

**Dynamic Relationship between Yuan-Dollar
Exchange Rate and Malaysian Macroeconomic
Variables in Pre- and Post-
Exchange Rate Reform Periods in China**

Lin Yao*, **Wee-Yeap Lau**** and **Tien-Ming Yip*****

Faculty of Economics and Administration, University of Malaya

Abstract

This study investigates the impact of changes in the Yuan-Dollar exchange rate (CNYUSD) on Malaysia's macroeconomic variables during China's pre- and post-exchange rate reform periods. Using data from 1988 Q1 to 2017 Q2, our results show: firstly, changes in CNYUSD influence Malaysia's macroeconomic indicators in the post-exchange rate reform period, and an appreciation in CNYUSD leads to an expansion in real GDP and price level; secondly, positive impact on real GDP and price level lasts for one-year horizon; lastly, the variance decomposition yields consistent results with the impulse response function. As a policy suggestion, the Malaysian government should improve the competitiveness of the export sector in order to reap the benefit of Chinese Yuan appreciation through the aggregate demand channel.

Keywords: *Renminbi, China's exchange rate, Malaysian currency, macroeconomic indicators*

1. Introduction

Owing to the macroeconomic performance of the Chinese economy, as McKinnon and Schnabl (2003) point out, the Chinese Yuan has a stabilizing influence on the East Asian economies during the Asian Financial Crisis in the 1990s. The trade channel or the aggregate demand channel mentioned by Ibrahim (2007), apart from investment one, is considered as the primary transmission mechanism for the effect of the Chinese Yuan exchange rate changes on the economies of other countries.

As China rises in economic power, it seems inevitable that its currency will also rise in importance as well. This is evident by several studies such as Zhang and Fung (2006). They found that an appreciation of the Chinese Yuan would have a notable effect on the trade balance of the ASEAN countries. Feng and Alon (2007) found that there is no difference between the impacts of Yuan appreciation and depreciation on the price adjustment of the ASEAN economies. Ahmed (2011) and Thorbecke and Smith (2010) support the view that changes in exchange rates throughout Asian supply chain countries exert an essential effect on exports. Wang *et al.* (2012), using panel cointegration, find out that a real appreciation of Yuan has no overall long-run effect, but it has a significant effect in the short run.

Due to the trade-oriented development pattern, the ASEAN economies are highly dependent on international trade in their economic performance. Besides, the synchronized character of the business cycle in East Asia, due to the regional economic integration, makes the growth rates of the regional economies highly correlated (McKinnon and

Schnabl, 2003). This implies that these economies are exposed to any trade-related external shocks such as the shock in foreign exchange rates.

McKinnon and Schnabl (2003) insist that pegging to the Dollar benefits the East Asian Dollar bloc as a whole, but it also constitutes an instability source for the economies within the bloc. Some literature argues that the economy that treats the U.S. Dollar as an anchor currency, like Malaysia, may be vulnerable in the face of the shocks in a third currency such as the Yen-Dollar rate (Rajan, 2002; McKinnon and Schnabl, 2003; Ibrahim 2007).

The surrounding countries of China, especially the developing countries, begin to have a concern about the impact of the Chinese Yuan's exchange rate on their economies. Due to the high trade volume with China, Malaysia is one of them who has a close trade tie with China. As China's largest trade partner in ASEAN and the third largest trade partner in Asia, Malaysia has significantly benefited from its trade tie with China. However, the competition imposed by China's strong international trade growth, such as the low value of Chinese Yuan against the U.S. Dollar, also constitutes a real challenge to Malaysia's manufactured exports.

Therefore, it is interesting to examine the impact of Chinese Yuan changes on Malaysian macroeconomic performance. Specifically, this study examines the impact of Chinese Yuan appreciation on real GDP, price level and money supply in the Malaysian economy. Notably, the present findings on the impact of Chinese Yuan changes on macroeconomic indicators mostly focus on developed countries. Therefore, the results may not be generalized to developing countries such as Malaysia, due to their different economic structure and government regulations. To the best of our knowledge, Ibrahim (2007) pioneers in examining the impact of foreign currency changes on

Malaysian macroeconomic indicators. However, the study focuses on the role of Japanese Yen instead of Chinese Yuan.

Given the increasing role of China in the world economy and the close trade tie with Malaysia, it is crucial to understand the impact of Chinese Yuan changes on Malaysia's macroeconomic indicators. Therefore, this study contributes to the existing literature by examining the dynamic relationship between Chinese Yuan-Dollar and Malaysian macroeconomic variables in pre- and post-exchange rate reform in China. The findings are significant because it provides direction to the policymakers on whether China is the engine for growth or an economic threat to Malaysia.

The remainder of this paper is structured as follows. Section 2 reviews the related literature. Section 2.1 shows the theoretical framework of this study. Section 3 outlines the data and methodology. Section 4 and 5 present the results. Section 6 discusses the findings of this study. The last section concludes this paper with the key findings.

2. Literature Review

The United States is perceived to be the largest economy in the world, and therefore the movement in the U.S. Dollar is believed to have a significant impact on the economic performance for the rest of the world. However, the role of China in influencing countries' macroeconomic performance is increasing since China moved to a managed float currency regime in July 2005. As such, the movement of Chinese Yuan (Renminbi) is found to have a significant impact on the currencies for the rest of the world, especially Asian currencies (Shu, Chow and Chan, 2007; Fratzscher and Mehl, 2011; Henning, 2012; Subramanian and Kessler, 2012). In this regard, it can be argued that changes (appreciation or depreciation) in the Chinese Yuan will have an

impact on the countries' macroeconomic performance.

Given that the scope of this study is to evaluate the impact of Chinese Yuan's exchange rate changes on the economies of other countries, therefore the role of U.S. Dollar in affecting countries' economic performance will not be highlighted here but is well documented in the literature (Liu, Spiegel and Tai, 2016; Avdjiev, Bruno, Koch and Shin, 2018; Shousha, 2019).

To date, numerous studies have examined the impact of Chinese Yuan changes on countries' macroeconomic performance (Fair, 2010; Xing, 2010; Li and Xu, 2011; Mattoo, Mishra and Subramanian, 2012; Yang, Zhang and Tokgoz, 2012; Zhang, 2012; Chow, 2014; Meng, 2015; Shu, He and Cheng, 2015; Schnabl and Spantig, 2016; Cuevas, 2017). By and large, the empirical study demonstrates that changes in Chinese Yuan will have a significant impact on the performance of macroeconomic indicators of a country.

Specifically, Fair (2010) employs a multi-country macro-econometric model to examine the macroeconomic effect of a Chinese Yuan appreciation against the U.S. Dollar for the U.S. economy. The study found that the positive impact of Chinese Yuan appreciation on U.S. output and employment is modest, partly due to the adverse effect from a decline in Chinese output and an increase in U.S. import prices. To support, Xing (2010) estimates the pass-through effects of the Chinese Yuan exchange rates on the prices of U.S. imports from China. The study found that a 1% nominal appreciation of the Chinese Yuan would result in a 0.23% increase in the prices of the U.S. imports in the short run and 0.47% in the long run. Moreover, changes in Chinese Yuan is found to have a bearing on the U.S. trade deficit with China (Zhang, 2012). As such, the simulations based on an MC macro-econometric model (Fair model) show that Chinese Yuan appreciation improves current account in China but deteriorates in the U.S.

Consequently, Chinese Yuan appreciation worsens the trade imbalances between China and the U.S., leading to a higher trade deficit in the U.S.

Subsequently, changes in Chinese Yuan is found to affect the performance of the export sector for competitor countries. As such, Mattoo, Mishra and Subramanian (2012) examine the spillover effect of China's exchange rate changes on exports of competitor countries in third markets. The paper develops an identification strategy in which competition between China and its developing country competitors in specific products and destinations plays a vital role. The study exploits the variation – afforded by disaggregated trade data – across exporters, importers, product, and time to estimate the spillover effect. Findings show that a 10 per cent appreciation of China's real exchange rate boosts on average a developing country's export of a typical 4-digit HS product category to third markets by about 1.5-2 per cent. Moreover, the magnitude of the spillover effect varies systematically with product characteristics.

In a later study, Meng (2015) provides a comprehensive analysis of the economic impact of Chinese Yuan changes on the country's export performance. By covering more countries in the analysis, the results from GTAP model show that a 10% appreciation in Chinese Yuan would lead to a decline in export for Australia (0.606%), Hong Kong (0.584%), Japan (1.478%), Korea (0.591%), Taiwan (0.584%), India (0.869%), Mexico (0.883%) and U.S. (1.14%). The decline in exports in those countries indicates that they have a significant amount of exports to China. Subsequently, when China's demand for import decreases (due to the import-export linkage), the countries have a high exporting volume to China will experience a significant decline in their export performance. Conversely, Chinese Yuan appreciation is found to improve the export performance for Malaysia (0.046%), Singapore (0.082%) and Vietnam (0.191%). This is because these countries are

China's competitors in the exportation market, and therefore an appreciation in Chinese Yuan makes the Chinese export become expensive and thus gives these countries a price advantage. Subsequently, this improves the export of these countries.

The literature mentioned above shows that changes in Chinese Yuan would influence the country output level, employment rate, trade performance (import and export) and current account balance. Furthermore, changes in Chinese Yuan is also found to have an impact on currency movement for the rest of the world (Chow, 2014; Shu, He and Cheng, 2015; Schnabl and Spantig, 2016). Specifically, the role of Chinese Yuan in affecting Asian currencies has increased after the global financial crisis, and it is found to exert either higher or a similar impact as the U.S. Dollar (Chow, 2014). Notably, not only the onshore Chinese Yuan market but the offshore Chinese Yuan market is also found to have a growing influence on the Asian currencies (Shu, He and Cheng, 2015).

In the case of Malaysia, to the best of our knowledge, Ibrahim (2007) pioneers in examining the impact of foreign currency changes on Malaysia's macroeconomic performance. Specifically, the study employs Vector Autoregressive (VAR) model in quantifying the impact of the Japanese Yen exchange rate on Malaysia's macroeconomic indicators, namely real output, price level and monetary aggregate. Results suggest that variations in the Yen-Dollar rate have significant influences on Malaysia's macroeconomic variables. Specifically, the Yen-Dollar depreciation leads to a contraction in real GDP and money supply in Malaysia.

Recently, China has emerged as the largest trading partner of Malaysia. Hence, it can be expected that changes in the Chinese Yuan would influence the Malaysia's macroeconomic performance through various channels such as aggregate demand and foreign direct

investment channel. Therefore, a detailed study on the impact of Chinese Yuan changes on Malaysia's macroeconomic indicators is needed. This is important because it can provide input to the Malaysian authority on whether China is the engine of growth or an economic threat to Malaysia.

Based on the studies as mentioned earlier, two research gaps can be identified. Firstly, the study on the impact of Chinese Yuan changes on Malaysia's macroeconomic indicators is limited. Most of the studies focuses on developed countries, and less attention has been paid to developing countries, especially Malaysia. The present findings based on developed countries may not be generalized to Malaysia due to their different economic structures and government regulations. Secondly, the current study by Meng (2015) provides insight into the nexus between Chinese Yuan changes and Malaysia's export performance. However, results based on a single macroeconomic indicator may not be able to represent the overall macroeconomic performance of the nation, and therefore more macroeconomic indicators should be considered.

Thus, this study aims to fill in those gaps by examining the dynamic relationship between Chinese Yuan-Dollar and Malaysian macroeconomic variables. Specifically, this study employs the framework proposed by Ibrahim (2007) in examining the impact of Chinese Yuan changes on Malaysia real output, price level and monetary aggregate.

2.1. Theoretical Framework

The exchange rate is defined as Dollar per Chinese Yuan (CNYUSD). Therefore an increase in the exchange rate indicates appreciation in the Chinese Yuan. Thus, a positive variation of the CNYUSD represents an appreciation of the Yuan currency. As mentioned earlier, changes in the

CNYUSD will affect Malaysia's macroeconomic performance. Hence, it can be hypothesized that:

H1: There is a positive shock in CNYUSD which will have an expansionary effect on GDP.

H2: There is a positive shock in CNYUSD which will have an expansionary effect on the CPI.

H3: There is a positive shock in CNYUSD which will have an expansionary effect on the M3.

Hypothesis 1 and 2 are used to illustrate the aggregate demand channel of CNYUSD changes. Malaysia is one of China's competitors in the exportation market. An appreciation in the Chinese currency makes the Chinese export more expensive and therefore gives Malaysia a price advantage, subsequently, positively affect exports and aggregate demand, leading to expansion in domestic real output and prices (Ibrahim, 2007; Meng, 2015). Thus, a positive shock in CNYUSD is expected to exert upward pressure on Malaysia's output and price level.

Next, hypothesis 3 illustrates that foreign direct investment (FDI) channel of CNYUSD changes. As such, an appreciation in CNYUSD makes China's investment in foreign countries more profitable as Yuan-denominated assets become cheaper, thereby leading to an increase in FDI (Buckley *et al.*, 2007; Li and Rengifo, 2018). The influx of FDI would increase the net foreign asset received by a country, and subsequently increases the monetary aggregate in the economy. Therefore, a positive shock in CNYUSD is expected to accelerate the money supply in the Malaysian economy.

3. Data and Methodology

3.1. Data

The data period selected was from 1988 Q1 to 2017 Q2. The study employs the framework provided by Ibrahim (2007) in examining the dynamic relationship between Chinese Yuan and Malaysia's macroeconomic indicators. In this regard, this study uses two types of the exchange rate, namely Chinese Yuan to U.S. Dollar exchange rate (CNYUSD) and Ringgit Malaysia to U.S. Dollar exchange rate (MYRUSD) to analyse the impacts of exchange rates of both foreign currency and domestic currency on the performance of the Malaysian economy.

Three domestic variables are considered in the analysis, namely real output (GDP), consumer price index (CPI), and money supply (M3). The inclusion of the variables enables the study to examine the influences of Chinese Yuan on the goods and money markets. Moreover, Ibrahim (2007) used money supply M1, and this study uses M3 to capture a broader aspect of the money market. In further analysis, the sample period is divided into pre- and post-exchange rate reform in China. This seeks to ascertain the impacts of CNYUSD on Malaysian macroeconomic variables in different exchange rate regimes. The variables used are shown in Table 1.

3.2. Unit Root Test

A unit root test is used to examine whether a time series is stationary or non-stationary using the autoregressive model. The economic time series must be stationary in a VAR framework. A differencing method is commonly used in order to eliminate the non-stationary trend in time series data, which has a non-stationary sequence. In order to establish sequence stationarity, standard unit root tests will be performed.

Table 1 List of Variables

Variables	Description	Unit of measurement
CNYUSD	Chinese Yuan to U.S. Dollar exchange rate	Exchange rate
MYRUSD	Ringgit Malaysia to U.S. Dollar exchange rate	Exchange rate
GDP	Real Gross Domestic Product	MYR million
CPI	Consumer Price Index	Price index
M3	M3 Money Supply	MYR million

Notes: All data are retrieved from Thomson Reuter DataStream. Data period: 1988 Q1 to 2017 Q2.

The tests which shall be employed include the Augmented Dickey-Fuller (ADF) test, Phillips-Perron (PP) test, and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test in order to improve the credibility of the empirical findings. These tests are further explained below.

3.2.1. Augmented Dickey-Fuller (ADF) test

The Augmented Dickey-Fuller (ADF) test is an extension of the Dickey-Fuller test which is used to test the unit root of a series by adding lagged terms of dependent variables to ensure that error terms are not correlated. Furthermore, by adding the lagged difference term of variable y_t , the ADF test enables higher-order serial correlation to be avoided.

The ADF test equation can be explained below:

$$\Delta y_t = \psi y_{t-1} + \sum_{i=1}^p \alpha_i \Delta y_{t-i} + u_t \quad (1)$$

The test for stationarity can be further explained based on the hypothesis below:

$$H_0 : \psi = 0$$

$$H_1 : \psi < 0$$

The test statistic refers to

$$DF = \frac{\hat{\gamma}}{SE(\hat{\gamma})} \sim \tau \quad \text{distribution} \quad (2)$$

H_0 is rejected if the computed $DF >$ Mackinnon critical value and the series y_t is integrated into the order of 0. In choosing the appropriate lag length of the unit root test, the value that minimizes the information criteria such as Akaike Information Criteria (AIC) is as below:

$$AIC = n \sum \tilde{\varepsilon}_t^2 + 2m \quad (3)$$

Also, Schwarz's Bayesian Information Criteria (BIC) (as below)

$$BIC = n \sum \tilde{\varepsilon}_t^2 + m \ln n \quad (4)$$

where ε_t is the residual of the unit root test regression and m is the parameter in the test regression, including a constant, is used.

3.2.2. Phillips-Perron (PP) test

The Phillips-Perron (PP) test is also used to test for the unit root of the series. The PP test equation is:

$$\Delta y_t = \mu + \beta t + \gamma y_{t-1} + \varepsilon_t \quad (5)$$

The hypothesis to be tested is

$H_0 : \gamma = 0$ (The series needs to be differenced in order to make it stationary)

$H_1 : \gamma < 0$ (The series is stationary and need not be differenced)

3.2.3. Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test

However, the power of ADF and PP tests is low if the root is close to a non-stationary boundary. In order to confirm the result of the unit root test, stationarity tests have also been carried out. In this instance, the KPSS test by Kwiatowski, Phillips, Schmidt, and Shin (1992) is used.

To further explain the KPSS test, it could be argued that KPSS is another unit root test with time trend, t , where:

$$y_t = \mu + \beta t + \varphi \sum_{i=1}^t \varepsilon_{t-1} + u_t \quad (6)$$

where μ is constant, u_t is a stationary process and the past error $\varepsilon_{t-1} \sim$ i.i.d (0,1).

Under the null hypothesis, the series y_t is assumed to be stationary. On the contrary, under the alternative hypothesis, y_t is non-stationary, so that by default under the null the series will appear stationary:

$H_0 : y_t \sim I(0)$

$H_1 : y_t \sim I(1)$

The nonlinearity and structural breaks may influence the stationarity properties of a series. However, the traditional unit root tests (ADF, PP and KPSS) are unable to cater for both conditions, and therefore the Ender and Lee (2012) FADF test and Perron and Vogelsang (1992) ADF-SB test will be used to ensure the robustness of the unit root test results. The Ender and Lee (2012) FADF is used to cater for nonlinearity

in a series. While Perron and Vogelsang (1992) ADF-SB test is to incorporate structural change in testing the unit root for a series, both tests have been widely used in economic research in ensuring the robustness of traditional unit root test results (Furuoka, 2014; 2015; 2016a; 2016b; 2016c).

3.3. Vector Autoregressive (VAR)

Vector autoregressive model VAR (p) is an extension of the univariate autoregressive model to model multivariate time series model. In the case where the k variables are not co-integrated, a VAR model with lag p is defined as

$$y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \dots + A_p y_{t-p} + \varepsilon_t \quad (7)$$

where y_t is defined as $(y_{1,t}, y_{2,t}, \dots, y_{k,t})$ of $k \times 1$ vector, each c is a $k \times 1$ vector of constant (intercept), each A_i is a $k \times k$ coefficient matrix, and ε_i is $k \times 1$ error terms vector.

The lag length for the VAR(p) model may be determined by using model selection. However, the method may not be adequate in the presence of moving average error terms (Cheung and Lai, 1993). Therefore, this study follows the suggestion by Hall (1989) and Johansen (1992) in specifying the lag length such that the VAR residuals are serially uncorrelated.

4. Results

4.1. Descriptive Statistics

Table 2 presents the descriptive statistics of all the series. It can be observed that MYRUSD exhibits a higher standard deviation than

CNYUSD. This implies that MYRUSD is highly volatile as relative to CNYUSD. Moreover, M3 is highly volatile with higher standard deviation as compared to GDP.

Table 2 Descriptive Statistics

Variables	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Observation
CNYUSD	0.151	0.040	1.675	5.384	83.148(0.000)	118
MYRUSD	0.314	0.055	0.311	1.652	10.841(0.004)	118
GDP	134596	89377	0.584	2.095	10.744(0.005)	118
CPI	84.164	18.602	0.064	1.925	5.763(0.056)	118
M3	671784	498562	0.660	2.164	12.013(0.002)	118

Notes: GDP and M3 are in MYR million. Data period: 1988 Q1 to 2017 Q2.

4.2. Unit Root and Stationarity Test Results

Table 3 presents the unit root and stationarity test results for all of the series. Before the unit root test is conducted, all series are transformed into a natural logarithm. Both ADF and PP test has shown that all series become stationary after taking the first difference. As for the KPSS test, all series reject the null hypothesis. Hence, they are stationary after taking the first difference. The unit root and stationary tests show consistent results regardless of the series being the test with a trend or without a trend. Therefore, it can be concluded that all the series are integrated of order one or $I(1)$.

Since all the series are integrated of the order one, it is interesting to examine the long-run relationship among the series. Therefore, the test for cointegration has been conducted. In testing for cointegration, this paper uses the Johansen and Juselius (1990) procedure. This procedure is a multivariate cointegration analysis, in which it allows one to test for

Table 3 Unit Root and Stationarity Test Results

Variable	Level		First Difference	
	without trend	with trend	without trend	with trend
ADF Test				
LCNYUSD	-2.75(0)	-2.18(0)	-10.24(0)***	-10.61(0)***
LMYRUSD	-1.49(1)	-2.07(1)	-8.78(0)***	-8.75(0)***
LGDP	-2.51(5)	-1.93(5)	-6.38(4)***	-6.89(4)***
LCPI	-1.65(0)	-1.96(0)	9.50(0)***	-9.64(0)***
LM3	-4.01(1)***	-1.51(1)	-	-8.07(0)***
PP Test				
LCNYUSD	-2.75[0]	-2.19[4]	-10.24[2]***	-10.62[3]***
LMYRUSD	-1.18[0]	-1.85[1]	-8.70[5]***	-8.66[5]***
LGDP	-2.61[7]	-2.35[7]	-10.58[8]***	-11.66[7]***
LCPI	-1.77[5]	-1.94[3]	-9.43[3]***	-9.58[5]***
LM3	-4.15[6]***	-1.22[6]	-	-8.14[5]***
KPSS Test				
LCNYUSD	2.98[0]**	0.28[9]**	0.63[0]	0.13[3]
LMYRUSD	0.65[9]**	0.16[9]**	0.08[2]	0.09[2]
LGDP	1.28[9]**	0.26[9]**	0.46[7]	0.05[7]
LCPI	1.27[9]**	0.24[9]**	0.29[2]	0.09[5]
LM3	1.25[9]**	0.25[9]**	0.71[8]	0.11[6]

Notes: The asterisks *** and ** denote statistical significance at 1% and 5% level respectively. The optimal lag length selected for ADF is based on SIC. The optimal lag length selected for PP and KPSS is based on Newey-West Bandwidth. Figures in () indicate optimal lag length chosen. Figures in [] indicate optimal bandwidth is chosen. Ln denotes all series having transformed to the natural logarithm.

the number of the cointegrating vector that might exist. Before the test for cointegration, a vector autoregression model (VAR) in level form is conducted to determine the appropriate lag length. Referring to the suggestion by Hall (1989) and Johansen (1992), this study specifies the lag length to be three and sufficient to mitigate the problem of autocorrelation (*p-value of LM test is 0.362*).

As observed from Table 4 and Table 5, both FADF and ADF-SB test yield consistent results as the traditional unit root tests. As such, all the series are found to become stationary after taking the first difference. Thus, it can be concluded that all the series are integrated of order one.

Table 6 shows the Johansen cointegration test. The estimated results show that the null hypothesis of the non-cointegrating vector is rejected at the 1 % significance level at the first rank. This indicates the presence of one cointegrating relationship, suggesting a long-run equilibrium relationship between the series.

4.3. VAR Results Based on the Full Sample Period (1988Q1 to 2017Q2)

As noted by Engle and Granger (1987) and Selover and Round (1996), a vector error correction model or an unrestricted VAR in levels can be applied if the series are cointegrated. In this analysis, VAR in levels form will be estimated instead of VECM. This is because: (1) there is no guarantee that imposing cointegrating restriction can be a reliable basis for making inferences, which is right in the case of imposing inappropriate cointegrating relationships (Faust and Leeper, 1997; Ibrahim, 2007); (2) Ramaswamy and Sløk (1998) and Ibrahim (2007) state that the impulse response functions generated from a VECM tend to imply that the effects of shocks are permanent. While the impulse response function from an unrestricted VAR provides insight into

Table 4 Ender and Lee (2012) Flexible Fourier Form and Dickey-Fuller-type Unit Root Tests

Variables	Level	First difference
LnGDP	-1.539	-15.511***
LnM1	-2.124	-6.986*
LnCPI	-0.779	-8.508***
LnMYRUSD	-1.254	-7.359***
LnCPYUSD	-2.155	-8.068***

Notes: The 1%, 5% and 10% critical values for FADF test are 10.35, 7.58 and 6.35, respectively (Ender and Lee, 2012). The asterisks ***, ** and * denote statistical significance at 1%, 5% and 10% level respectively.

Table 5 Perron and Vogelsang (1992) ADF-SB Test

Variables	Without trend	Breakpoint	With trend	Breakpoint
LnGDP	-2.242	2009Q2	-5.678	1992Q2
Δ LnGDP	-17.174***	1998Q1	-17.117***	1998Q1
LnM1	-2.392	1999Q1	-3.394	1997Q4
Δ LnM1	-8.059***	1998Q1	-8.005***	1998Q1
LnCPI	-2.242	2004Q3	-3.514	1991Q4
Δ LnCPI	-10.332***	2008Q3	-10.251***	2008Q3
LnMYRUSD	-4.377	1997Q2	-4.706	1997Q2
Δ LnMYRUSD	-8.834***	1997Q3	-8.729***	1997Q3
LnCPYUSD	-3.993	1989Q4	-4.464	1994Q1
Δ LnCNYUSD	-13.587***	1994Q2	-13.232***	1994Q2

Notes: Critical values are based on Furuoka (2016a). The asterisks ***, ** and * denote statistical significance at 1%, 5% and 10% level respectively.

Table 6 Johansen Cointegration Test

Hypothesized number of CE	Trace statistics	5 % Critical value	Prob
None*	85.471	69.818	0.002
At most 1	36.457	47.856	0.374
At most 2	17.429	29.797	0.608
At most 3	7.169	15.494	0.558
At most 4	1.405	3.841	0.236

Note: The Johansen tests are based on a model with an only intercept but no trend in the cointegrating equation.

whether the effects of shocks are permanent or temporary. Thus, unrestricted VAR (level VAR) remains appropriate and is employed in this study.

As mentioned above, lag three will be employed in estimating the VAR. From the VAR, impulse response function and variance decomposition will be conducted as bases for inferences. As noted by Sims (1980), this study employs the Cholesky factorization to identify shocks in the system. This option imposes an ordering of variables in the VAR system and attributes the effect of any common component to the variable that appears first in the VAR system. Hence, the method is sensitive to the ordering of the variable. Therefore, this study follows the suggestion from Ibrahim (2007) and orders the variables in the following way: LCNYUSD, LMYRUSD, LGDP, LCPI, LM3.

As a variable from the external sector, the Chinese Yuan is reasonably the most exogenous of all the variables. The Malaysian Ringgit is stabilized against the U.S. Dollar. Hence it can be placed before the domestic variables. Next, real GDP and price level are sluggish to adjust and, therefore, should be treated as more exogenous than money supply.

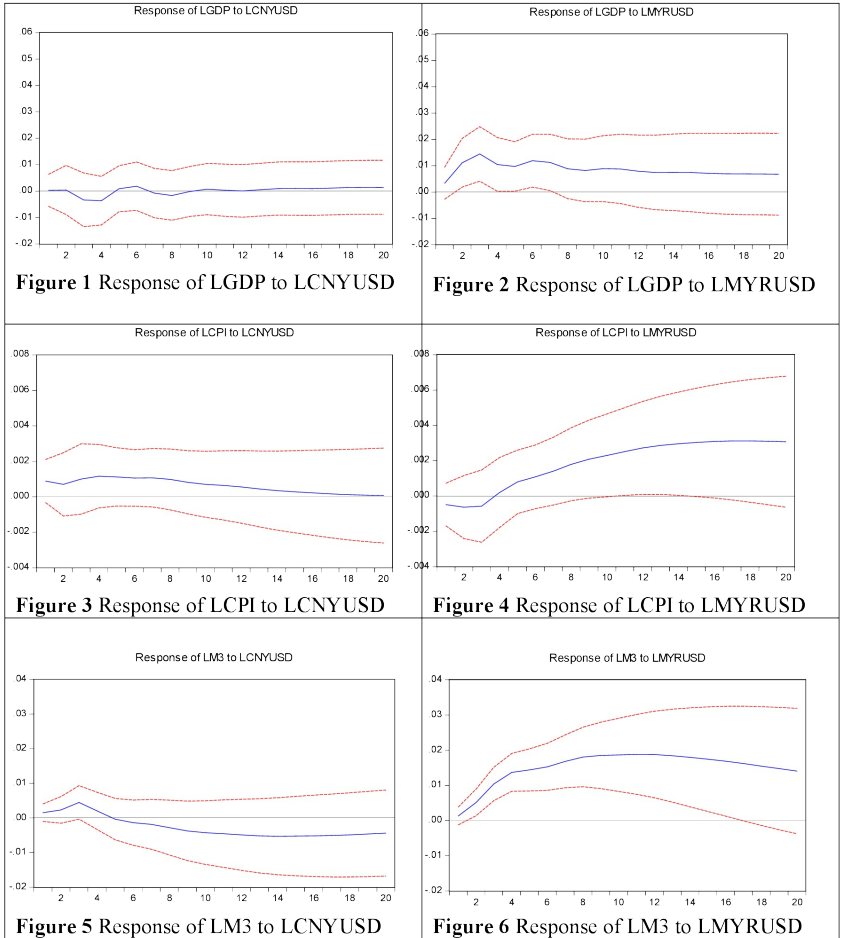
Table 7 Residual Correlations Matrix of VAR Model

	LCNYUSD	LMYRUSD	LGDP	LCPI	LM3
LCNYUSD	1.000				
LMYRUSD	0.101	1.000			
LGDP	0.009	0.102	1.000		
LCPI	0.136	-0.060	0.108	1.000	
LM3	0.110	0.105	0.093	-0.001	1.000

Table 7 shows the contemporaneous correlations among the shocks in the VAR. Notably, all the correlations are low, and therefore our preferred ordering is not a cause for concern. As a robustness check, this study employs the generalized impulses in generating the impulse response functions, in which the function constructs an orthogonal set of innovations that do not depend on the VAR ordering (Pesaran and Shin, 1998). This study presents the impulse response function based on the preferred ordering. However, the results are the same when the impulse response function is generated based on generalized impulses.

Figure 1 to 6 show the impulse response function. As observed, all the three Malaysian macroeconomic indicators, namely LGDP, LCPI and LM3 response positively concerning LCNYUSD appreciation (Figure 1, 3 and 5 respectively). However, the impact of the LCNYUSD appreciation on all the three macroeconomic indicators is insignificant in both short and longer horizons as the confidence interval contains the value of zero.

On the appreciation of shock from LMYRUSD, Figure 2 shows that Malaysia's output (LGDP) increases significantly in response to LMYRUSD appreciation shock at quarter three and six. Hence, the significant effect is felt in less than one year and becomes apparent in



Notes: The impulse response function is based on the following order: LCNYRUSD LMYRUSD LGDP LCPI LM3. Robustness check using generalized impulse yields same results but are not reported here to conserve space. They are available upon request.

the second year. Therefore, it can be observed that Ringgit appreciation shocks do not seem to exert a permanent expansionary effect on real output. This result concurs with earlier findings by Upadhyaya (1999) and Ibrahim (2007).

Next, the LMYRUSD appreciation shock is found to have no impact on the price level in short and longer horizons (Figure 4). However, M3 increases significantly in response to LMYRUSD appreciation shocks at 3-quarter to 16-quarter horizons (Figure 6). The significant effect is felt in less than one year and lasts until five years. Appreciation in LMYRUSD makes the Ringgit-denominated assets attractive, thereby leading to an increase in FDI and net foreign assets received, subsequently, increases the monetary aggregate in the economy.

Next, Table 8 illustrates how much of the forecast error variance of each of the domestic variables can be explained by exogenous shocks to the other variables. It can be observed that the dominant role of explaining the variation of LGDP, LCPI and LM1 in both short and the longer horizon is LMYRUSD changes while Chinese Yuan is found to have a limited impact on the variation of Malaysia's macroeconomic indicators.

Table 8 Variance Decompositions (Full sample period: 1988Q1 to 2017Q2)

Period	VDC of LGDP		VDC of LCPI		VDC of LMI	
	LCNYUSD	LMYRUSD	LCNYUSD	LMYRUSD	LCNYUSD	LMYRUSD
4	0.738	13.575	2.856	0.785	3.273	33.597
8	0.603	16.712	4.354	4.299	1.696	51.908
12	0.475	17.012	3.713	11.668	2.432	55.292
16	0.433	16.831	2.787	17.914	3.088	53.573
20	0.452	16.631	2.135	21.480	3.306	50.574

Note: Cholesky Ordering: LCNYRUSD LMYRUSD LGDP LCPI LM3.

As such, after 20-quarter horizon, the Ringgit fluctuation accounts for about 16%, 21% and 50% of the variation in LGDP, LCPI and LM3 respectively, while Yuan fluctuation only explains 0.5%, 2.1% and 3.3% of the variation in LGDP, LCPI and LM3 respectively. These results confirm the findings from the impulse response function above, in which changes in MYRUSD is essential in affecting the macroeconomic indicators as opposed to changes in Chinese Yuan.

Hence, the analysis based on the full sample period (1988Q1 to 2017Q2) demonstrates that Chinese Yuan changes have a negligible impact on the Malaysian macroeconomic performance while fluctuation in the Ringgit Malaysia plays the dominant role in affecting the real GDP and M3 in both short and longer horizons, respectively.

However, the full sample period involves a series of event that affects the currency movement of Chinese Yuan and Ringgit Malaysia. For instance, both Chinese Yuan and Ringgit Malaysia were pegged to the U.S. Dollar in the aftermath of the 1997 Asian Financial Crisis and de-pegged in July 2005. Moreover, China was having exchange rate reform in a particular period and moved to a managed float regime in July 2005. Given all these events, it can be argued that the analysis based on the full sample period is fundamentally inaccurate as the estimation results may be affected by the exchange rate policy in a particular period. In other words, the role of Chinese Yuan in affecting Malaysia macroeconomic indicators may be hindered by the exchange rate policy. Therefore, a further analysis which splits the sample period into pre- and post-exchange rate reform in China is motivated.

5. Further Analysis (Pre-and Post-Exchange Rate Reform in China)

As mentioned earlier, the full data period used in the analysis earlier covers several strategic time points, which are essential in the roadmap

of China's exchange rate reform agenda. Partially because of the worsening situation of inflation, the official Chinese Yuan exchange rate was sharply cut in 1994. With the coming of the Asian crisis, the Chinese Yuan was deliberately pegged to the US dollar within a narrow range from 1997 until July 2005.¹ The dummy variable is used to take into account the structural break observed from 1994Q1 to 2005Q3.

In other words, data from 1994Q1 to 2005Q2 will not be included in the analysis. According to the likelihood ratio test, the result implies that the dummy variable is significant in the unrestricted VAR model². For this purpose, two VAR models have been estimated for pre- and post-exchange rate reform in China.

Moreover, the lag length specified for the VAR model in pre- and post-exchange rate reform is one and two, respectively, which is sufficient to render error terms serially uncorrelated. Furthermore, with the findings of cointegration in pre- and post-exchange rate reform period³, a level VAR model will be estimated for the two periods. Similarly, this study reports the impulse response functions and variance decomposition of the three domestic variables to innovations in the two exchange rates for pre- and post-exchange rate reform period.

Panel A shows the impulse responses from the first VAR model (Pre-reform). Notably, in the pre-exchange rate reform period, both LCNYUSD and LMYRUSD appreciation shocks are found to have an insignificant impact on the three macroeconomic indicators. This may be due to insufficient sample size in the pre-reform period⁴. Therefore, it is reasonable that no significant results can be obtained. However, the variance decomposition from Table 9 Panel A shows that fluctuation in LCNYUSD is essential in influencing the variation in real output, price level and monetary condition as compared to the fluctuation in LMYRUSD.

Panel A: Impulse Response Function for the Pre-Exchange Rate Reform Period (1988Q1 to 1993Q4)

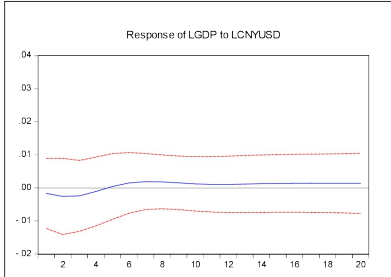


Figure 7 Response of LGDP to LCNYUSD

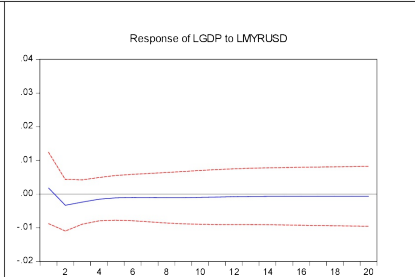


Figure 8 Response of LGDP to LMYRUSD

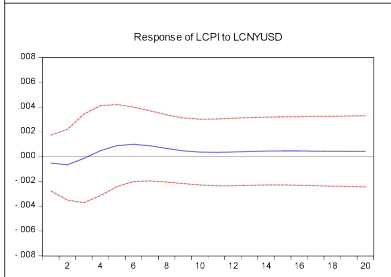


Figure 9 Response of LCPI to LCNYUSD

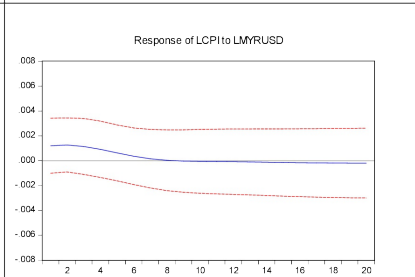


Figure 10 Response of LCPI to LMYRUSD

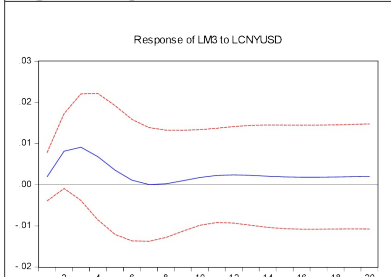


Figure 11 Response of LM3 to LCNYUSD

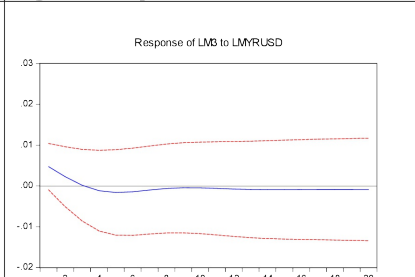


Figure 12 Response of LM3 to LMYRUSD

Notes: The impulse response function is based on the following order: LCNYRUSD LMYRUSD LGDP LCPI LM3. Robustness check using generalized impulse yields same results but are not reported here to conserve space. They are available upon request.

Panel B: Impulse Response Function for Post-Exchange Rate Reform Period (2005Q3 to 2017Q2)

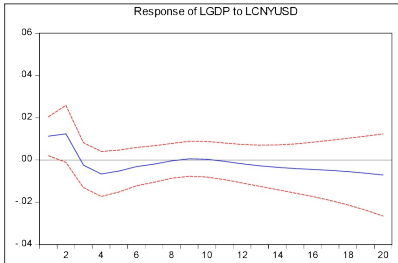


Figure 13 Response of LGDP to LCNUSD

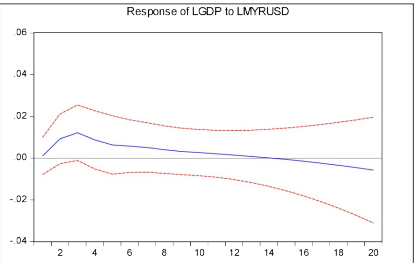


Figure 14 Response of LGDP to LMYRUSD

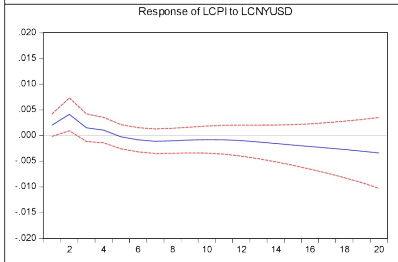


Figure 15 Response of LCPI to LCNUSD

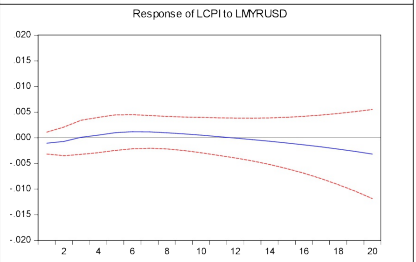


Figure 16 Response of LCPI to LMYRUSD

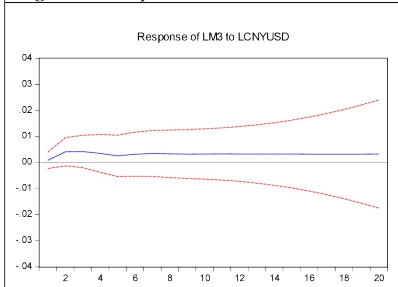


Figure 17 Response of LM3 to LCNUSD

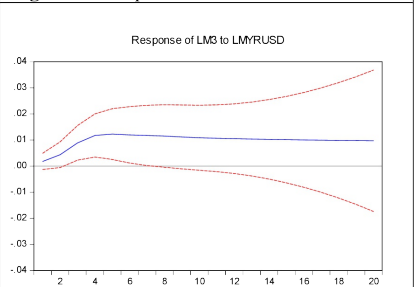


Figure 18 Response of LM3 to LMYRUSD

Notes: The impulse response function is based on the following order: LCNUSD LMYRUSD LGDP LCPI LM3. Robustness check using generalized impulse yields same results but are not reported here to conserve space. They are available upon request.

Panel B shows the impulse response function for the post-exchange rate reform period. Notably, LCNYUSD appreciation is found to have an expansionary effect on real output at quarter 1 to 2 (Figure 13). The effect lasts within one year, and therefore it can be concluded that the positive impact of LCNYUSD appreciation on real output is temporary. Thus, hypothesis 1 is supported in which positive shock in LCNYUSD will have an expansionary effect on Malaysia's GDP.

Similarly, price level responds positively and significantly concerning the LCNYUSD appreciation shock at quarter two and the effect becomes insignificant in a longer horizon (Figure 15). Hence, LCNYUSD appreciation shock is also found to have a temporary positive impact on the domestic price level. Thus, hypothesis 2 is supported in which positive shock in CNYUSD will have an expansionary effect on Malaysia's price level. Conversely, LCNYUSD appreciation shock has no significant impact on the monetary aggregate (Figure 17). Thus, hypothesis 3 cannot be accepted.

For the domestic exchange rate, LMYRUSD appreciation shock is only useful in influencing the monetary aggregate at 3-quarter to 5-quarter horizon (Figure 18). For output and price level, the impact of LMYRUSD appreciation shock is found to be insignificant (Figure 14 and Figure 16 respectively).

Next, Table 9 Panel B tabulates the variance decomposition for post-exchange rate reform period. The results concur with the above findings and, more importantly, further emphasize the relative importance of the Chinese Yuan exchange rate for domestic real output and price level. As such, a fraction of forecast error variance in LGDP attributed to innovations in LCNYUSD and LMYRUSD is roughly 12% and 11% respectively at the one-year horizon. Similar to the price level, the Chinese Yuan fluctuations account for about 16% of the variations in

LCPI as compared to only 1% by LMYRUSD at a one-year horizon. Thus, hypothesis 1 and 2 are further supported.

Table 9 Variance Decompositions – Further Analysis

Panel A: Pre-Exchange Rate Reform Period (1988Q1 – 1993Q4)

Period	VDC of <i>LGDP</i>		VDC of <i>LCPI</i>		VDC of <i>LMI</i>	
	<i>LCNYUSD</i>	<i>LMYRUSD</i>	<i>LCNYUSD</i>	<i>LMYRUSD</i>	<i>LCNYUSD</i>	<i>LMYRUSD</i>
4	1.725	2.320	1.416	7.749	18.821	2.736
8	1.987	2.058	3.819	5.512	11.571	1.903
12	1.904	1.809	3.261	4.071	8.892	1.423
16	1.873	1.562	3.023	3.243	7.304	1.188
20	1.876	1.378	2.820	2.708	6.228	1.030

Panel B: Post-Exchange Rate Reform Period (2005Q3 – 2017Q2)

Period	VDC of <i>LGDP</i>		VDC of <i>LCPI</i>		VDC of <i>LMI</i>	
	<i>LCNYUSD</i>	<i>LMYRUSD</i>	<i>LCNYUSD</i>	<i>LMYRUSD</i>	<i>LCNYUSD</i>	<i>LMYRUSD</i>
4	12.621	11.874	16.454	1.255	5.631	27.832
8	10.898	12.448	12.636	3.006	4.267	38.569
12	9.307	11.086	10.041	2.459	4.237	40.736
16	8.982	9.361	9.741	2.522	4.349	41.905
20	9.335	8.436	11.048	5.259	4.501	42.855

Notes: Cholesky Ordering: LCNYRUSD LMYRUSD LGDP LCPI LM3.

6. Discussion

Generally, there are two possible channels on how fluctuation in foreign currencies influences Malaysia's macroeconomic indicators. The first channel is the aggregate demand channel suggested by Ibrahim (2007)

and Meng (2015). In this study, the aggregate demand channel informs that the appreciation of the Chinese Yuan exchange rate would have an expansionary effect on Malaysia's output and price level. As such, appreciation of the Chinese Yuan increases the international competitiveness of China's export competitors and, subsequently, positively affects exports and aggregate demand, leading to an expansion in domestic real output and prices.

Next, the second channel is the foreign direct investment channel mentioned by Buckley *et al.* (2007) and Li and Rengifo (2018). In the context of this study, the channel suggests that an appreciation of the Chinese Yuan exchange rate would have a positive impact on the monetary aggregate in the Malaysian economy. As such, the appreciation of the Chinese Yuan exchange rate increases the profit of Yuan-denominated investment in Malaysia. Hence, there will be an influx of foreign direct investment, which in turn increases the net foreign assets received by Malaysia, and subsequently increases the monetary aggregate in the economy.

Notably, the empirical results show that fluctuation in Chinese Yuan exchange rate has a negligible impact on Malaysia's macroeconomics indicators when the full sample period is used in the analysis. This may be due to the exchange rate reform in China over the period 1994Q1 to 2005Q2, which hinders the role of Chinese Yuan in affecting Malaysia's macroeconomic performance. However, the impact of Chinese Yuan fluctuation on Malaysian macro-economy becomes apparent after splitting the sample period into pre-and post-exchange rate reform.

The post-exchange rate reform reflects the period where China moves to managed float exchange rate regime and, subsequently, increases the role of China in influencing countries' macroeconomic performance through the movement of Chinese Yuan. In conjunction with this, our results show that Chinese Yuan appreciation shock has an

expansionary effect on Malaysia's real output and price level. The results suggest that the aggregate demand channel seem to be operative. This is particularly true in the context of Malaysia, which is one of the export competitors of China. In particular, appreciation of Chinese Yuan would reduce the export competitiveness of China, thereby providing price advantage to Malaysia. Subsequently, Malaysia's export to the rest of the world would increase, leading to higher aggregate demand, output produced and price level in the economy. Empirically, Meng (2015) has proven that Malaysia's export tends to be benefited in response to the appreciation of Chinese Yuan. Moreover, the findings concur with earlier work done by Fair (2010) and Ibrahim (2007) in which fluctuation in foreign currency would have an impact on domestic output and price level.

Next, Chinese Yuan appreciation shock is found to have no impact on the monetary condition in Malaysian economy. The results contradict earlier findings by Ibrahim (2007), in which fluctuation in foreign currency would have a bearing on the Malaysian monetary condition. This can be explained by the ease of doing business in Malaysia as opposed to other countries. In 2017, the ease of doing the business index of Malaysia was 78.11 points, ranked at 23 out of 190 countries in the world (World Bank, 2017). The top five countries which had the least restriction in doing business were New Zealand, Singapore, Denmark, Hong Kong and Korea. Hence, it can be argued that if there is an appreciation in Chinese Yuan against the U.S. Dollar, China's investment in foreign countries becomes more profitable as Yuan-denominated assets become cheaper. As a result, China firms may diversify their investment into countries which has the least restriction in doing business to reap the benefit from Chinese Yuan appreciation. Therefore, instead of Malaysia, the top five countries which have the highest ease of doing business index will be their preferred choice of

investment. Thus, this explains the findings above, in which appreciation shock in Chinese Yuan is found to have no impact on Malaysia's monetary condition.

By and large, our results are in line with the thesis that fluctuations in foreign currencies can have a significant impact on countries' macroeconomic performance. Specifically, this study contributes to the existing literature in revealing the impact of Chinese Yuan appreciation on the performance of Malaysia's macroeconomic indicators. Results indicate that Chinese Yuan appreciation would lead to an increase in real output and price level in the economy. Therefore, this study highlights the importance of China as the engine of growth for the Malaysian economy.

7. Conclusion

This study investigates the impact of changes in the Yuan-Dollar exchange rate (CNYUSD) to Malaysia's macroeconomic variables in pre- and post-Chinese exchange rate reform period. Our result shows that both Chinese Yuan and Ringgit Malaysia appreciation have no impact on Malaysia's macroeconomic variables in pre-exchange rate reform period. This may occur due to insufficient observations in the pre-reform period, in which no inferences can be made.

However, in the post-exchange rate reform period, the impulse response function shows that Chinese Yuan appreciation shock has an expansionary effect on Malaysia's real output and price level. However, the positive impact is found to be temporary and lasts for the 1-year horizon. Moreover, the variance decomposition yields consistent results with impulse response function, in which fluctuation in Chinese Yuan accounts for a more substantial variation in real output and price level for the 1-year horizon. The influence is found to deteriorate in more

periods ahead. Hence, hypothesis 1 and 2 are supported, in which appreciation in Chinese Yuan would result in output expansion and an increase in the price level in the Malaysian economy. The results also support the presence of aggregate demand channel in explaining the influence of Chinese Yuan on domestic macroeconomic variables. Furthermore, the findings concur with the earlier studies by Ibrahim (2007) and Fair (2010), in which changes in foreign currency would have a significant impact on the performance of Malaysia's macroeconomic indicators.

As a policy suggestion, the Malaysian government should improve the competitiveness of the export sector. This would enable the country to reap much of the benefit if there is an appreciation in Chinese Yuan. A competitive export sector, together with Chinese Yuan appreciation, would further enhance the export sales, thereby generating greater aggregate demand and higher economic growth in the country.

Notes

* Lin Yao (林遙) completed her Master of Applied Statistics at the University of Malaya. Upon her graduation from the University of Malaya, she has worked as a Data Analyst at Alibaba.com in Hangzhou. She is currently focusing on the analysis of asset gain and loss. <Email: dreamseeker1117@gmail.com>

** Dr Lau Wee-Yeap (劉偉業) is an Associate Professor at the Faculty of Economics and Administration, University of Malaya. He was Monbusho Scholar for his postgraduate studies at Osaka University and Visiting Scholar at Risk Management Institute, National University of Singapore, from 2012 to 2013. He also attended an Executive Education Programme at Bendheim Centre for Finance, Princeton University, in June 2013. Currently, he is an Associate Research Fellow of Malaysian Institute of

Economic Research (MIER). He works in the area of financial economics, capital market and macroeconomics. <Email: wylau@um.edu.my>

*** Yip Tien-Ming (葉添明) received his Bachelor of Economics (Distinction) from the Faculty of Economics and Administration, University of Malaya, and is currently a postgraduate student at the same institution. His research interest is in applied econometrics and macroeconomics. <Email: yiptienming@um.edu.my>

1. This is in order to resist the depreciation pressures as well as to stabilize the neighbouring economies, especially the ASEAN economies that are important trade partners of China. After 2005, China resumed its so-called managed float system with its exchange rate determined based on market supply and demand to maintain the primary stability. Similar to China, the Malaysian ringgit was also de-pegged from U.S. dollar in July 2005.
2. The p-value for the likelihood ratio test is 0.015. Therefore we reject the null hypothesis of VAR without dummy variable and accept an alternative model which is the VAR with a dummy variable.
3. The cointegration tests will not be reported here to conserve space, but they are available upon request.
4. The sample size for the pre-exchange rate reform is 24 (n=24).

References

- Ahmed, S. (2011). Are Chinese exports sensitive to changes in the exchange rate? *Working Paper* No. 987. FRB International Finance Discussion.
- Avdjiev, S., V. Bruno, C. Koch and H.S. Shin (2018). The dollar exchange rate as a global risk factor: Evidence from investment. *BIS Working Paper* No. 695. Bank for International Settlements.
- Buckley, P.J., L.J. Clegg, A.R. Cross, X. Liu, H. Voss and P. Zheng (2007). The determinants of Chinese outward foreign direct investment. *Journal of International Business Studies*, Vol. 38, No. 4, pp. 499-518.

- Cheung, Y-W. and K.S. Lai (1993). Finite-sample sizes of Johansen's likelihood ratio tests for cointegration. *Oxford Bulletin of Economics and Statistics*, Vol. 55, No. 3, pp. 313-328.
- Chow, H.K. (2014). Is the renminbi Asia's dominant reference currency? A reconsideration. *China Economic Policy Review*, Vol. 3, No. 1, pp. 1-20.
- Cuevas, V. (2017). The impact of the yuan-dollar exchange rate on Mexican manufacturing exports to the US: A cointegration approach. *The World Economy*, Vol. 41, No. 3, pp. 1-18.
- Enders, W. and J. Lee (2012). The flexible Fourier form and Dickey-Fuller type unit root tests. *Economics Letters*, Vol. 117, No. 1, pp. 196-199.
- Engle, R.F. and C.W.J. Granger (1987). Co-integration and error correction: Representation, estimation, and testing. *Econometrica*, Vol. 55, No. 2, pp. 251-276.
- Fair, R.C. (2010). Estimated macroeconomic effects of a Chinese yuan appreciation. *Business Economics*, Vol. 45, No. 4, pp. 233-243.
- Faust, J. and E.M. Leeper (1997). When do long-run identifying restrictions give reliable results? *Journal of Business & Economic Statistics*, Vol. 15, No. 3, pp. 345-353.
- Feng, X. and I. Alon (2007). Chinese RMB exchange rate and local currency price stability in ASEAN trade. *China Economic Review*, Vol. 18, No. 4, pp. 417-424.
- Fratzscher, M. and A. Mehl (2011). China's dominance hypothesis and the emergence of a tri-polar global currency system. *CEPR Discussion Paper*, No. 8671.
- Furuoka, F. (2014). Are unemployment rates stationary in Asia-Pacific countries? New findings from Fourier ADF test. *Economic Research-Ekonomska Istraživanja*, Vol. 27, No. 1, pp. 34-45.
- Furuoka, F. (2015). Unemployment hysteresis in the "Nordic Kitten": Evidence from five Estonian regions. *Panoeconomicus*, Vol. 62, No. 5, pp. 631-642.

- Furuoka, F. (2016a). A new approach to testing unemployment hysteresis. *Empirical Economics*, Vol. 53, No. 3, pp. 1253-1280.
- Furuoka, F. (2016b). A new test for analyzing hysteresis in European unemployment. *Applied Economics Letters*, Vol. 24, No. 15, pp. 1102-1106.
- Furuoka, F. (2016c). Is population beneficial to economic growth? An empirical study of China. *Quality & Quantity*, Vol. 52, No. 1, pp. 209-225.
- Hall, S.G. (1989). Maximum likelihood estimation of cointegration vectors: An example of Johansen procedure. *Oxford Bulletin of Economics and Statistics*, Vol. 51, No. 2, pp. 213-218.
- Henning, C (2012). Choice and coercion in East Asian exchange rate regimes. *Working Paper* No. 12-15. Peterson Institute for International Economics.
- Ibrahim, M.H. (2007). The yen-dollar exchange rate and Malaysian macroeconomic dynamics. *The Developing Economies*, Vol. 45, No. 3, pp. 315-338.
- Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control*, Vol. 12, No. 2, pp. 231-254.
- Johansen, S. (1992). Testing weak exogeneity and the order of cointegration in UK money demand data. *Journal of Policy Modeling*, Vol. 14, No. 3, pp. 313-334.
- Johansen, S. and K. Juselius (1990). Maximum likelihood estimation and inference on cointegration—with applications to the demand for money. *Oxford Bulletin of Economics and Statistics*, Vol. 52, No. 2, pp. 169-210.
- Kwiatkowski, D., P.C.B. Phillips, P. Schmidt and Y. Shin (1992). Testing the null hypothesis of stationarity against the alternative of a unit root. *Journal of Econometrics*, Vol. 54, Issues 1-3, pp. 159-178
- Li, X. and Xu, D. (2011). Impact of RMB appreciation on trade and labor markets of China and the USA: A multi-country comparative general equilibrium model. *China & World Economy*, Vol. 19, No. 2, pp. 19-39.

- Li, Y. and E.W. Rengifo (2018). The Impact of institutions and exchange rate volatility on China's outward FDI. *Emerging Markets Finance and Trade*, Vol. 54, No. 12, pp. 2778-2798.
- Liu, Z., M.M. Spiegel and A. Tai (2016). Measuring the effects of dollar appreciation on Asia: A FAVAR approach. *Working Paper* No. 2016-30. Federal Reserve Bank of San Francisco.
- Mattoo, A., P. Mishra and A. Subramanian (2012). Spillover effects of exchange rates: A study of the renminbi. *IMF Working Paper* No. WP/12/88. International Monetary Fund.
- McKinnon, R. and G. Schnabl (2003). Synchronised business cycles in East Asia and fluctuations in the yen/dollar exchange rate. *The World Economy*, Vol. 26, No. 8, pp. 1067-1088.
- Meng, S. (2015). Modelling the impact of exchange rates using a multicurrency framework. *Economic Modelling*, Vol. 49, pp. 223-231.
- Perron, P. and T.J. Vogelsang (1992). Nonstationarity and level shifts with an application to purchasing power parity. *Journal of Business & Economic Statistics*, Vol. 10, No. 3, pp. 301-320.
- Pesaran, H.H and Y. Shin (1998). Generalized impulse response analysis in linear multivariate models. *Economic Letters*, Vol. 58, No. 1, pp. 17-29.
- Rajan, R. (2002). Exchange rate policy options for post-crisis Southeast Asia: Is there a case for currency baskets? *The World Economy*, Vol. 25, No. 1, pp. 137-163.
- Ramaswamy, R., and T. Sløk (1998). The real effects of monetary policy in the European Union: What are the differences? *Staff Papers*, Vol. 45, No. 2, pp. 374-396.
- Schnabl, G. and K. Spantig (2016). (De)Stabilizing exchange rate strategies in East Asian monetary and economic integration. *The Singapore Economic Review*, Vol. 61, No. 2, pp. 1-24.

- Selover, D.D. and D.K. Round (1996). Business cycle transmission and interdependence between Japan and Australia. *Journal of Asian Economics*, Vol. 7, No 4, pp. 569-602.
- Shousha, S. (2019). The dollar and emerging market economies: Financial vulnerabilities meet the international trade system. *International Finance Discussion Papers* No. 1258.
- Sims, C.A. (1980). Macroeconomics and reality. *Econometrica*, Vol. 48, No. 1, pp. 1-48.
- Shu, C, N. Chow and J-Y. Chan (2007). Impact of the renminbi exchange rate on Asian currencies. *China Economic Issues*, No. 3/07. Hong Kong Monetary Authority.
- Shu, C., D. He and X. Cheng (2015). One currency, two markets: the renminbi's growing influence in Asia-Pacific. *China Economic Review*, Vol. 33, pp. 163-178.
- Subramanian, A. and M. Kessler (2012). The renminbi bloc is here: Asia down, rest of the world to go? *Working Paper* No. 12-19. Peterson Institute for International Economics.
- Thorbecke, W. and G. Smith (2010). How would an appreciation of the renminbi and other East Asian currencies affect China's exports? *Review of International Economics*, Vol. 18, No. 1, pp. 95-108.
- Upadhyaya, K.P. (1999). Currency devaluation, aggregate output, and the long run: An empirical study. *Economic Letters*, Vol. 64, No 2, pp. 197-202.
- Wang, C.H., C.H.A. Lin and C.H. Yang (2012). Short-run and long-run effects of the exchange rate change on trade balance: Evidence from China and its trading partners. *Japan and the World Economy*, Vol. 24, No. 4, pp. 266-273.
- World Bank (2017). *Doing Business 2017: Equal opportunity for all*. Washington, DC: World Bank.

- Xing, Y.Q. (2010). The yuan's exchange rates and pass-through effects on the prices of Japanese and US imports. *Comparative Economic Studies*, Vol. 52, No. 4, pp. 531-548.
- Yang, J., W. Zhang and S. Tokgoz (2012). The macroeconomic impacts of Chinese currency appreciation on China and the rest of world: A global computable general equilibrium analysis. *IFPRI Discussion Paper No. 01178*.
- Zhang, J. and H.G. Fung (2006). Winners and losers: Assessing the impact of Chinese Yuan appreciation. *Journal of Policy Modeling*, Vol. 28, No. 9, pp. 995-1009.
- Zhang, J.X. (2012). Will RMB appreciation reduce the trade deficit in the US? *Journal of the Asia Pacific Economy*, Vol. 17, No 1, pp. 171-187.
- Zhang, M.N. (2015). New RMB exchange rate reform must obtain international credibility. *China-US Focus*, 28 August 2015. Retrieved from: <<https://www.chinausfocus.com/finance-economy/new-rmb-exchange-rate-reform-must-obtain-international-credibility>>.