Has the Currency Swap Arrangement Affected the Value of Yuan?

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Abstract

The world economy was hit by a series of external shocks, such as, the devaluation of the Chinese renminbi and Japanese yen, the raising of interest rate by the U.S. Federal Reserve, and the sharp decline in semiconductor prices in the mid-1990s. The shocks plunged the economy of several Asian countries into a full-blown financial crisis. While the raising of interest rate by the U.S. made the U.S. a more attractive investment destination relative to these countries that had currencies pegged to the U.S. dollar, the rise in the value of the U.S. dollar due to short-term capital inflow these countries' exports more expensive and less competitive in the global markets leading to a dramatic slowdown of exports and a sharp deterioration of their current account position. China, on the other hand, sitting on the vast amounts of foreign currency reserves had an opportunity to enhance its capabilities of providing liquidity to world financial markets. This proper match of interest led to the birth of the so-called Chiang Mai Initiative. It is a multilateral currency swap arrangement among the ten members of the Association of Southeast Asian Nations, the People's Republic of China, Japan, and South Korea signed in 2009. Since a swap agreement can change the reserve composition of sovereign states changing, thereby, the dynamics of international capital movements along with the demand for an international currency, swap agreements have the potential of changing the relative values (exchange rates) of international currencies.

The purpose of this study, therefore, is to examine the effect of the currency swap agreement between China and Indonesia signed in 2009 on the exchange rate of Chinese yuan with Indonesian rupiah, which has never been done before. In our study, we develop a model, in which Chinese yuan's exchange rate with Indonesian rupiah – defined as the number of rupiahs needed to purchase one yuan – is a function of China's real GDP, Indonesia's real GDP, China's money supply, Indonesia's money supply, and a swap dummy that takes on a value of 1 for the years since China signed a swap agreement with Indonesia (i.e. 2009) and 0 for all preceding years. Our findings show that China's swap agreement with Indonesia has no effect on the exchange rate (value) of yuan.

Keywords: currency swap, settlement currency, store of wealth, real GDP, exchange rate.
JEL Classification: F3

I.   Introduction

In the mid-1990s, a series of external shocks, such as, the devaluation of the Chinese renminbi and Japanese yen, the raising of interest rate by the U.S. Federal Reserve, and the sharp decline in semiconductor prices led the economy of several Asian countries into a full-blown financial crisis. The top among them were South Korea, Indonesia, and Thailand that were experiencing an export-led economic growth. While the raising of interest rate by the U.S. made the U.S. a more attractive investment destination relative to these countries that had currencies pegged to the U.S. dollar, the rise in the value of the U.S. dollar due to short-term capital inflow these countries' exports more expensive and less competitive in the global markets leading to a dramatic slowdown of exports and a sharp deterioration of their current account position. In addition, the devaluation of renminbi and yen made the exports of these Asian nations even less competitive in the global market causing a further deterioration in their current account position. Moreover, the raising of interest rate by the U.S. led to the massive outflows of capital from these countries into the U.S. worsening their capital account

position. The worsening of both the current and the capital account created huge shortage of foreign exchanges they needed for their imports of raw materials for their export-oriented industries.

China, on the other hand, sitting on vast amounts of foreign currency reserves, had an opportunity to enhance its capabilities of providing liquidity to world financial markets. In addition, such an agreement would also help China secure the supplies of needed natural resources (e.g. oil and minerals) for its ever expanding industrial sector. This proper match of interest led to the birth of the so-called Chiang Mai Initiative. It is a multilateral currency swap arrangement among the ten members of the Association of Southeast Asian Nations, the People's Republic of China, Japan, and South Korea. By May, 2015, China had bilateral swap agreements with 31 countries.

Since a currency swap is an agreement between two trading partners to use each other's currency as a settlement currency it can change the reserve composition of sovereign states changing, thereby, the dynamics of international capital movements. Also, by changing the demand for an international currency, as a store of value, swap agreements also have the potential of changing the relative value of international currencies.

The purpose of this study, therefore, is to examine the effect of the currency swap agreement between China and Indonesia signed in 2009 on the exchange rate of Chinese yuan with Indonesian rupiah.

On the impact of a domestic policy on the value of the domestic currency there have been several studies. For example, Glick and Leduc (2013) have studied the effect of unconventional and conventional U.S. monetary policy on the dollar using intra-daily data and concluded that the U.S. credit easing does have effect on the value of the dollar and has the same effect as that of conventional U.S. monetary policy. Similarly, Adhikari (2016) has studied the impact of U.S. Federal Reserve's credit easing policy on the value of dollar and has concluded that this policy has negatively affected the dollar's exchange rate with Canadian dollar. There have also been several studies on the impact of a currency swap agreement on various aspects of domestic and global economy. For example, a study by Yelwa (2016) concludes that the currency swap between China and Nigeria will boost the Nigerian economy. However, Atkins (2016) indicates both the benefits and dangers of Nigeria's swap agreement with China. While he sees increased trade with China as the benefit, he sees political turmoil as the danger of swap agreements with China. Some researchers have dedicated their study on the motivation behind China's initiation of swap agreements. For example, Zhitao, Wenjie and Cheung (2016) in their study have tried to identify the determinants of China's bilateral local currency swap lines since the recent global financial crisis and have concluded that factors such as trade intensity, economic size, strategic partnership, free trade agreement, corruption, and stability affect the decision of signing a swap line agreement. A study on the reasons for the rise in swap agreements by Liao and McDowell (2015) has found that the ability to insulate the trading nations from international liquidity shocks and the advantage of reduced transaction costs of cross-border exchange are the major reasons. Durden (2014) has studied the impact of increasing use of swap lines on the value of U.S. dollar and argues that as many countries, through swap agreements, begin to reject the dollar due to the exported inflation that is growing in nations that are relegated to having to hold them for global oil purchases, alternatives such as the Chinese Yuan will become a more viable option. A study by Garcia-Herrero and Xia (2013) on the reason for the choice of swap agreements finds the gravity motif being the

predominant reason for the choice of swap agreements. An article by Alex VanNess (2014) in The Washington Times warns on the possible impact of China's swap agreements on U.S. economy and argues that China's swap agreements with other countries will make international community rely less and less on the dollar, eliminating the dollar's reserve currency status resulting in higher interest rates, a rise in prices, and a greater difficulty servicing the debts for the United States. But the article does not show the channel through which the swap agreements will impact the various aspects of U.S. economy. However, Murphy and Yuan (2009) see no immediate danger to the dollar from China's currency swap agreements. To them, United States is still the number one destination for Chinese exports and transactions are still denominated in dollars. Therefore, China will continue to build its dollar reserves. And given its vast holdings and limited investment options, Beijing has little choice but to continue to support the U.S. dollar.

Thus, none of these studies examine the impact of China's swap agreement with other countries on the value of its currency. This study, therefore, attempts to examine the impact of China's swap agreement with Indonesia on the Chinese yuan's exchange rate with Indonesian rupiah, which will be a net addition to the contemporary literature. In our study, we develop a model, in which Chinese yuan's exchange rate with Indonesian rupiah – defined as the number of rupiahs needed to purchase one yuan – is a function of China's real GDP, Indonesia's real GDP, China's money supply, Indonesia's money supply, and a swap dummy.

Our study has been organized as following: the model is laid out in section II, the methodology in section III, the data source in section IV, the empirical findings in section V, and the conclusion of the study in section VI.

II.   The Model
In our model, we make use of the Fisher equation, which is given as,

$$MV = PY \tag{1}$$

Here M is the quantity of money, V is the velocity of money defined as the number of times a dollar bill is used in purchasing goods and services, P is the price level, and Y is the real output (gross domestic product, GDP). Dividing both sides by Y yields,

$$P = \frac{MV}{Y} \tag{2}$$

Since the relationship shown in equation (2) also holds for any other country, equation (2) for a foreign country (Indonesia) can be written as,

$$P^* = \frac{M^* V^*}{Y^*} \tag{3}$$

Dividing equation (2) by (3) yields,

$$\frac{P}{P^*} = \frac{MVY^*}{M^*V^*Y} \tag{4}$$

Next, we make use of the purchasing power parity equation of exchange rate determination with no transportation costs, tariffs, and other trade restrictions, which is represented as,

$$e = \frac{P}{P^*} \tag{5}$$

That is, the exchange rate between the currencies of any two countries is equal to the relative price in the two countries. Here e is the exchange rate of the domestic currency (e.g. Chinese yuan) with a foreign currency (e.g. Indonesian rupiah) – expressed as the number of rupiahs needed to purchase one yuan, – P is the domestic price level (price level in China), and P^* is the foreign price level (price level in Indonesia). Substituting equation (4) into (5) yields,

$$e = \frac{MVY^*}{M^*V^*Y} \tag{6}$$

Taking natural logarithmic of equation (6) yields,

$$lne = lnM + lnV + lnY^* - lnM^* - lnV^* - lnY \tag{7}$$

If velocities of money are assumed to be constant, so that $lnV - lnV^* = \alpha_0$, a constant, then equation (7) can be rewritten as,

$$lne = \alpha_0 + lnM + lnY^* - lnM^* - lnY \tag{8}$$

III.   Methodology
In stochastic and estimable form with time subscript, equation (8) can be rewritten as,

$$lne_t = \alpha_0 + \alpha_1 lnM_t + \alpha_2 lnY_t^* + \alpha_3 lnM_t^* + \alpha_4 lnY_t + u_t \tag{9}$$

Next, in order to analyze the effect of China's currency swap agreement with Indonesia on the exchange rate of yuan with respect to rupiah, we introduce a swap dummy (S_t) in equation (9), which takes on a value of 1 for the years since the year China signed a swap agreement with Indonesia (i.e. 2009) and a value of 0 for all preceding years. So, we will estimate the following equation with the policy dummy (S_t) included in equation (9):

$$lne_t = \alpha_0 + \alpha_1 lnM_t + \alpha_2 lnY_t^* + \alpha_3 lnM_t^* + \alpha_4 lnY_t + \alpha_5 S_t + u_t \tag{10}$$

The sign of α_1 is expected to be negative, because when domestic money supply (lnM_t) rises, the interest rate at home falls, causing a capital outflow and thereby forcing the exchange rate of domestic currency (lne_t) to fall. On the contrary, the sign of α_3 is expected to be positive, because when foreign money supply (lnM_t^*) rises, the interest rate there falls, causing a capital outflow from the foreign country and into the domestic country, and thereby forcing the exchange rate of domestic currency (lne_t) to rise. Similarly, the sign of α_4 is expected to be positive, because when domestic real output (lnY_t) rises, the transaction demand for money rises causing the interest rate at home to rise, which, in turn, causes a capital inflow and thereby forcing the exchange rate of domestic currency (lne_t) to rise. On the contrary, the sign of α_2 is expected to be negative, because when the foreign real output (lnY_t^*) rises, the transaction demand for money in the foreign country rises also, causing the interest rate in the foreign country to rise, which, in turn, causes a capital inflow into the foreign country and out of the domestic country, thereby forcing the exchange rate of domestic currency (lne_t) to fall. Since the purpose of this study is the examine the effect of China's swap agreement with Indonesia on the exchange rate of Chinese yuan with respect to Indonesian rupiah, our interest is in the sign and significance of the coefficient α_5. If α_5 turns out to be positive

(negative) and significant, we will conclude that the swap agreement has raised (lowered) the value (the exchange rate of) of yuan with respect to rupiah.

IV.   Data

We use the data on China's real GDP and money supply, Indonesia's real GDP and money supply, and the exchange rate of Chinese yuan with respect U.S. dollar and that of Indonesian rupiah with respect to U.S. dollar over the period, 1999 – 2015, obtained from the World Development Indicators, 2016. We then compute the cross exchange rate of Chinese yuan with respect to Indonesian rupiah as the ratio of the exchange rate of Chinese yuan with respect to U.S. dollar to the exchange rate of Indonesian rupiah with respect to U.S. dollar. The money supply for both China and Indonesia is defined as M2 (Money and quasi money in local currency unit).

V.   Empirical Findings

We estimated equation (9) using the ordinary least square technique and obtained the following equation:

$$lne_t = -69.03 - 2.57lnM_t + 5.14lnY_t^* + 0.37lnM_t^* - 0.02lnY_t + 0.37S_t \qquad (10)$$
$$(-2.19) \quad (-2.03) \qquad (1.77) \qquad (0.52) \qquad (-0.02) \qquad (1.60)$$

R^2 = 0.9303; F-statistics = 29.3575; Prob. (F-stat.) = 0.000005;
Durbin-Watson Stat. = 1.8338

The numbers in the parentheses are corresponding t-statistics. The d_L and d_U for 17 observations and 5 slope coefficients are 0.481 and 1.847 respectively, while the actual D-W statistic (d) is 1.833802. Thus the actual D-W statistic is greater than the d_L but less than d_U, indicating the inconclusiveness of the test on the presence of the positive autocorrelation. On the other hand, (4 – d) is greater than d_U, indicating no presence of negative autocorrelation. Therefore, we can safely use our estimates, presented in equation (10), to interpret our findings. The p-value associated with the F-statistic shows that the model as a whole is significant. The corresponding t-statistics, given in the parentheses, show that, at 5% significance level, only variable that is significant is China's money supply, lnM_t. The negative sign associated with the variable, lnM_t, indicates that an increase (decrease) in China's money supply lowers (raises) the Chinese yuan's exchange rate with respect to Indonesian rupiah, which is as expected. However, our interest is in the swap dummy which has turned out to be positive but insignificant indicating that China's swap agreement with Indonesia has no effect on the exchange rate (value) of yuan. The positive sign is as expected, because Indonesia's imports from China dominate its exports to China by two-to-one (see Trading Economics, 2016) resulting in a higher demand for yuan in Indonesia than the demand for rupiah in China causing a rise in the value of yuan in terms of rupiah. The insignificance of the coefficient of the "swap" dummy could be the result of insufficiency of the data used in the study. This is because China signed a swap agreement with Indonesia only in March of 2009. So, the data only covers seven years post the signing of the agreement.

VI.   Summary and Conclusion

The world economy was hit by a series of external shocks in the mid-1990s, such as, the devaluation of the Chinese renminbi and Japanese yen, the raising of interest rate by the U.S. Federal Reserve, and the sharp decline in semiconductor prices. The shocks plunged the economy of several Asian countries into a full-blown financial crisis. The top among them

were South Korea, Indonesia, and Thailand. While the raising of interest rate by the U.S. made the U.S. a more attractive investment destination relative to these countries that had currencies pegged to the U.S. dollar, the rise in the value of the U.S. dollar due to short-term capital inflow made these countries' exports more expensive and less competitive in the global markets leading to a dramatic slowdown of exports and a sharp deterioration of their current account position. In addition, the devaluation of renminbi and yen made the exports of these Asian nations even less competitive in the global market causing a further deterioration in their current account position. Moreover, the massive outflows of capital from these countries into the U.S. caused by the raising of interest rate by the U.S. worsened their capital account position. The worsening of both current and capital account in these countries created huge shortages of foreign exchanges needed for their imports of raw materials to feed their export-oriented industries.

Sitting on vast amounts of foreign currency reserves, China, on the other hand, had an opportunity to enhance its capabilities of providing liquidity to world financial markets. In addition, such an agreement would also help China secure the supplies of needed natural resources (e.g. oil and minerals) for its ever expanding industrial sector. This proper match of interest led to the birth of the so-called Chiang Mai Initiative. It is a multilateral currency swap arrangement among the ten members of the Association of Southeast Asian Nations, the People's Republic of China, Japan, and South Korea. By May, 2015, China had bilateral swap agreements with 31 countries. These agreements allow two trading partners to use each other's currency as a settlement currency. A swap agreement, therefore, can change the reserve composition of sovereign states changing, thereby, the dynamics of international capital movements. Also, by changing the demand for an international currency, as a store of value, swap agreements also have the potential of changing the relative value (exchange rates) of international currencies.

There have been several studies on the impact of China's swap agreements but none have examined their impact on the relative value (exchange rate) of a currency. The purpose of this study, therefore, is to examine the effect of the currency swap agreement between China and Indonesia signed in 2009 on the exchange rate of Chinese yuan with Indonesian rupiah.

In our study, we develop a model, in which Chinese yuan's exchange rate with Indonesian rupiah – defined as the number of rupiahs needed to purchase one yuan – is a function of China's real GDP, Indonesia's real GDP, China's money supply, Indonesia's money supply, and a swap dummy that takes on a value of 1 for the years since China signed a swap agreement with Indonesia (i.e. 2009) and 0 for all preceding years.

Our findings show that, at 5% significance level, only variable that is significant is China's money supply, lnM_t. The negative sign associated with the variable, lnM_t, indicates that an increase (decrease) in China's money supply lowers (raises) the Chinese yuan's exchange rate with respect to Indonesian rupiah, which is as expected. However, our interest is in the swap dummy which has turned out to be positive but insignificant indicating that China's swap agreement with Indonesia has no effect on the exchange rate (value) of yuan. The positive sign seems plausible, because Indonesia's imports from China dominate its exports to China by two-to-one resulting in a higher demand for yuan in Indonesia than the demand for rupiah in China causing a rise in the value (exchange rate) of yuan in terms of rupiah. The insignificance of the coefficient of the "swap" dummy could be result of insufficiency of the data used in the study. This is because China signed a swap agreement with Indonesia only in March of 2009. So, the data only covers 7 years post the signing of the agreement.

References

Adhikari, D. R. (2016): Credit Easing and Value of Dollar, *International Research Journal of Applied Finance, January, 2016.*

Aizenman, J. Y. Jinjarak, and D. Park (2011): International Reserves and Swap Lines: Substitutes or Complements? *International Review of Economics and Finance,* Vol. 20, Issue 1, Jan. 2011, pp. 5-18.

Atkins, D. (2016): Benefits and Dangers of the Currency Swap Agreement Nigeria Had with China, *The Voltage Post,* April 27, 2016.

Durden, T. (2014): The March of Global De-dollarization Continues, *Political Vel Craft,* November 13, 2014.

Federal Reserve Bank of St. Louis (2016): Economic Research, https://fred.stlouisfed.org/series/CCUSSP02IDQ650N

Garcia-Herrero, A. and L. Xia (2013): China's RMB Swap Agreements: What Explains the Choice of Countries? *BOFIT Discussion Paper,* BBVA, working paper 13/18, May 2013.

Glick, R. and S. Leduc (2013): Effects of unconventional and conventional U.S. monetary policy on the dollar, Federal Reserve Bank of San Francisco.

Liao, S. and D. McDowell (2015): Redback Rising: China's Bilateral Swap Agreements and Renminbi Internationalization, *International Studies Quarterly,* Vol. 59, Issue 3, Sept. 2015, pp. 401-422.

Murphy, M. and W. Jin Yuan (2009): Is China Ready to Challenge the Dollar? *Center for Strategic and International Studies,* October 2009.

Trading Economics (2016): Indonesia Exports to China.
 (http://www.tradingeconomics.com/indonesia/exports-to-china)

VanNess, A. (2014): Russia, China Preparing to Eliminate Our Reserve Currency Status, *The Washington Times,* November 18, 2014.

U.S. Census Bureau (2016): (https://www.census.gov/foreign-trade/balance/c5600.html).

World Bank (2016): World Development Indicators.
 (http://data.worldbank.org/data-catalog/world-development-indicators)

Yelwa, A. I. (2016): Currency Swap with China will Boost Economy, *Vanguard,* April 16, 2016   (http://www.vanguardngr.com/2016/04/currency-swap-china-will-boost-economy-bureau-de-change-operator/).

Zhitao, L. Z. Wnjie, and Y. Cheung (2016): China's Bilateral Currency Swap Lines, *Global Research Unit,* working paper # 2016-013.

Appendices

Appendix – A

Dependent Variable: LNEX (lne_t)
Method: Least Squares
Date: 11/27/16   Time: 10:48
Sample (adjusted): 10 26
Included observations: 17 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C (α_0)	-69.03267	31.52948	-2.189464	0.0510
LNCHMS (α_1)	-2.573785	1.266039	-2.032943	0.0669
LNINGDP (α_2)	5.138811	2.908790	1.766649	0.1050
LNINMS (α_3)	0.364752	0.696071	0.524015	0.6107
LNCHGDP (α_4)	-0.015880	0.892032	-0.017802	0.9861
SWAP (α_5)	0.374086	0.233992	1.598714	0.1382

R-squared	0.930286	Mean dependent var		7.169495
Adjusted R-squared	0.898598	S.D. dependent var		0.213978
S.E. of regression	0.068139	Akaike info criterion		-2.263980
Sum squared resid	0.051072	Schwarz criterion		-1.969904
Log likelihood	25.24383	Hannan-Quinn criter.		-2.234748
F-statistic	29.35750	Durbin-Watson stat		1.833802
Prob(F-statistic)	0.000005			

Appendix – B

Swap and Value of Yuan

Year	Exchange Rate (rupiah/yuan)	China's GDP, PPP (International $)	Indonesia's GDP, PPP (International $)	China's Money Supply (M2)	Indonesia's Money Supply (M2)	Swap Dummy
1990		1.11246E+12	5.25048E+11	1.47E+12	8.5354E+13	0
1991		1.25602E+12	5.9096E+11	1.86E+12	1.0031E+14	0
1992		1.46805E+12	6.48074E+11	2.43E+12	1.2E+14	0
1993		1.71246E+12	7.11624E+11	3.57E+12	1.4406E+14	0
1994		1.97763E+12	7.81567E+11	4.69E+12	1.7317E+14	0
1995		2.24083E+12	8.64859E+11	6.07E+12	2.2083E+14	0
1996		2.50819E+12	9.47954E+11	7.61E+12	2.8063E+14	0
1997		2.78651E+12	1.00949E+12	9.19E+12	3.515E+14	0
1998		3.03796E+12	8.86497E+11	1.06E+13	5.7212E+14	0
1999	943.902165	3.31943E+12	9.07184E+11	1.21E+13	6.4211E+14	0
2000	1013.800278	3.68113E+12	9.73477E+11	1.36E+13	7.4885E+14	0
2001	1237.024302	4.07746E+12	1.03194E+12	1.56E+13	8.3774E+14	0
2002	1128.003604	4.51642E+12	1.09492E+12	1.77E+13	8.776E+14	0
2003	1034.520264	5.06805E+12	1.17014E+12	2.11E+13	9.4726E+14	0
2004	1082.811589	5.73209E+12	1.26281E+12	2.42E+13	1.0339E+15	0
2005	1184.904607	6.58819E+12	1.37764E+12	2.83E+13	1.2028E+15	0
2006	1132.029386	7.6522E+12	1.49807E+12	3.46E+13	1.3825E+15	0
2007	1200.429049	8.97099E+12	1.63553E+12	4.03E+13	1.6497E+15	0
2008	1392.068542	1.00272E+13	1.76789E+12	4.75E+13	1.8958E+15	0
2009	1506.571514	1.10363E+13	1.86377E+12	6.1E+13	2.1414E+15	1
2010	1342.11994	1.23587E+13	2.00395E+12	7.26E+13	2.4712E+15	1
2011	1351.654044	1.38103E+13	2.17152E+12	8.52E+13	2.8772E+15	1
2012	1485.535964	1.51547E+13	2.34488E+12	9.74E+13	3.3075E+15	1
2013	1696.297235	1.65852E+13	2.51553E+12	1.11E+14	3.7302E+15	1
2014	1925.296712	1.80829E+13	2.68531E+12	1.23E+14	4.1733E+15	1
2015	1925.296712	1.95243E+13	2.84224E+12	1.39E+14	4.5488E+15	1

Source:

World Development Indicators, World Bank (http://data.worldbank.org/data-catalog/world-development-indicators)

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