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Another Look at Devaluation and the Trade Balance in China

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Abstract

This paper estimates the effect of Chinese Yuan devaluation on the trade balance of China. For that a regression equation is developed in which domestic income, foreign income, domestic money supply, foreign money supply and real effective exchange rate are used as explanatory variable with trade balance as the dependent variable. In order to test the J-curve phenomenon the lagged values of exchange rata are also included. Quarterly time series data from 1999 to 2016 are used. Before estimating the model the time series properties of the data are diagnosed and an error correction model is developed and estimated. The estimated results show that the contemporaneous effect of devaluation is positive, but the total effect is insignificant. A J-curve pattern of adjustment of the trade balance is also detected.

JEL Classification: F10, F31, F32
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I. Introduction

The Chinese yuan, (sometimes identified as the renminbi,) became China's official currency in 1949. Authorities have kept it fixed and inconvertible to impede its ability to respond to price disparities between China and the rest of the global market (Upadhyaya et. al, 2017). Historically, the yuan's value has been overestimated to tax exports and subsidize imported goods. In fact, all of China's international trade used to be run by government foreign trade corporations, allowing them to claim all profits while subsidizing losses; effectively removing any market incentives for trade adjustments in response to changes in prices and exchange rate policies. If any change could happen, it could only happen through a government policy.

Eventually the tightly controlled industries of China began to enervate, releasing new incentives in the playing field and fostering competition in its markets. In the tide of these changes, the foreign exchange regime adapted and chose to release its tight grip on exchange controls, allowing the yuan's exchange rate to adjust to reasonable values. The Chinese monetary authority made the yuan even easier to exchange through the implementation of a "managed float" regime. The yuan's exchange rate eventually leveled out at around eight to everyone US dollar- and remained in this position until July of 2005 when exchange controls were even further relaxed for the Chinese yuan. This narrow trading band grew from +/- 0.2 percent to +/-0.3 over the next decade, and in August of 2015 China chose to allow its currency to depreciate further from the trading band; and that the yuan's exchange rate would be controlled by foreign exchange markets and exchange rates.

China has kept a sizable current account surplus through the use of various exchange rate policies, but as the currency transitions into a fully convertible status it is likely that the yuan will become more volatile (and subsequently a higher risk for exchange) over time. The exact impact of this exchange rate volatility is subject to speculation; some studies indicate that there is no clear and discernable relationship between level of trade and exchange rate, while others suggest that exchange volatility has a negative effect on bilateral trade. These conflicting findings are highlighted in the literature review

Following the devaluation of a country's currency, its balance of trade will first deteriorate, before proceeding to reach a higher level than its initial position. This is known as the J-Curve phenomenon. It operates on the principle that when a country's currency is depreciated, itsimports become relatively expensive, leading to a decline in its volume. At the same time a devaluation or depreciation makes exports relatively cheaper which raises the volume of exports. Initially, because of the transactions costs as well as consumers' consumption habits the import as well as export volumes remain relatively inelastic as a result the trade balance initially deteriorates. Over the period; with new contracts and adjustments in consumers' consumption from relatively expensive to inexpensive goods (in both exporting as well as importing countries) the trade balance starts improving and eventually surpass the initial condition. The purpose of this paper is to estimate and analyze the effect of devaluation of Chinese currency yuan on China's trade balance. In addition to estimating the effect of devaluation on trade balance, we also test the hypothesis of the existence of J-curve in China's trade balance.

The organization of the paper is as follows. Section II presents a brief review of literature. In section III, we present the methodology and description about the data. Section IV reports the empirical estimation and its analyses. Summary and conclusion are presented in section V.

II. Literature Review

Empirical findings on the effectiveness of devaluation and the J-curve effect are mixed. For example, Bahmani-Oskooee and Kutan (2009) used monthly data from 11 Eastern European economies from 1990 to 2005 and implemented a bound testing approach to generate modelling for cointegration and error-correction. Their study identified tangible evidence for the J-curve hypothesis in 3 of the 11 reviewed countries- Croatia, Russia, and Bulgaria. Bahmani-Oskooee& Kutan (2011) go further to annunciate the value of these findings for policy makers, stating that those working on exchange rate policy as a platform for achieving a real convergence with the EU standard would do well to take note of this economic phenomenon.

The findings of their study are corroborated by results of Anju & Uma's (2006) tests on the Japanese economy. Using an error-correction model and quarterly data from 1975 to 1996, they monitored the effects of the Japanese Yen's appreciation- specifically in relation to the ratio of imports to exports. Anju & Uma (2006) reported similar findings to Bahmani-Oskooee & Kuta (2011), stating the impulse response function exhibited clear signs of the J-curve phenomenon during Japan's flexible exchange rate regime.

Upadhyaya and Dhakal (1997) tested the effectiveness of devaluation on the trade balance in eight developing countries from Asia, Europe, Africa and Latin America. They used a unique and new methodology to estimate the long run effect of devaluation on the trade balance. Their estimated results suggest that devaluation, in general, does not improve the trade balance in the long-run. Their findings further suggest that in some cases it even can have a perverse effect.

Another study, by Onafowora (2003), aimed to identify J-curves in East Asia by using a cointegrating vector error correction model to examine the short and long run effects of the real exchange rates on the trade balances of Thailand, Malaysia, and Indonesia- particularly in their respective bilateral trading with the US and Japan. Their findings suggest something marginally different from the previous studies, as they identify a steady cointegrating relationship between real domestic and foreign income, real exchange rate, and real trade balance in each country. Despite some sizable variations in their results, the general implication of their findings suggests that a Marshall-Lerner condition is at play in the long-run, but varying degrees of J-curve effects can still be witnessed in the short-term.

However, this would not be a thorough review of literature if contradictory findings were not mentioned. To test the J-curve hypothesis in Nepal (and more specifically, whether or not the devaluation of Nepalese currency could be a policy tool to restore trade balance with the global economy, Chaulagai’s (2015) study utilizes Johansen’s cointegration test, impulse response functions, a vector autoregression model, and an autoregressive distributed lag bounds testing cointegration approach to get an in depth look at the effect that exchange rates have on trade balance in Nepal. The study did not find any signs of the J-curve phenomenon regarding Nepalese trade; rather it suggests that a depreciation of the exchange rate produces a subtler “L-curve,” which Chaulagai feels is an indicator that Nepalese trade imbalances cannot be rectified through a currency devaluation process.

A different study, conducted by Bahmani-Oskooee & Wang (2006,) coincides with Chaulagai's (2015) findings- this time with China under the microscope. Bahmani-Oskooee & Wang disaggregate the trade data by country and model their time series utilizing new methods. They implement this to estimate individual trade balance models between China and its 13 primary trading partners. While their findings did show that the real depreciation of their exchange rate has a positive effect on its trade balance with certain countries, there is not much evidence of the J-curve phenomenon is found.

Another study conducted by Ahmad &Yang (2002) attempted to estimate the J-curve in China using time series data on its bilateral trade with G-7 countries. This study implemented cointegration and causality tests to evaluate the long and short run relationships between exchange rate, national income, and trade balance. Ahmad & Yang reported that while there is some evidence that suggests depreciation will eventually improve the trade balance (again only with certain countries) there is still no indication of a J-curve phenomenon in China.

The J-curve phenomenon is a prominent relationship between devaluation and trade, and it can be witnessed in several instances. However, with such varying results, it is difficult to ascertain exactly what leads certain economies to have this relationship, and why in China's case, this phenomenon only takes place in certain bilateral trade relationships.

III. Theoretical Background and Methodology

The model developed in this study for the purpose of estimating the impact of Chinese currency devaluation on its trade balance follows Bahmani-Oskooee (1985) and Buluswar, Thompson, and Upadhyaya (1996). The model is as follows:

$$TB_t = \beta_0 + \beta_1 Y_t + \beta_2 Y_t^* + \beta_3 m_t + \beta_4 m_t^* + \sum_{i=0}^{n} b_i E_{t-i} + v_t \qquad (1)$$

In equation (1) *TB* is the trade balance, *Y* is the domestic output, *m* is domestic money supply. Likewise, Y* is the foreign output, *m** is foreign money supply. E is exchange rate (real effective exchange rate), *v* is the random error term and t is the time period. In equation (2) the explanatory variables are selected on the basis of absorption (income), elasticity (exchange rate) and monetary (money supply) approaches to the trade balance (for detail see Buluswar, Thompson, and Upadhyaya, 1996).

Absorption approach to the trade balance suggests that the domestic income and foreign income are the primary determinants of the trade balance. According to this approach an increase in domestic income, *Y* raises the volume of import and lowers the trade balance. In contrast an increase in foreign income *Y** raises the level of exports, therefore improves the trade balance. Following this logic, the coefficient of Y is expected to be negative and the coefficient of Y* is expected to be positive. Accordingly, the monetary approach to exchange rate suggests that an increase in the exchange rate reduces the purchasing power of domestic currency and increases the demand for money in order to maintain the consumption of imports. An increase in money supply would create an excess supply of money, leading domestic residence to spend their excess cash balances by purchasing imports. This ultimately would reduce the trade balance. Therefore, the coefficient of domestic money supply *m* is expected to carry a negative coefficient and the foreign money supply is expected to carry a positive coefficient.

The main focus of this study is the coefficients of *E* and its lags. According to the elasticity approach of trade balance devaluation or depreciation of domestic currency makes domestic exports relatively cheaper in foreign countries and raises the domestic price of imports resulting in an improvement in the trade balance. However, the higher import prices may contribute to higher domestic prices of non-traded goods (Williamson, 1983), which may raise the overall price level in home country. This in turn may raise the effective real exchange rate, which in turn may negatively affect the trade balance. Therefore, the coefficient of the real effective exchange rate (*E*) is a testable hypothesis. In order to identify a possible J-curve effect of devaluation on trade balance lags of exchange rate *E* are included. Appropriate lag length is determined using Akaike's information criterion during the estimation. If sum of these coefficients are positive and statistically significant it can be inferred that devaluation has a positive effect on trade balance. A negative and statistically significant sum of coefficients on other hand will indicate that devaluation deteriorates the trade balance. If the sum of these coefficients is statistically insignificant, devaluation has no effect on the trade balance.

Quarterly data from the year 2000 to 2016 are used. All the data are in billion U.S. dollars. The data used are derived from the Federal Reserve Bank of Saint Louis (FRED.) World output (real GDP) is derived using trade weighted sum of Japanese, United States, and European Union's respective GDP series. The same method is used for derivation of world money supply as well.

IV. Empirical Findings

Macroeconomic time series data are usually not stationary (Nelson and Plosser, 1982). The use of non-stationary data produces spurious regression results. Therefore, it is necessary to establish that the data series is stationary before estimating the model. To ensure the stationrity of the data augmented Dicky–Fuller (1981) and Phillip-Perron (1988) tests are conducted. The test results are reported in Table 1. As indicated in Table 1, all the data series are integrated of order 1 and are stationary only at the first difference level.

After establishing the stationarity of the data series Johansen's cointegration test (Johansen 1988) is conducted in order to check if the data series used in the model are cointegration. The cointegarion test result is reported in Table 2. The test result rejects the hypothesis of no cointegration. Therefore, following Engle and Granger (1987) an error correction model is developed which is as follows:

$$\Delta TB_t = \beta_0 + \beta_1 \Delta Y_t + \beta_2 \Delta Y_t^* + \beta_3 \Delta m_t + \beta_4 \Delta m_t^* + \sum_{i=0}^{n} b_i \Delta E_{t-i} + c\, EC_{t-1} + v_t \qquad (2)$$

In equation (2) EC_{t-1} is nothing but the lag of the error term derived from equation (1). The coefficient of the error correction term is expected to be negative. The estimated result of equation (2) is as follows:

$$\Delta TB_t = \underset{(0.09)}{0.0003} + \underset{(1.51)}{0.017}\,\Delta Y_t + \underset{(0.695)}{0.0001}\,\Delta Y_t^* - \underset{(2.11)^{**}}{0.0002}\,\Delta m_t + \underset{(1.51)}{0.0002}\,\Delta m_t^* + \underset{(2.01)^{**}}{0.0156}\,\Delta E_t$$

$$- \underset{(0.026)}{0.0002}\,\Delta E_{t-1} - \underset{(0.025)}{0.0002}\,\Delta E_{t-2} - \underset{(4.96)^{***}}{0.516}\,EC_{t-1} \qquad (3)$$

$$Adj\ R^2 = 0.315 \qquad F = 4.91 \qquad D.W. = 2.06 \qquad n = 69$$

Note: Figures in the parentheses represent "t" values for the corresponding coefficients. ***, ** represent significant at 1% and 5% critical level respectively.

The estimated result in equation (3) seems to be good in terms of the goodness of fit. The D.W. value also indicates that there is no autocorrelation problem. The direction of coefficients of the variables are also consistent with the theoretical expectation with exception of domestic income which is positive instead of negative. Even though it is not statistically significant at the conventional level of significance, it is significant at 15 % critical level. One explanation for positive coefficient is that as an economy grows its volume of exports also grows which, *ceteris* *paribus* positively affects the trade balance. This is particularly true for a large export- oriented economy like China. The coefficients of both the domestic as well as the foreign money supply carry appropriate sign. The coefficient of domestic money supply is negative and statistically significant; likewise the coefficient of foreign money supply is positive which is significant at 15 % critical level. Interestingly, both coefficients are of the same magnitude with opposite sign as predicted by the monetary approach discussed above.

The main focus of this study is the coefficients of the exchange rate and its lags. The contemporaneous effect of devaluation is positive and statistically significant. It suggests that a one percent devaluation of the Chinese Yuan improves the trade balance of China by $15.6 million U.S. dollars. The one period as well as two period lags both is negative, however, they are not statistically significant. Based on the finding that the lagged effect of devaluations is negative which increases over the period and eventually becomes positive, it can be argued that that a J-curve phenomenon has been detected with the Chinese trade balance adjustment during the period of study. The sum of the coefficients of the lags is 0.015, which is statistically not significant indicating that devaluation is not a very helpful tool to improve the trade balance in China. As expected the error correction term carries a negative and significant coefficient.

To ensure the estimated findings are robust the model is re-estimated splitting the sample beginning the first quarter of 2005, which is as follows:

$$\Delta TB_t = \underset{(0.834)}{0.045} + \underset{(1.688)^{*}}{0.022}\,\Delta Y_t + \underset{(0.094)}{0.0001}\,\Delta Y_t^{*} - \underset{(2.523)^{**}}{0.0002_3}\Delta m_t + \underset{(1.56)}{0.0002}\,\Delta m_t^{*} + \underset{(1.50)}{0.0156}\,\Delta E_t$$

$$- \underset{(0.0222)}{0.0002}\,\Delta E_{t-1} - \underset{(0.052)}{0.0006}\Delta E_{t-2} - \underset{(4.616)^{***}}{0.626}\,EC_{t-1} \qquad (4)$$

$Adj\ R^2 = 0.369 \qquad F = 4.44 \qquad D.W. = 2.07 \qquad n = 48$

Note: Figures in the parentheses represent "t" values for the corresponding coefficients. ***, **,* represent significant at 1%, 5% and 10% critical level respectively.

The estimated coefficients, their signs and the level of significance are consistent with estimated results of equation (3). The only difference is that in equation (4) the domestic income Y is statistically significant at 10 percent critical level and the coefficient of the contemporaneous exchange rate is significant only at 15 percent critical level but the size of the coefficient is pretty much same. The sum of the lagged exchange rate is 0.017 which is statistically insignificant as in equation (4). Finally, as in previous estimation the coefficient of the error correction term is negative and statistically significant.

V. Summary and Conclusion

This paper studies the effect of devaluation on trade balance in China. For that a model is developed which includes domestic and foreign income, domestic and foreign money supply, exchange rate (real effective exchange rate) as explanatory variable and trade balance as the dependent variable. In order to test the J-curve phenomenon lags of exchange rate are also included. Quarterly time series data from 1999 to 2016 is used. Before estimating the model the time series properties of the data series are diagnosed. Since all the data series are found to integrated of order one and the hypothesis of no cointegration is rejected, an error correction model is developed and estimated. The estimated results indicate that the contemporaneous effect of devaluation is significant but the lagged effect as well as total effect are insignificant. The direction and magnitude of the coefficients of lagged variables indicate a presence of J-curve phenomena with Chinese trade balance.

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Table 1: Unit Root Test

Variables	*Augmented Dickey Fuller Test*		*Phillip - Perron Test*	
	Level	*First Difference*	*Level*	*First Difference*
TB	*-2.48*	*-5.17****	*-2.47*	*-10.29****
m	*-1.03*	*-3.78***	*-1.12*	*-6.37****
*m**	*-0.95*	*-6.82****	*-0.73*	*-11.10****
Y	*-2.58*	*-13.45****	*-1.57*	*-21.82****
*Y**	*-1.77*	*-4.79***	*-1.20*	*-5.55****
E	*-1.18*	*-5.14****	*-2.03*	*-6.33****

Note: ***,** represent significant at 1% and 5% critical level respectively.

Table 2: Johansen's Cointegration Test

H_0	*Eigen Value*	*Trace Statistics*
r = 0	*0.603***	*174.21***
r ≤ 1	*0.472***	*110.51***
r ≤ 2	*0.302*	*66.39***
r ≤ 3	*0.274*	*41.53*
r ≤ 4	*0.186*	*19.43*
r ≤ 5	*0.073*	*5.24*

Note: ** rejection of null hypothesis at 5 % critical level