)	9.653	0.588		16.41	0			
Financial FDI China	6.04E-05	0	0.051	1.703	0.099	-0.307	0.302	0.045
Income FDI China	2.88E-05	0	0.004	0.091	0.928	-0.541	0.017	0.002
GPD	10.677	1.235	0.362	8.645	0	0.396	0.849	0.228
Inflation	-10.024	2.067	-0.198	-4.85	0	0.403	-0.669	-0.128
Long	-0.193	3.416	-0.006	-0.057	0.955	0.865	-0.01	-0.001
Short	5.861	5.186	0.083	1.13	0.268	0.884	0.205	0.03
Public Debt	-2.761	0.841	-0.652	-3.283	0.003	-0.934	-0.52	-0.087
Reserve	1.62E-06	0	0.081	0.628	0.535	-0.861	0.116	0.017
Export China	-2.47E-05	0	-0.261	-3.289	0.003	-0.889	-0.521	-0.087
Trade Balance China	6.82E-06	0	0.129	2.587	0.015	0.73	0.433	0.068

Note. A standard multiple regression was conducted to examine the relationship between predictors of macro-economy factors with the outcome USD/CNY in quarterly from 2005 to 2014. The model indicated that GDP, Inflation rate, Public Debt, Trade Balance and Export significantly predict the outcome: exchange rate USD/CNY (p-value <0.05).

Table 5. Residual result of the multiple regression of USD/CNY

Residuals Statistics					
	Minimum	**Maximum**	**Mean**	**Std. Deviation**	**N**
Predicted Value	5.941669	8.279169	6.944563	.7086831	40
Std. Predicted Value	-1.415	1.883	.000	1.000	40
Standard Error of Predicted Value	.045	.094	.060	.013	40
Adjusted Predicted Value	5.834743	8.280347	6.945422	.7114616	40
Residual	-.2381982	.1973303	.0000000	.1017817	40
Std. Residual	-2.018	1.672	.000	.862	40
Stud. Residual	-2.399	2.076	-.004	1.006	40
Deleted Residual	-.3366477	.3042566	-.0008596	.1402226	40
Stud. Deleted Residual	-2.633	2.211	-.002	1.039	40
Mahal. Distance	4.626	23.627	9.750	4.950	40
Cook's Distance	.000	.216	.035	.051	40
Centered Leverage Value	.119	.606	.250	.127	40

Note. Maximum Cook's distance was 0.22 with a maximum standardized residual of 1.67 (from one subject) suggesting a relatively high level of accuracy of the regression model. The contributions of each predictor could be arranged as Public Debt > GDP > Export > Inflation > Balance.

4.2.2 The Effects of the Import Predictor on USD/CNY Exchange Rate

To explore the influences of the import predictor, the paper implemented the multiple regression with the method STEPWISE. The results of the multiple regressions in Table 6 indicate that four models could significantly explain the variances in USD/CNY exchange rate. These models also have p-values of ANOVA in Table 7 equal to 0 (p-value < 0.001). The STEPWISE multiple regression results in Table 8 also reveal that public debt, GDP, inflation and import have a significant impact statistically. The import is significant (p-value < 0.001) for the third and fourth model indicating that it is also a determinant of USD/CNY exchange rate.

Table 6. Model summary of STEPWISE multiple regression of USD/CNY

Model Summary									
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**	**Change Statistics**				
					R Square Change	**F Change**	**df1**	**df2**	**Sig. F Change**
1	.934[a]	.872	.868	.2597049	.872	258.398	1	38	.000
2	.957[b]	.917	.912	.2122543	.045	19.889	1	37	.000
3	.976[c]	.953	.949	.1617042	.036	27.749	1	36	.000
4	.987[d]	.974	.970	.1229963	.021	27.224	1	35	.000

Note. The result of multiple regression with the method STEPWISE indicated 4 models, which could significantly predict the outcome USD/CNY. These four models could reflect up to more than 90% the correlation between the observed values of the outcome USD/CNY, and the values predicted by the model. Moreover, the R Squares (effect size) are more than 87.2 % of the total variance of the predictors can be explained by the regression model.

Table 7. ANOVA result of STEPWISE multiple regression of USD/CNY

ANOVA						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	**Regression**	17.428	1	17.428	258.398	.000[b]
	Residual	2.563	38	.067		
	Total	19.991	39			
2	**Regression**	18.324	2	9.162	203.367	.000[c]
	Residual	1.667	37	.045		
	Total	19.991	39			
3	**Regression**	19.050	3	6.350	242.843	.000[d]
	Residual	.941	36	.026		
	Total	19.991	39			
4	**Regression**	19.462	4	4.865	321.613	.000[e]
	Residual	.529	35	.015		
	Total	19.991	39			

Note. These model also have p-values of ANOVA equal to 0 (p-value < 0.001).

Table 8. Coefficient result of STEPWISE multiple regression of USD/CNY

Coefficients									
Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**	**Correlations**		
		B	**Std. Error**	**Beta**			**Zero-order**	**Partial**	**Part**
1	**(Constant)**	10.180	.205		49.560	.000			
	PublicDebt	-3.953	.246	-.934	-16.075	.000	-.934	-.934	-.934
2	**(Constant)**	9.799	.188		52.034	.000			
	PublicDebt	-3.768	.205	-.890	-18.360	.000	-.934	-.949	-.872
	GPD	6.380	1.431	.216	4.460	.000	.396	.591	.212
3	**(Constant)**	9.844	.144		68.494	.000			
	PublicDebt	-2.535	.281	-.599	-9.007	.000	-.934	-.832	-.326
	GPD	7.930	1.129	.269	7.024	.000	.396	.760	.254
	ImportChina	-1.239E-05	.000	-.343	-5.268	.000	-.838	-.660	-.191
4	**(Constant)**	10.204	.129		78.947	.000			
	PublicDebt	-3.086	.239	-.729	-12.928	.000	-.934	-.909	-.356
	GPD	10.993	1.040	.372	10.568	.000	.396	.873	.291
	ImportChina	-9.886E-06	.000	-.274	-5.339	.000	-.838	-.670	-.147
	Inflation	-10.568	2.025	-.209	-5.218	.000	.403	-.661	-.144

Note. The STEPWISE multiple regression also highlighted the significant predictions and influences of Public Debt, GDP growth rate, Inflation and Import. Especially, the import predictor is significant (p-value < 0.001) for the third and fourth model with the relative contribution. It means that the import predictor is also a determinant to the fluctuations of the foreign exchange USD/CNY.

4.3 India

The assumption of variables type was met because the outcome USD/INR and 11 predictors are continuous. The independence of observation was also assumed. The assumption of Non-Zero variance was met because there are standard deviations of the predictors are unequal to 0. Based on the Figure 2, the assumption of Normally-distributed errors was met. Because the histogram followed the normal distribution and the Normal P-P plot followed a straight line.

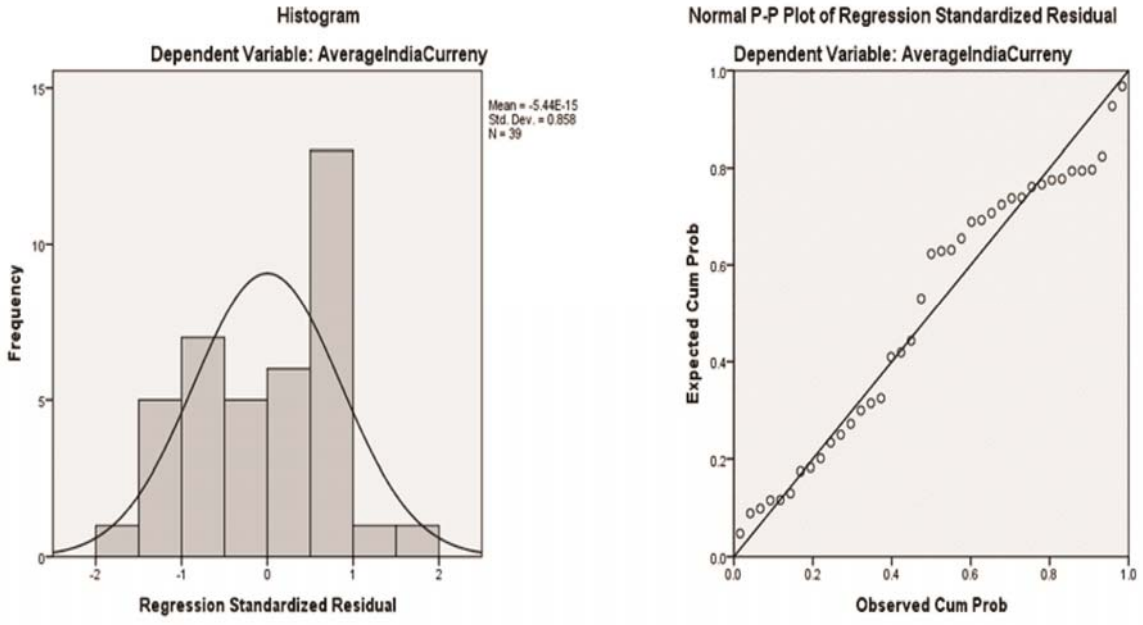

Figure 2. Histogram and normal P-P plot of the outcome USD/INR

Table 9 shows that long-term interest rate, short-term interest rate and trade balance have negative relationships with USD/INR exchange rate.

Table 9. Pearson correlations among variables of USD/INR

Correlations												
Pearson Correlations	**USD/ INR**	**Financial FDI India**	**Income FDI India**	**GPD**	**Inflation**	**Long**	**Short**	**Public Debt**	**Reserve**	**Trade Balance India**	**Import India**	**Export India**
USD/INR	1.000	-.240	.537	-.103	-.459	-.644	-.708	.796	.670	-.736	.778	.537
Financial FDI India	-.240	1.000	-.029	-.017	.126	.010	.043	-.063	-.100	.099	-.077	-.023
Income FDI India	.537	-.029	1.000	.006	-.134	-.740	-.759	.744	.758	-.521	.673	.600
GPD	-.103	-.017	.006	1.000	.605	.353	.224	-.170	-.082	-.379	.104	-.258

Inflation	-.459	.126	-.134	.605	1.000	.496	.366	-.435	-.352	.004	-.130	-.229
Long	-.644	.010	-.740	.353	.496	1.000	.859	-.911	-.899	.410	-.662	-.712
Short	-.708	.043	-.759	.224	.366	.859	1.000	-.900	-.849	.560	-.791	-.768
Public Debt	.796	-.063	.744	-.170	-.435	-.911	-.900	1.000	.955	-.648	.869	.804
Reserve	.670	-.100	.758	-.082	-.352	-.899	-.849	.955	1.000	-.598	.816	.769
Trade Balance India	-.736	.099	-.521	-.379	.004	.410	.560	INR	-.598	1.000	-.857	-.369
Import India	.778	-.077	.673	.104	-.130	-.662	-.791	.869	.816	-.857	1.000	.796
Export India	.537	-.023	.600	-.258	-.229	-.712	-.768	.804	.769	-.369	.796	1.000

Note. The foreign exchange USD/INR has strong relationship with the macro-economic factors: Interest rate (Long and Short), Public Debt, National Reserve, Trade Balance and Import. USD/INR also has a negative relationship with FDI (Financial, GDP, Inflation, Interest Rate and Trade Balance.

4.3.1 Macro-economic Determinants to the USD/INR

Import is excluded from the multiple regression equation due to its too high VIF and Tolerance. As can be seen from Table 10, the regression model of 10 variables explains 86.2% (effect size) of the total variance in USD/INR exchange rate significantly. This indicates that selected macro-economic factors have 86.2% of explanatory power on USD/INR exchange rate.

Table 10. Model summary and ANOVA of multiple regression of USD/INR

Model Summary				**ANOVA**					
R	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**	**Model**	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
.929[a]	.862	.813	2.9173454	Regression	1491.492	10	149.149	17.524	.000[b]
				Residual	238.305	28	8.511		
				Total	1729.798	38			

Note. The multiple regression model with the method ENTER reflected 92.9% the correlation between the observed values of the fluctuations of USD/INR and the values predicted by the model for 10 years in quarterly. Besides, the regression model of 10 variables also explained 86.2% (effect size) of the total variance of the predictors.

According to results from Table 11 and 12, financial FDI, public debt, national reserve, trade balance have a significant impact on USD/INR exchange rate (p-value <0.05). Financial FDI has statistically significantly negatively related to USD/INR exchange rate, β = -0.19, t (37) = -2.53, $p < 0.05$. Trade Balance has statistically significantly negatively effect on the exchange

rate of USD/INR, β = -0.44, t (37) = -2.81, $p < 0.05$. Public debt is statistically significantly positively related to USD/INR exchange rate, β = 1.26, t (37) = 2.76, $p < 0.05$. National reserve has a statistically significantly negatively effect on USD/INR exchange rate, β = -0.91, t (37) = -3.03, $p < 0.05$. Maximum Cook's distance from Table 12 is 0.23 with a maximum standardized residual of 1.85 (from one subject) suggesting that there is a relatively high level of accuracy in the regression model.

Table 11. Coefficient result of the multiple regression of USD/INR

Coefficients								
Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**	**Correlations**		
	B	**Std. Error**	**Beta**			**Zero-order**	**Partial**	**Part**
(Constant)	23.335	12.737		1.832	.078			
FinancialIndia	-.005	.002	-.187	-2.526	.017	-.240	-.431	-.177
IncomeIndia	.003	.018	.018	.146	.885	.537	.028	.010
GPD	-3.632	36.198	-.013	-.100	.921	-.103	-.019	-.007
Inflation	-84.818	56.340	-.178	-1.505	.143	-.459	-.274	-.106
Long	-21.880	89.109	-.067	-.246	.808	-.644	-.046	-.017
Short	18.628	121.376	.028	.153	.879	-.708	.029	.011
PublicDebt	50.509	18.321	1.257	2.757	.010	.796	.462	.193
Reserve	.001	.001	-.907	-3.027	.005	.670	-.497	-.212
BalanceIndia	-.002	.001	-.436	-2.815	.009	-.736	-.470	-.197
ExportIndia	.001	.001	-.021	-.134	.894	.537	-.025	-.009

Note. A standard multiple regression was conducted to examine the relationship between predictors of macro-economy factors with the outcome USD/INR in quarterly from 2005 to 2014. The model indicated that Financial FDI, Public Debt, National Reserve and Trade Balance significantly predict the outcome: exchange rate USD/INR (p-value <0.05).

Table 12. Residual result of the multiple regression of USD/INR

Residuals Statistics					
	Minimum	**Maximum**	**Mean**	**Std. Deviation**	**N**
Predicted Value	38.413094	61.938473	48.969474	6.2649657	39
Std. Predicted Value	-1.685	2.070	.000	1.000	39
Standard Error of Predicted Value	1.128	2.392	1.524	.284	39
Adjusted Predicted Value	36.072819	62.519463	48.784856	6.6140403	39
Residual	-4.8598824	5.3924074	.0000000	2.5042350	39
Std. Residual	-1.666	1.848	.000	.858	39
Stud. Residual	-1.996	2.004	.024	1.004	39
Deleted Residual	-6.9781394	6.3404737	.1846182	3.4955071	39
Stud. Deleted Residual	-2.117	2.127	.021	1.023	39
Mahal. Distance	4.708	24.579	9.744	4.248	39
Cook's Distance	.000	.234	.038	.047	39
Centered Leverage Value	.124	.647	.256	.112	39

Note. Maximum Cook's distance was 0.23 with a maximum standardized residual of 1.85 (from one subject) suggesting a relatively high level of accuracy of the regression model.

4.3.2 The Effects of the Import Predictor to the Outcome USD/INR

To explore the influences of the import predictor, the paper implements the multiple regressions with the STEPWISE method. The results the multiple regression model in in Table 13 indicate five models could significantly affect USD/INR exchange rate. These five models could reflect up to more than 79.6% the correlation between the observed values of the outcome USD/INR exchange rate and the values predicted by the model. The R-Squares (effect size) are more than 63.4 % of the total variance in USD/INR exchange rates can be explained by the macro-economic factors. These models also have p-values of ANOVA in Table 14 equal to 0 (p-value < 0.001). The STEPWISE multiple regressions in Table 15 also show that public debt, national reserve, trade balance, financial FDI and inflation have a significant impact on USD/INR exchange rate.

Table 13. Model summary of STEPWISE multiple regression of USD/INR

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.796[a]	.634	.624	4.1393117
2	.853[b]	.727	.712	3.6233566
3	.891[c]	.795	.777	3.1850043
4	.916[d]	.839	.821	2.8576753
5	.928[e]	.861	.840	2.6979151

Note. The result of multiple regression with the method STEPWISE indicated 5 models, which could significantly predict the outcome USD/INR. These four models could reflect up to more than 79.6% the correlation between the observed values of the outcome USD/INR, and the values predicted by the model. Moreover, the R Squares (effect size) are more than 63.4 % of the total variance of the predictors can be explained by the regression model.

Table 14. ANOVA result of STEPWISE multiple regression of USD/INR

ANOVA						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	**Regression**	1095.843	1	1095.843	63.958	.000[b]
	Residual	633.954	37	17.134		
	Total	1729.798	38			
2	**Regression**	1257.164	2	628.582	47.878	.000[c]
	Residual	472.634	36	13.129		
	Total	1729.798	38			
3	**Regression**	1374.749	3	458.250	45.173	.000[d]
	Residual	355.049	35	10.144		
	Total	1729.798	38			
4	**Regression**	1452.143	4	363.036	44.455	.000[e]
	Residual	277.654	34	8.166		
	Total	1729.798	38			
5	**Regression**	1489.599	5	297.920	40.930	.000[f]
	Residual	240.199	33	7.279		
	Total	1729.798	38			

Note. These model also have p-values of ANOVA equal to 0 (p-value < 0.001).

Table 15. Coefficient result of STEPWISE multiple regression of USD/INR

Coefficients									
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	22.621	3.361		6.731	.000			
	PublicDebt	31.987	4.000	.796	7.997	.000	.796	.796	.796
2	(Constant)	11.688	4.287		2.726	.010			
	PublicDebt	71.733	11.867	1.785	6.045	.000	.796	.710	.527
	Reserve	.000	.000	-1.035	-3.505	.001	.670	-.504	-.305
3	(Constant)	15.047	3.896		3.863	.000			
	PublicDebt	59.492	11.033	1.480	5.392	.000	.796	.674	.413
	Reserve	.000	.000	-.950	-3.642	.001	.670	-.524	-.279
	BalanceIndia	-.001	.000	-.344	-3.405	.002	-.736	-.499	-.261
4	(Constant)	15.333	3.497		4.385	.000			
	PublicDebt	63.702	9.993	1.585	6.374	.000	.796	.738	.438
	Reserve	.000	.000	-1.056	-4.466	.000	.670	-.608	-.307
	BalanceIndia	-.001	.000	-.318	-3.498	.001	-.736	-.514	-.240
	FinancialIndia	-.006	.002	-.215	-3.079	.004	-.240	-.467	-.212
5	(Constant)	22.575	4.592		4.916	.000			
	PublicDebt	50.804	11.016	1.264	4.612	.000	.796	.626	.299
	Reserve	.000	.000	-.875	-3.688	.001	.670	-.540	-.239
	BalanceIndia	-.002	.000	-.420	-4.335	.000	-.736	-.602	-.281
	FinancialIndia	-.005	.002	-.183	-2.707	.011	-.240	-.426	-.176
	Inflation	-91.717	40.431	-.192	-2.268	.030	-.459	-.367	-.147

Note. The STEPWISE multiple regression also highlighted the significant predictions and influences of Public Debt, National Reserve, Inflation, Trade Balance and Financial FDI. Especially, the import predictor is not significant, but inflation is significant for the fifth model with the relative contribution. It means that inflation is also a determinant to the fluctuations of the foreign exchange USD/INR.

4.4 Brazil

As can be seen from Figure 3, the assumption of variables type was met because the outcome USD/BRL and 11 predictors are continuous. The independence of observation was also assumed. The assumption of Non-Zero variance was met because there are standard deviations of the predictors are unequal to 0. In addition, the assumption of Normally-distributed errors was met. Because the histogram followed the normal distribution and the Normal P-P plot followed a straight line.

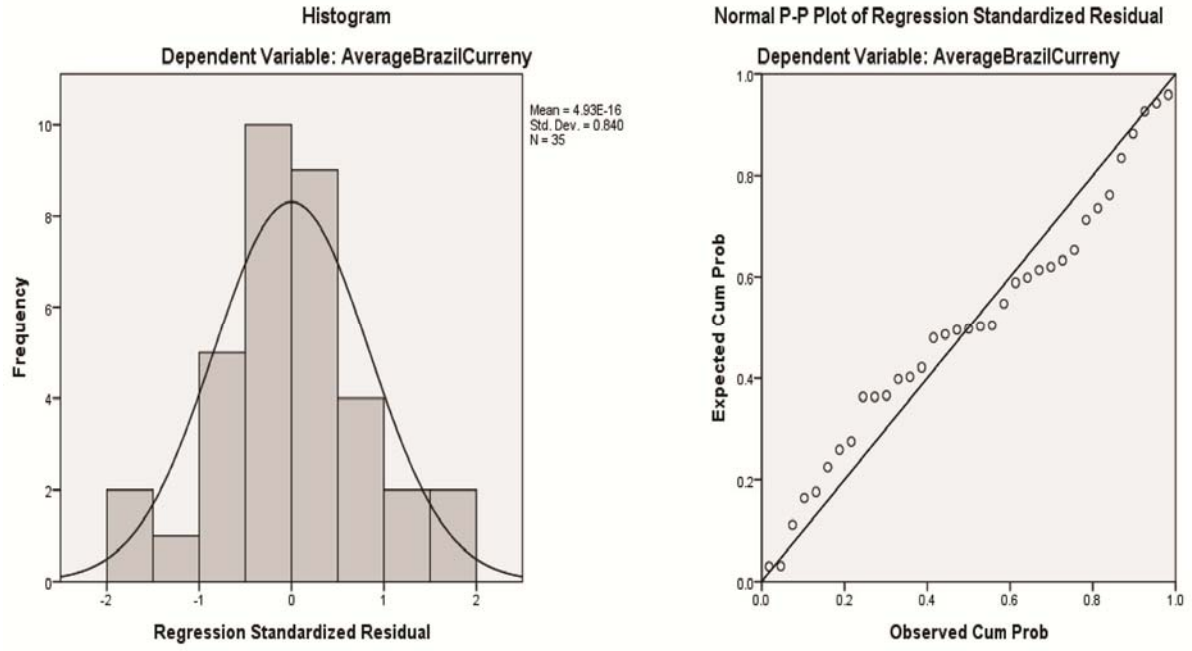

Figure 3. Histogram and normal P-P plot of the outcome USD/BRL

4.4.1 Relationships among Variables

Table 16 shows that macro-economic factors have low correlations with USD/BRL exchange rate. Most of them have negative relationship with the exchange rate except inflation, income FDI and interest rate.

Table 16. Pearson correlations among variables of USD/BRL

Correlations												
	USD/BRL	**Financial FDI Brazil**	**Income FDI Brazil**	**GPD**	**Inflation**	**Long**	**Short**	**Public Debt**	**Reserve**	**Trade Balance Brazil**	**Import Brazil**	**Export Brazil**
USD/BRL	1.000	-.270	.165	.227	-.048	.273	.149	-.243	-.356	-.379	-.149	-.375
Financial FDI Brazil	-.270	1.000	-.077	.164	.261	-.114	.113	.042	.179	.033	.025	.037
Income FDI Brazil	.165	-.077	1.000	.093	.093	-.202	-.284	.302	.223	.315	.223	.351
GPD	.227	.164	.093	1.000	.695	.381	.248	-.207	-.113	-.330	.320	-.146
Inflation	-.048	.261	.093	.695	1.000	.527	.410	-.425	-.342	-.441	.417	-.198
Long	.273	-.114	-.202	.381	.527	1.000	.858	-.912	-.897	-.863	-.148	-.776
Short	.149	.113	-.284	.248	.410	.858	1.000	-.904	-.842	-.826	-.392	-.843

Public Debt	-.243	.042	.302	-.207	-.425	-.912	-.904	1.000	.950	.925	.370	.916
Reserve	-.356	.179	.223	-.113	-.342	-.897	-.842	.950	1.000	.883	.370	.882
Trade Balance Brazil	-.379	.033	.315	-.330	-.441	-.863	-.826	.925	.883	1.000	.225	.920
Import Brazil	-.149	.025	.223	.320	.417	-.148	-.392	.370	.370	.225	1.000	.588
Export Brazil	-.375	.037	.351	-.146	-.198	-.776	-.843	.916	.882	.920	.588	1.000

Note. The foreign exchange USD/BRL has weak relationship with the macro-economy factors. USD/BRL has a negative relationship with FDI (Financial), Inflation, Public Debt, National Reserve, Trade Balance, Import and Export.

4.4.2 Macro-economy Determinants to the USD/BRL

The multiple regression models exclude the trade balance predictor due to its too high VIF and Tolerance. The results from Table 17, 10 variables reflect 77% the correlation between the USD/BRL exchange rate and the macro-economic factors. The regression model with 10 variables also explains 59.3% (effect size) of the total variance in USD/BRL exchange rates. The regression model is statistically significant because p-value < 0.05.

Table 17. Model summary and ANOVA of multiple regression of USD/BRL

Model Summary				**ANOVA**					
R	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
.770[a]	.593	.424	.2078420	Regression	1.514	10	.151	3.504	.006[b]
				Residual	1.037	24	.043		
				Total	2.550	34			

Note. The multiple regression model with the method ENTER reflected 77% the correlation between the observed values of the fluctuations of USD/BRL and the values predicted by the model for 10 years in quarterly. Besides, the regression model of 10 variables also explained 59.3% (effect size) of the total variance of the predictors.

Based on the results from Table 18 and 19, GDP growth rate is statistically significantly positively related to USD/BRL exchange rate, $\beta = 0.56$, $t\ (33) = 2.21$, $p < 0.05$. However, national reserve has a statistically significantly negatively impact on USD/BRL exchange rate, $\beta = -1.23$, $t\ (33) = -2.20$, $p < 0.05$. Maximum Cook's distance is 0.84 with a maximum standardized residual of 1.73 (from one subject) suggesting that there is a relatively high level of accuracy of the regression model.

Table 18. Coefficient result of the multiple regression of USD/BRL

Coefficients								
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
	B	Std. Error	Beta			Zero-order	Partial	Part
(Constant)	2.273	.973		2.337	.028			
Financial FDI Brazil	8.155E-06	.000	.030	.172	.865	-.270	.035	.022
Income FDI Brazil	.002	.001	.265	1.750	.093	.165	.336	.228
GPD	5.929	2.679	.557	2.213	.037	.227	.412	.288
Inflation	-10.974	5.933	-.556	-1.850	.077	-.048	-.353	-.241
Long	-2.116	6.798	-.156	-.311	.758	.273	-.063	-.041
Short	-9.017	9.797	-.336	-.920	.366	.149	-.185	-.120
Public Debt	1.696	1.236	1.032	1.372	.183	-.243	.270	.179
Reserve	-9.557E-06	.000	-1.232	-2.190	.038	-.356	-.408	-.285
Import Brazil	7.940E-05	.000	.325	1.310	.203	-.149	.258	.170
Export Brazil	-9.348E-05	.000	-.952	-1.775	.089	-.375	-.341	-.231

Note. A standard multiple regression was conducted to examine the relationship between predictors of macro-economy factors with the outcome USD/BRL in quarterly from 2005 to 2014. The model indicated that GDP and Import significantly predict the outcome: exchange rate USD/BRL (p-value <0.05).

Table 19. Residual result of the multiple regression of USD/BRL

Residuals Statistics					
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	1.564037	2.411451	2.054457	.2109983	35
Std. Predicted Value	-2.324	1.692	.000	1.000	35
Standard Error of Predicted Value	.078	.169	.114	.024	35
Adjusted Predicted Value	1.534518	2.553813	2.066836	.2423713	35
Residual	-.3927003	.3606406	.0000000	.1746222	35
Std. Residual	-1.889	1.735	.000	.840	35
Stud. Residual	-2.791	1.925	-.023	1.046	35
Deleted Residual	-.8568132	.4894379	-.0123789	.2771551	35
Stud. Deleted Residual	-3.324	2.049	-.037	1.128	35
Mahal. Distance	3.846	21.637	9.714	4.544	35
Cook's Distance	.000	.837	.061	.148	35
Centered Leverage Value	.113	.636	.286	.134	35

Note. Maximum Cook's distance was 0.84 with a maximum standardized residual of 1.73 (from one subject) suggesting a relatively high level of accuracy of the regression model.

4.4.3 The Effects of the Trade Balance on USD/BRL Exchange Rate

To examine the influences of the trade balance on USD/BRL exchange rate, the paper uses the multiple regressions with STEPWISE method. The results from Table 21 show that only one model could significantly affect USD/BRL exchange rate and it explains 37.9% of the correlation between USD/BRL exchange rate and the macro-economic factors. Only 14.4 % of the total variance in USD/BRL exchange can be explained by the macro-economic factors. This model also has p-value of ANOVA < 0.05 in Table 20. The STEPWISE multiple regression in Table 20 also reveal that the trade balance has a significant impact in USD/BRL exchange rate with the p-value < 0.05.

Table 20. Model summary and ANOVA of STEPWISE multiple regression of USD/BRL

Model Summary					ANOVA				
R	R Square	Adjusted R Square	Std. Error of the Estimate		Sum of Squares	df	Mean Square	F	Sig.
.379[a]	.144	.118	.2572086	Regression	.367	1	.367	5.552	.025[b]
				Residual	2.183	33	.066		
				Total	2.550	34			

Note. The result of multiple regression with the method STEPWISE indicated only 1 model, which could significantly predict the outcome USD/BRL. These four models could reflect 37.9% the correlation between the observed values of the outcome USD/BRL, and the values predicted by the model. Moreover, the R Squares (effect size) are 14.4% of the total variance of the predictors can be explained by the regression model. This model also have p-value of ANOVA significant (< 0.05)

Table 21. Coefficient result of STEPWISE multiple regression of USD/BRL

Coefficients									
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	2.121	.052		40.971	.000			
	Trade Balance Brazil	-4.488E-05	.000	-.379	-2.356	.025	-.379	-.379	-.379

Note. The STEPWISE multiple regression also highlighted the significant prediction and influence of Trade Balance predictor. Especially, the trade balance predictor is significant (p-value < 0.05), which indicated that Trade Balance is also a determinant to the foreign exchange USD/BRL.

4.5 Mexico

The assumption of variables type was met because the outcome USD/MXN and 11 predictors are continuous. The independence of observation was also assumed. The assumption of Non-Zero variance was met because there are standard deviations of the predictors are unequal to 0. Based on the Figure 4, the assumption of Normally-distributed errors was met. Because the histogram followed the normal distribution and the Normal P-P plot followed a straight line.

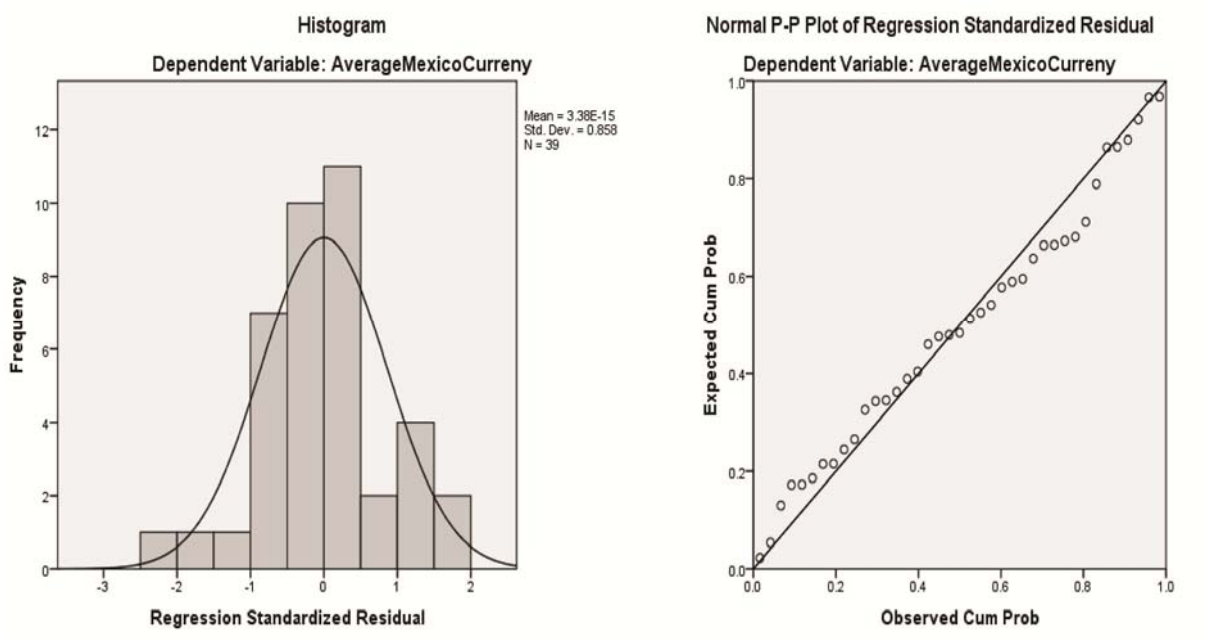

Figure 4. Histogram and normal P-P plot of the outcome USD/MXN

4.5.1 Relationships among Variables

Table 22 shows that inflation rate, long-term interest rate, short-term interest rate, public debt and national reserve ($-0.6 < x < 0.6$) have strong correlations with USD/MXN exchange rate. Specifically, inflation rate and interest rate have negative relationships with USD/MXN exchange rate.

Table 22. Pearson correlations among variables of USD/MXN

Correlations												
Pearson Correlation	**USD/ MNX**	**Financial FDI Mexico**	**Income FDI Mexico**	**GPD**	**Inflation**	**Long**	**Short**	**Public Debt**	**Reserve**	**Trade Balance Mexico**	**Import Mexico**	**Export Mexico**
USD/MNX	1.000	.057	.436	-.495	-.719	-.806	-.779	.797	.705	.471	.427	.542
Financial FDI Mexico	.057	1.000	.270	.059	.005	-.099	-.117	.121	.133	-.131	.184	.156
Income FDI Mexico	.436	.270	1.000	-.025	-.028	-.595	-.662	.752	.741	-.154	.806	.781
GPD	-.495	.059	-.025	1.000	.605	.353	.224	-.170	-.082	-.345	.190	.112
Inflation	-.719	.005	-.028	.605	1.000	.496	.366	-.435	-.352	-.534	.001	-.124
Long	-.806	-.099	-.595	.353	.496	1.000	.859	-.911	-.899	-.372	-.587	-.682
Short	-.779	-.117	-.662	.224	.366	.859	1.000	-.900	-.849	-.286	-.720	-.797
Public Debt	.797	.121	.752	-.170	-.435	-.911	-.900	1.000	.955	.236	.823	.890
Reserve	.705	.133	.741	-.082	-.352	-.899	-.849	.955	1.000	.154	.788	.835
Trade Balance Mexico	.471	-.131	-.154	-.345	-.534	-.372	-.286	.236	.154	1.000	-.174	.057
Import Mexico	.427	.184	.806	.190	.001	-.587	-.720	.823	.788	-.174	1.000	.973
Export Mexico	.542	.156	.781	.112	-.124	-.682	-.797	.890	.835	.057	.973	1.000

Note. The foreign exchange USD/MXN has strong relationship with Inflation rate, Long-term interest rate, Short-term interest rate, Public Debt and National Reserve ($-0.6 < x < 0.6$). USD/MXN also has a negative relationship with GDP, Inflation and Interest Rate (Long and Short).

4.5.2 Macro-economy Determinants to the USD/MXN

The multiple regression equation excludes the import due to its too high VIF and Tolerance. According to Table 23, the model explains 87.6% (effect size) of the total variance in USD/MXN exchange rate. The model is statistically significant with p-value = 0 (< 0.001).

Table 23. Model summary and ANOVA of multiple regression of USD/MXN

Model Summary				ANOVA					
R	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
.936[a]	.876	.831	.4648864	Regression	42.686	10	4.269	19.751	.000[b]
				Residual	6.051	28	.216		
				Total	48.737	38			

Note. The multiple regression model with the method ENTER reflected 93.6% the correlation between the observed values of the fluctuations of USD/MXN and the values predicted by the model for 10 years in quarterly. Besides, the regression model of 10 variables also explained 87.6% (effect size) of the total variance of the predictors.

From Table 24, public debt and export have a statistically significant impact USD/MXN exchange rate with p-value <0.05. Public debt is statistically significantly positively related to USD/MXN exchange rate, $\beta = 1.63$, $t(37) = 2.84$, $p < 0.05$. Export has statistically

significantly negatively impact USD/MXN exchange rate, $\beta = -0.60$, $t(37) = -2.16$, $p < 0.05$. Maximum Cook's distance is 0.30 with a maximum standardized residual of 2.07 (from one subject) suggesting that there is a relatively high level of accuracy in the regression model.

Table 24. Coefficient result of the multiple regression of USD/MXN

Coefficients								
	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
	B	Std. Error	Beta			Zero-order	Partial	Part
(Constant)	8.809	2.416		3.646	.001			
FinancialMexico	3.879E-05	.000	.037	.515	.611	.057	.097	.034
IncomeMexico	.000	.001	-.099	-.692	.495	.436	-.130	-.046
GPD	-6.128	5.327	-.130	-1.150	.260	-.495	-.212	-.077
Inflation	-10.553	11.521	-.132	-.916	.367	-.719	-.171	-.061
Long	19.865	16.245	.362	1.223	.232	-.806	.225	.081
Short	-33.306	18.534	-.297	-1.797	.083	-.779	-.322	-.120
PublicDebt	10.994	3.876	1.630	2.837	.008	.797	.472	.189
Reserve	-9.047E-06	.000	-.284	-.988	.332	.705	-.184	-.066
BalanceMexico	3.929E-05	.000	.088	.939	.356	.471	.175	.063
ExportMexico	-6.192E-05	.000	-.596	-2.157	.040	.542	-.377	-.144

Note. A standard multiple regression was conducted to examine the relationship between predictors of macro-economy factors with the outcome USD/MXN in quarterly from 2005 to 2014. The model indicated that Public Debt and Export significantly predict the outcome: exchange rate USD/MXN (p-value <0.05).

Table 25. Residual result of the multiple regression of USD/MXN

Residuals Statistics					
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	10.534721	13.846875	12.208577	1.0598636	39
Std. Predicted Value	-1.579	1.546	.000	1.000	39
Standard Error of Predicted Value	.151	.389	.241	.055	39
Adjusted Predicted Value	10.349805	14.228850	12.212921	1.0515243	39
Residual	-.9325971	.8615537	.0000000	.3990562	39
Std. Residual	-2.006	1.853	.000	.858	39
Stud. Residual	-2.333	2.070	-.003	1.011	39
Deleted Residual	-1.2612948	1.1340175	-.0043436	.5659148	39
Stud. Deleted Residual	-2.552	2.209	-.001	1.049	39
Mahal. Distance	3.056	25.571	9.744	5.170	39
Cook's Distance	.000	.296	.041	.064	39
Centered Leverage Value	.080	.673	.256	.136	39

Note. Maximum Cook's distance was 0.30 with a maximum standardized residual of 2.07 (from one subject) suggesting a relatively high level of accuracy of the regression model.

4.5.3 The Effects of the Import USD/MXN Exchange Rate

To investigate the impact of the import in USD/MXN exchange rate, the paper implements the multiple regressions with STEPWISE method. The results from Table 26 four multiple regression models could statistically significantly predict USD/MNX exchange rate. These

models could reflect up to more than 80.6% the correlation between USD/MXN exchange rate and the macro-economic factors. In addition, 64.9% of the total variance in USD/MXN exchange rate can be explained by the macro-economic factors. This model also has p-values of ANOVA in Table 27 = 0 (< 0.001). The STEPWISE multiple regressions in Table 27 the import is not a determinant of USD/MXN exchange rate fluctuations.

Table 26. Model summary of STEPWISE multiple regression of USD/MNX

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.806[a]	.649	.639	.6800452
2	.886[b]	.784	.772	.5403391
3	.913[c]	.834	.819	.4812739
4	.908[d]	.825	.815	.4873709

Note. The result of multiple regression with the method STEPWISE indicated 4 models, which could significantly predict the outcome USD/MNX. These four models could reflect up to more than 80.6% the correlation between the observed values of the outcome USD/MNX, and the values predicted by the model. Moreover, the R Squares (effect size) are more than 64.9 % of the total variance of the predictors can be explained by the regression model.

Table 27. ANOVA of STEPWISE multiple regression of USD/MNX

ANOVA						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	**Regression**	31.626	1	31.626	68.386	.000[b]
	Residual	17.111	37	.462		
	Total	48.737	38			
2	**Regression**	38.226	2	19.113	65.464	.000[c]
	Residual	10.511	36	.292		
	Total	48.737	38			
3	**Regression**	40.630	3	13.543	58.471	.000[d]
	Residual	8.107	35	.232		
	Total	48.737	38			
4	**Regression**	40.186	2	20.093	84.591	.000[e]
	Residual	8.551	36	.238		
	Total	48.737	38			

Note. These model also have p-values of ANOVA equal to 0 (p-value < 0.001).

Table 28. Coefficient result of STEPWISE multiple regression of USD/MNX

Coefficients									
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	13.006	.145		89.414	.000			
	Long	-44.260	5.352	-.806	-8.270	.000	-.806	-.806	-.806
2	(Constant)	13.565	.165		82.282	.000			
	Long	-32.697	4.899	-.595	-6.674	.000	-.806	-.744	-.517
	Inflation	-33.971	7.145	-.424	-4.755	.000	-.719	-.621	-.368
3	(Constant)	14.860	.428		34.726	.000			
	Long	-11.084	8.003	-.202	-1.385	.017	-.806	-.228	-.095
	Inflation	-36.766	6.423	-.459	-5.724	.000	-.719	-.695	-.395
	Short	-49.080	15.235	-.438	-3.222	.003	-.779	-.478	-.222
4	(Constant)	15.321	.272		56.291	.000			
	Inflation	-40.159	6.012	-.501	-6.679	.000	-.719	-.744	-.466
	Short	-66.767	8.411	-.596	-7.938	.000	-.779	-.798	-.554

Note. The STEPWISE multiple regression also highlighted the significant predictions and influences of Long-term, Short-term Interest Rate and Inflation. Especially, the import predictor is not significant, interest rate and inflation are significant for 4 models with the high contribution. It means that the interest rate and inflation are also determinants to the fluctuations of the foreign exchange USD/MNX.

5. Conclusion

This study examines the impact of macro-economic factors on the foreign exchange rates between USA and four big emerging countries, India, Mexico, Brazil and China for the period of 2005 to 2014 by using Enter and Stepwise multiple regression methods.

The multiple regression results with the type I error to examine determinants of USD/CNY, USC/INR, USD/BRL and USD/MNX exchange rates from January 2005 to December 2014. The results reveal that GDP, inflation, public debt and international trade have statistically significant impact USD/CNY exchange rate and ENTER method suggests that 98% of total variances in USD/CNY exchange rate can be explained by the macro-economic factors. STEPWISE method suggests 4 significant models.

On the other hand, financial FDI, public debt, national reserve, trade balance and inflation statistically significant effect on USD/INR exchange rate and ENTER method reveal that 86.2% of variances in USD/INR exchange rate can be explained by the macro-economic factors.

GDP growth rate, national reserve and trade balance statistically significant impact on USD/BRL exchange rate. The macro-economic factors explain the 59.3% of total variance in USD/BRL exchange rate. STEPWISE method suggests only one significant model. Lastly, public debt, export, interest rate (Long and Short) and inflation have statistically significant

impact in USD/MNX exchange rate. ENTER method reveal that 87.6% of total variance in USD/MXN can be explained by the macro-economic factors. STEPWISE method suggests 4 significant models. All of the ANOVA results with the type I error as 0.05 are significant with p-values < 0.05. Therefore, it is crucial to emphasize that the macroeconomic policies have to be implemented in order to stabilize and reduce the exchange rates volatilities.

An interesting extension of this research would be to study the impact of the macro-economic factors on the different countries. In addition, the impact of other macro-economic factors on exchange rates can be examined. This question, though intriguing, is left for future research.

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