AN AUTOREGRESSIVE DISTRIBUTED LAG APPROACH TO ESTIMATING REAL EXCHANGE RATE FOR THAILAND

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ABSTRACT

This paper uses the stock-flow approach to examine the behavior of the real equilibrium exchange rate in Thailand. A simple model is developed in line with Mussa (1984), Faruqee (1995), and Égert et al. (2004). The model is then tested by the autoregressive distributed lag approach to the cointegration for the long run and using the error correction model to examine the short-run dynamic relationship among real exchange rate, dual productivity differentials, net foreign assets, and real absorption. The empirical analysis is based on the annual data series from 1980 to 2018, collected electronically from the online databases of the International Monetary Fund, the Penn World Table (10.0), and the World Bank. The study finds that increased capital flow, greater real absorption, and faster productivity growth in the tradable sector relative to that of the non-tradable sector led to real exchange rate appreciation. The estimated parameters are also stable.

INTRODUCTION

The real exchange rate is an important measure of a country's external competitiveness. Through its impact on trade and capital flows, changes in the real exchange rate can affect a country's economic development and growth. Movements in the real exchange rate have been credited for economic prosperity in some countries while blamed for hardship in others.

This paper utilizes the stock-flow approach to determine the real equilibrium exchange rate and apply it to Thailand for the 1980-2018 period using the autoregressive distributed lag (ARDL) approach to cointegration analysis. Thailand provides an interesting case study. Over the last four decades, Thailand achieved remarkable economic progress that moved the country from a low-income category in the 1980s to an upper-income category in 2011. Various sources such as the International Monetary Fund (IMF), Morgan Stanly Capital International, and Standard and Poor's classify Thailand as an emerging market. The World Bank often promoted Thailand as a model for other developing countries. However, Thailand's progress has not been steady. From 1950 to 1997, the country pursued a fixed foreign exchange-rate regime, and it helped the country record impressive economic growth. This success encouraged large-scale financial inflows in Thailand. Then in 1997, Thailand experienced a currency crisis, and the country unpegged the Thai baht from the United States dollar because it lacked reserves needed to peg to the dollar. This set off a series of currency devaluations and massive flights of capital. In essence, Thailand's roller-coaster rides in exchange rate movements and capital flows make it a fascinating country to study. While several studies have been done on Thailand in the exchange rate, no consensus has emerged on the determinants of its real exchange rate. Few studies explicitly incorporate net foreign assets when modeling Thailand's exchange rate movement. This paper plans to bridge this gap, and it is perhaps one of the few to use the stock-flow model for exchange rate determination and the ARDL approach for empirical estimation for Thailand.

THAI ECONOMY AND A BRIEF LITERATURE REVIEW OF ITS CURRENCY

In purchasing power parity terms, Thailand's GDP was US$ 1,272 billion by the end of 2020 and per-capita GDP US$ 18,236 (World Bank). Thailand's economy grew at an average annual rate of 7.5% from 1960 to 1996 and 5.0% following the Asian Financial Crisis from 1997 to 2005. Its growth slowed to 3.5% over 2005-2015. Over the 2011-2017 period, the GDP per capita averaged $2,757, and the growth rate averaged 6.74% PPP (World Bank).

Thailand's exchange rate regime changed over time. Thai baht was pegged to the US dollar from late 1963 to early 1978. While officially pegged to a basket of currencies from early 1978 to mid-1997, baht was *de facto* pegged to the US dollar. When the financial crisis hit Thailand in the mid-1997, Thailand switched to a freely floating regime. From January 1998 to December 2001, Thailand pursued a managed floating regime. Since then, Thailand has followed a managed floating regime, with occasional interventions in case of excess volatility in the foreign currency market and capital flows. Thailand's economy, particularly the tourism sector, experienced serve disruption due to COVID-19, and the central bank stepped in to manage excessive swings in the exchange rate. In 2020, the central bank of Thailand took several measures to restrain the surging baht to keep the baht exchange rate stable so exporters could manage their revenues. Interestingly, the central bank refused to impose outright capital controls. During the last two years, the central bank of Thailand intervened heavily (10 out of 12 months in 2019 alone) in the foreign currency market, which prompted the US to add Thailand to the US watchlist for currency manipulation. (Bloomberg, 2020 and 2021, various issues).

The exchange rate literature is expansive and can be divided into theoretical and empirical areas. We first briefly review the theoretical approaches and then examine the empirical analysis. The theoretical literature reveals three main approaches. The first approach is known as the macroeconomic balance approach (e.g., Williamson 1994). This approach tries to find an exchange rate that leads to internal (full capacity output) and external (sustainable current account) balances. The second approach is known as the behavioral equilibrium exchange rate approach (e.g., Edwards 1994). This approach tries to uncover an exchange rate that will simultaneously achieve internal (clearing of all non-tradable markets) and external (current account balance, given the level of exogenous long-run capital flow) balances. The third approach is known as the natural rate of exchange rate (e.g., Stein 1995). This approach searches for a long-term (steady state) exchange rate that will balance internal and external balances. Bussière et. al. (2010), Bussière (2014), and Bella, Lewis, & Martin (2007) provide a good summary of different approaches to exchange rate determination. Our model is a hybrid of the first two approaches (see model section, please).

A voluminous empirical literature exists on the determinants of exchange rates. For a succinct survey, please see Vogiazas, Alexiou, & Ogan (2019) and Gautam, Chadha & Malik (2020). For brevity and relevancy reasons, we review the empirical studies that focus on Thailand only. We will refer to other empirical studies to validate our results. Hossain and Arwatchanakarn (2021) raised doubt on the effectiveness of the interest policy in influencing the real exchange rate and through it, variables such as real outputs, prices, and real exports and imports. Kubo (2017) argued that foreign reserves are important determinants for Thailand's exchange rate dynamics. Anifowose, Ismail, & Sukor (2017) found that the major fluctuations in the Thai baht and US dollar exchange rate can be explained by currency order fluctuations. Bouraouia and Phisuthtiwatcharavongb (2015) revealed that for the 2004-2013 period, the terms of trade and international reserves had a statistically important impact on Thailand's exchange rate with the US dollar. However, the interest rate differential, the manufacturing production index, the monetary base, and government debt did not display a significant relationship.

Al-Abri and Baghestani (2015) found that the greater foreign investment increased real exchange rate volatility for Thailand for the period 1980-201. Agbola and Kunanopparat (2005) noticed that Thailand favored a pegged exchange rate regime when faced with monetary shocks and unsustainable public finance but preferred a flexible exchange rate regime in periods of high foreign reserves and economic growth. More specifically, they opined that the most important determinants of the real exchange rate in Thailand from 1990 to 2003 were monetary shocks, high debt, foreign reserves, and economic development. Jongwanich (2008) found a persistent real exchange rate overvaluation from 1991 to the onset of the crisis in 1997, with excessive net short-term capital inflows and government expenditure expansion being the main contributing factors. After the extensive depreciation of the nominal exchange rate, the real exchange rate gradually returned to its long-term equilibrium level.

In summary, we conclude that the empirical literature overlooked the impact of productivity growth on the exchange rate, and the evidence on the effects of productivity growth on real exchange variation in Thailand is scarce. This remains a gap in the literature that needs to be filled for an emerging market economy like Thailand.

MODEL SPECIFICATION

The model developed below builds on the asset model of the current account (e.g., Musa 1984), Faruqee (1995), and Égert (2004). Musa, Faruqee, and Égert's models were intended to explain movements in exchange rates in the developed countries. These models are attractive because they incorporate capital flows into the exchange rate determination. They models can be extended to explain exchange rate changes in small middle-income open economies, as articulated below. In this model, the current account, in the long run, is driven by adjustment in the net foreign assets (*NFA*) towards a targeted level. The real equilibrium exchange rate can deviate from a value specified by the purchasing power parity. Given a country's long-run target for its stock of net foreign assets, the real equilibrium exchange rate then corresponds to a current account balance that is consistent with the income flows from this stock.

Let P = domestic price index and P^*= foreign price index. We will follow the convention that any variable with an asterisk (*) represents a variable for the foreign country. The price indexes are defined as the weighted averages of the prices in the traded (T) and non-traded goods (N) sectors:

$$P = (P_T)^{1-\alpha} P_N^{\alpha} \quad (1)$$

$$P^* = (P_T^*)^{1-\beta} (P_N^*)^{\beta} \quad (2)$$

where α and β are constant weights between 0 and 1. The real exchange rate then can be written as:

$$RER = \frac{EP^*}{P} = E\frac{(P_T^*)^{1-\beta}(P_N^*)^{\beta}}{(P_T)^{1-\alpha}P_N^{\alpha}} = E\left(\frac{P_N^*}{P_T^*}\right)^{\beta}\left(\frac{P_N}{P_T}\right)^{-\alpha}\left(\frac{P_T^*}{P_T}\right) \quad (3)$$

where E is the nominal exchange rate and RER is the real exchange rate. The, the exchange rate is defined as the foreign price of a unit of domestic currency in real terms so that a decrease represents an appreciation for the domestic currency (i.e., it takes fewer bahts to buy a unit of foreign currency). If we write the equation (3) in log form, we obtain the following:

$$lnRER = ln[E + (P_T^* - P_T) + \beta(P_N^* - P_T^*) - \alpha(P_N - P_T)]. \quad (4)$$

Assuming $E + (P_T^* - P_T)$ is constant, if the productivity in the home country rises more than in the foreign country, the real exchange rate will appreciate in the home country. On the other hand, if the productivity in the foreign country increases faster than in the home country, the real exchange rate will depreciate.

Assuming constant returns to scale, the fixed supply of labor both home and abroad and free movement of labor between sectors within the country, the nominal wage W should be the same in both sectors. Let A_T and A_N denote average labor productivity in the traded and non-traded goods sectors, respectively. Perfect competition among producers in both sectors ensures that prices equal average production costs:

$$P_T = \frac{W}{A_T}, P_N = \frac{W}{A_N} P_T^*, = \frac{W^*}{A_T^*}, P_N^* = \frac{W^*}{A_N^*}. \quad (5)$$

Substituting equation (5) into equation (4) and rearranging, one obtains

$$lnRER = \alpha(lnA_N - lnA_T) - \beta(lnA_N^* - lnA_T^*) + lnE + ln\left(\frac{W^*}{A_T^*}\right) - ln\left(\frac{W}{A_T}\right). \quad (6)$$

The first term on the right side of the equation shows the differences in productivity between domestic non-traded and traded sectors. Similarly, the second term displays the same difference in the two foreign sectors. The term $\left(\frac{W^*}{A_T^*}\right) - \left(\frac{W}{A_T}\right)$ can be considered as the difference in the growth rates of a unit of labor costs between countries.

Next, we connect the real exchange rate with net foreign assets. Let us define the current account as the sum of net exports and interest income from a country's net foreign assets. Net exports depend on the real exchange rate (*RER*) and a shift parameter (*x*) encompassing other factors that impact the relative demand and supply for domestic and foreign goods. Thus, the current account equation can be written as:

$$CA = \Delta NFA = -\gamma(RER) + x + rNFA \quad (7)$$

where

CA = current account balance
NFA = net foreign assets
RER = real exchange rate, defined before
r = return on international investment
γ > 0.

In the steady state, the economy reaches the desired or equilibrium position of net foreign assets (NFA^D) so that $\Delta NFA = 0$. Thus, the equilibrium exchange rate ($\overline{RER}$) can be derived as:

$$\overline{RER} = \frac{1}{\gamma}\ (r\ NFA^D + x^D). \quad (8)$$

Fundamentals that determine an economy's desired *NFA* may include saving behavior, government, debt, absorption ratios, and so on (x). Before the equilibrium is reached, the rate of *NFA* accumulation is affected by the gap between the desired and current levels of net foreign assets. That is:

$$\Delta NFA = (NFA^D - NFA) \neq 0. \quad (9)$$

Combining equations (7), (8), and (9) produce

$$-\gamma(RER) + x + rNFA = (NFA^D - NFA)$$

$$RER = \overline{RER} = \frac{1}{\gamma}\ (NFA^D - NFA) - \frac{1}{\gamma}(\bar{x} - x). \quad (10)$$

Equation (8) shows that in the steady state, higher net foreign assets are associated with a more appreciated currency, while equation (10) reveals that the adjustment path of the exchange rate may be different from its long-run value. Combining equations (6) and (10) we get

$$\overline{RER} = \frac{1}{\gamma}(NFA^D - NFA) + \frac{1}{\gamma}(\bar{x} - x) + \alpha\,(A_N - A_T) - \beta(A_N^* - A_T^*) + E + \left(\frac{W^*}{A_T^*}\right) - \left(\frac{W}{A_T}\right). \quad (11)$$

From equation (11), equilibrium real exchange rate in reduced form can be linked to dual productivity (PROD), net foreign asset (*NFA*), and other factors (*x*): *RER = f (PROD, NFA, x).*

According to the Balassa-Samuelson effect, when productivity advances more rapidly in a country's traded goods sector than its non-traded goods sector, it causes changes in the price of traded goods relative to non-traded goods. This effect, in turn, changes the relative price levels between the home country and the foreign country. Hence, the underlying equilibrium real exchange rate will also change. In particular, faster productivity growth in the tradable sector will lead to domestic currency appreciation. While this situation may be true for trade between developing and developed countries, the situation is ambiguous in emerging market economies (Brixiova, Égert, and Essid 2014). Although domestic currency may appreciate due to the Balassa-Samuelson effect, it can also depreciate when the decline in tradable prices is more significant than the increase in non-tradable prices. The overall effect of productivity on the real exchange rate in emerging countries thus depends on the strengths and direction of these effects. Since emerging countries seek out foreign capital inflows to stimulate growth, their targeted net foreign position may be negative. In turn, these capital inflows often lead to an increase in aggregate demand, fueling inflation and causing real exchange rates to appreciate. Once the foreign liabilities are large enough, however, the outflow of interest payments may cause the real exchange rate to depreciate (Brixiova, Égert, and Essid 2014). Thus, the impact of net foreign assets on the currency is uncertain during an emerging market's adjustment to the long-run equilibrium.

DATA

The empirical analysis is based on the yearly data for the period 1980 to 2018, collected electronically from the online databases of the World Bank, the Penn World Table (10.0), and the IMF. The choice of data cutoff point is dictated by the availability of consistent data set. In the actual calculation, we use several control variables such as the domestic absorption ratio, investment ratio, terms of trade, and government spending ratio. We input the control variables one at a time, due to concern for degrees of freedom. We report the results for the real domestic absorption as the control since it produces the best results.

The real exchange rate (*RER*) is defined as the foreign price of a unit of a Thai baht multiplied by the ratio of US CPI to Thai CPI, with the year 2010 = 100. The productivity differential (*GDPPC*) is defined as the differences in GDP per capita between the US and Thailand, in constant 2010 dollars. The net foreign asset (*NFA*) is Thailand's current account balance as a percent of GDP. The current account includes goods and services, income, and current transfers. The real domestic absorption (*RDANA*) is defined as the sum of consumption, investment, and government expenditure (in mil. 2010 US$). For the dummy variable (*DUMMY*), we set 0 for the years 1975-1996 and 1 otherwise. Data on *RER* and *NFA* are obtained from the IMF, *GDPPC* from the World Bank, and *RDANA* from the Penn World Table (10.0).

MODEL ESTIMATION AND ANALYSIS

The paper applies the ARDL bounds testing procedure of Pesaran, Shin, and Smith (2001) to test the relationship between real exchange rate, productivity differential, net foreign asset flow, and absorption in Thailand. Before conducting ARDL bound testing, we test stationarity of each variable. The bound testing approach requires all variables to be integrated of I(0) or I(1) or of both natures to compute *F*-statistics. In addition, none of the variables used in the study can be I(2) or higher. Table 1 provides the results of unit root testing using the augmented Dicky-Fuller test (results of other unit root tests such as KPSS are similar and available on request). The results confirm that none of the variables are at *I*(2) or above that order; consequently, we can use the ARDL approach.

After verifying the unit root properties of variables, we proceed to analyze the long-run relationships using bounds testing. Following Pesaran et al., we write the general form of the ARDL model with n lags for variable Y and m lag for variable X as follows:

$$Y_t = \alpha_0 + \sum_{i=1}^{n} \alpha_i Y_{t-1} + \sum_{i=0}^{m} \beta_i X_{t-1} + u_t \quad (12)$$

We write the general form of the ARDL error correction model as follows:

$$\Delta Y_t = \alpha_0 + \sum \beta_j Y_{t-1} + \sum \beta_j X_{t-j} + \psi ECT_{t-1} + \varepsilon_t \quad (13)$$

Table 1
Unit Root Testing Using the Augmented Dicky-Fuller Test

Variable	Model	Level	First Difference	Decision
RER	Intercept	-1.365194***	-5.199661***	*I*(1)
	Trend and intercept	-1.336503***	-5.097540***	*I*(1)
	None	0.497157***	-5.078304***	*I*(1)
GDPPC	Intercept	-0.336208***	-3.939780***	*I*(1)
	Trend and intercept	-2.466416***	-3.876421**	*I*(1)
	None	2.311734***	-2.992509***	*I*(1)
NFA	Intercept	-2.405628***	-3.945008***	*I*(1)
	Trend and intercept	-2.376409***	-6.509793***	*I*(1)
	None	2.446256***	-6.687130***	*I*(1)
RDANA	Intercept	-0.237507***	-4.552930***	*I*(1)
	Trend and intercept	-2.984111***	-4.497713***	*I*(1)
	None	3.3112879***	-3.841795***	*I*(1)

*Asterisks *** and ** indicate 1% and 5% level of significance, respectively.*
Author's own calculation using Eviews 11 software

In equation (13), ψ represents the coefficient of the error correction term ECT_{t-1}, which is the speed of adjustment into long run equilibrium from the short run. This coefficient must be negative to indicate that any divergence from the long run equilibrium is non-explosive and that it will return to the long-run equilibrium position. ECT_{t-1} is the residuals that are acquired from the estimated cointegration model.

The relationship of the real exchange rate with variables from our theoretical model is specified as follows:

$$RER = f(NFA, GDPPC, RDANA) \qquad (14)$$

The specific form of the ARDL model for our study to find out the long run relationship among variables is as follows:

$$RER_t = \alpha_0 + \sum \alpha_1 NFA_{t-i} + \sum \alpha_2 GDPPC_{t-i} + \sum \alpha_3 RDNA_{t-i}$$

The short run dynamics of the ARDL model can be found via the following equation:

$$\Delta RER_t = \beta_0 + \sum \beta_1 \Delta RER_{t-i} + \sum \beta_2 \Delta GDPPC_{t-i} + \sum \beta_3 \Delta RDNA_{t-i} + \psi ECT_{t-1} \qquad (15)$$

The ARDL procedure involves two stages. The first stage is to establish that a long-run relationship exists among the variables. The second stage involves estimating the long-run and short-run relationships once it is established that the variables are cointegrated (Narayan and Smyth, 2005). To complete the first stage, an *F-test* is conducted for the joint significance of coefficients of the lag levels of the variables. In this setup, the null hypothesis of no cointegration is conducted as follows:

$$H_0 : \delta_1 = \delta_2 = \delta_n = 0$$
$$H_1 : \delta_1 \neq \delta_2 \neq \delta_n \neq 0$$

Thus, there is cointegration if the null hypothesis is rejected. The *F*-statistics for testing are compared with the critical values developed by Pesaran et al. that provide two critical values—an upper and lower value—to test the null hypothesis. The null hypothesis of no cointegration is rejected when the value of the test statistic exceeds the upper critical bounds value, while it is accepted if it is lower than the lower critical bounds value. In other, the cointegration test is inconclusive. We choose a maximum lag order of 2, because we are dealing with annual data with a short span, for the conditional ARDL vector error correction model by using the Akaike information criteria (AIC). In our case, the estimated *F*-statistic is 14.332, much higher than the upper critical value of 4.37. This means that we can reject the null hypothesis that no long-run relationship exists and proceed to estimate the long-run relationship.

The estimated coefficients are reported in Table 2. The coefficients are all significant at the 5% level. The coefficient for *GDPPC* is positive while negative for *NFA* and *RDANA*. The negative sign of *NFA*'s coefficient implies that decreases in net foreign assets (i.e., capital inflow) resulted in real appreciations of baht. Our result is consistent with Egert et al. (2004) findings for *NFA* in transition economics. Alonso-Gamo et al. (2002) come to the same conclusion for Lithuania and Alberola (2003) for the Czech Republic. Hinnosar et al. (2003) find the opposite of what find for Estonia, i.e., a decrease in the NFA position causes the real exchange rate to depreciate. As for the impact of productivity differential, the positive sign of *GDPPC*'s coefficient indicates that an increase in productivity differential led to a real depreciation of baht. For high-income countries, Vogiazas, Alexiou, & Ogan (2018) find results similar in line with our study, namely, increasing productivity causes the real exchange rates to depreciate while the opposite is true for upper-middle income countries. Grisse and Scheidegger (2021) find contrary results that higher per capita income is associated with real exchange rate appreciation. Erünlü (2018) find similar results for Turkey.

Regarding *RDANA*, the negative coefficient reveals that a greater *RDANA* (absorption) led to the real depreciation of baht. Hasnat (2019) find much the same results for Bangladesh, Lebdaoui (2013) for Morocco, and Brixiova et al. (2014) for Egypt. The coefficient for the dummy variable is significant, which indicates a structural break.

Table 2
Estimated Long-Run Coefficients Using the ARDL Approach
(Dependent Variable is *RER*)

Variable	Coefficient	t-Statistic	Prob.
NFA	-0.020720	-4.764596	0.0001
GDPPC	1.623451	3.678935	0.0014
RDANA	-1.009989	-5.407982	0.0000
DUMMY	0.060251	5.841971	0.0000
C	0.011610	1.035639	0.3112

Author's own calculation using Eviews 11 software

Next, we estimate the short-run dynamic parameters by estimating an error correction model associated with the long-run estimates. The empirical results for the short run, together with standard diagnostic tests, are presented in Table 3. The error correction term ECT(-1), which measures the speed of adjustment towards long-run equilibrium, is statistically significant. The negative sign of ECT indicates that the series is non-explosive, and the long-run equilibrium is attainable after shock. The magnitudes of ECT indicate for any shocks the speed of recovery from short-run disequilibrium to long-run equilibrium convergence. The correction coefficient -0.33 indicates that 33 percent of the errors from the lag are absorbed in the next year. In other words, once shocked, convergence to equilibrium is quick, with one-third of the adjustment occurring in the first year. AbuDalu and Ahmed (2011) also find similar results for Thailand [(ECT(-1) coefficient -0.27], Malaysia, Indonesia, Singapore, and the Philippines.

The positive lag value for the dependent variable *RER* indicates drift, where the real exchange rate movement this year continues the following year. However, the coefficient is not significant even at the 10% level. Brixiova et al. (2014) find similar results for *RER* for Egypt, Morocco, and Egypt, but their coefficients are significant. The estimated coefficient for the impact of productivity (*GDPPC*) on the real exchange rate is positive and statistically significant.

This result indicates that an increase in productivity has the traditional Balassa-Samuelson effect, meaning that faster productivity growth in the tradable sector than in the non-tradable sector leads to real exchange rate appreciation.

The coefficient for net foreign assets (*NFA*) for the current year is significant and negative, indicating that a decrease in net foreign assets (=equivalent to an increase in capital flow) leads to real exchange rate appreciation in Thailand. Jongwanich (2008) and AbuDalu and Ahmed (2011) find identical results for Thailand. The coefficient for one-year lag for *NFA* is significant and positive, which hints at a reversion towards an equilibrium value. The estimated coefficient for real domestic absorption (*RDANA*) for the current year is negative and significant, which is consistent with the finding of Jongwanich (2008). On the other hand, the coefficient for *RDANA* for the one-year lag is positive, which is also significant. These results indicate some uncertainty regarding the impact of real absorption (*RDANA*) on the real exchange rate in Thailand. It means in the short run a greater *RDANA* leads to an appreciation, but in the medium term it leads to depreciation. The coefficient for the dummy variable is significant at least at the 10% level, signaling a structural break in 1997.

To assess parameter stability, we conduct a cumulative sum of recursive residuals (CUSUM) and a CUSUM of squares (CUSUMSQ) test. Figures 1 and 2 plot the results of CUSUM and CUSUMSQ tests. The results clearly indicate the absence of any instability because the coefficients of the plot of the CUSUM and CUSUMSQ statistic fall inside the critical bands of the 5% confidence interval of parameter stability.

Table 3
The Results of Error Correction Model for Short-Run Dynamics Using the ARDL Approach [Error Correction: D(*RER*)]

Variable	**Coefficient**	**t-Statistic**	**Prob.**
D(RER(-1),2)	0.160518	1.578290	0.1200
D(NFA,2)	-0.011341	-5.795777	0.0000
D(NFA(-1),2)	0.007369	4.717805	0.0005
D(GDPPC,2)	0.871971	2.504149	0.0255
D(RDANA,2)	-0.852016	-6.094681	0.0000
D(RDANA(-1),2)	0.360013	2.209917	0.0320
D(DUMMY)	-0.061764	-1.835560	0.0811
D(DUMMY(-1))	-0.229415	-5.509421	0.0000
ECT(-1)	-0.330501	-10.00112	0.0000

Diagnostic statistics

Adjusted *R*-squared	0.9130	Durbin-Watson Stat	1.8570
Sum of squared residual	0.0309	Akaike info criteria	-4.0709
Log likelihood ratio	85.3099	Schwarz criteria	-3.6829

Author’s own calculation using Eviews 11 software

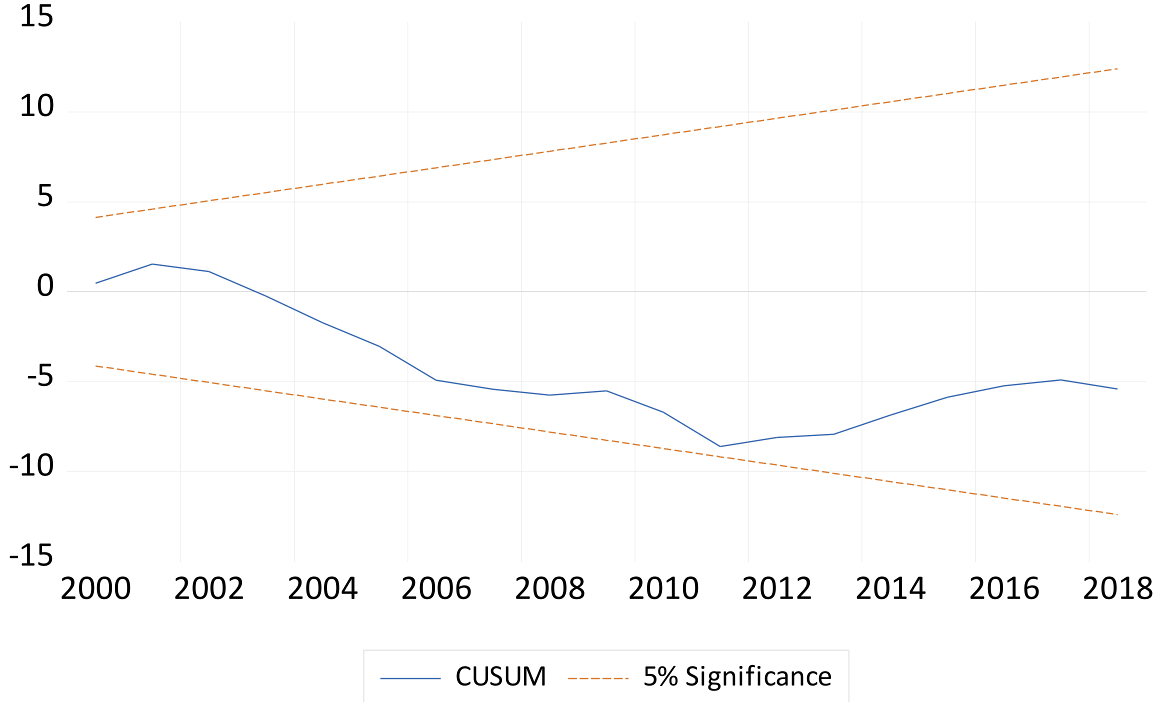
CONCLUSION

This paper investigated real exchange rate activity in Thailand for the 1980-2018 period. The study drew on the stock-flow approach to exchange rate determination for theoretical underpinning. For empirical estimation, the paper applied the autoregressive distributed lag model (ARDL) bound testing approach to cointegration for the long run and applied the error correction model to examine the short-run dynamic relationship among real exchange rate, dual productivity differentials, net foreign assets, and real absorption. The study found that increased capital flow, greater real absorption, and faster productivity growth in the tradable relative to the non-tradable sector led to real exchange rate appreciation.

The empirical results have several policy implications. For example, Thailand may consider keeping its currency relatively weak to protect domestic producers from foreign competition and strengthen their competitiveness to produce for and sell to world markets. Since Thailand is an export-oriented economy and capital flows have important implications for the exchange rate, the country needs to develop economic policies to avoid a boom and bust of capital flows. To this end, Thailand needs to strengthen its domestic financial system. The country should be careful in devising capital control policies as they tend to increase the cost of capital, allocate finance to investments favored by the capital control regime, and encourage corruption. The external factors often cause a change in capital flows in an emerging country like Thailand. It would be prudent for Thailand to take note of the macroeconomic developments in advanced countries like the US, the EU, the UK, Japan, and China. Overall, Thailand should closely monitor short-term capital flows to avoid real exchange rate appreciation.

Our study points to the realization that in the medium run, as Thailand moves towards its desired stock of foreign assets since future high growth cannot be financed by internal savings only, and the use of foreign savings implies the rise of NFA will lead to accumulation of foreign liabilities. However, in the long run, as Thailand moves towards a higher level of desired stock of NFA, the Thai baht may need to depreciate to service increasing debt.

Figure 1
CUSUM Graph
Plot of Cumulative Sum of Recursive Residuals

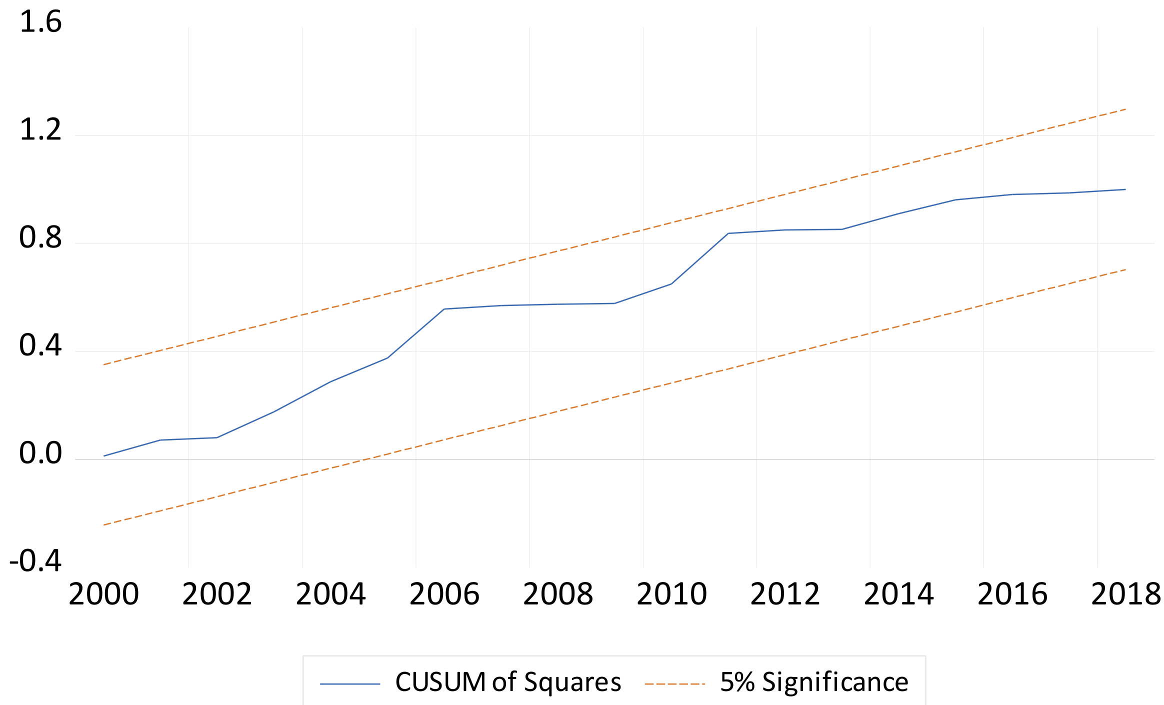


Author's own calculation using EViews 11 software

Overall, our results are consistent with the hypothesis, suggesting that productivity growth is linked to the real exchange rate. The central bank of Thailand should consider this when it intervenes in the foreign exchange market. Our results also show that real absorption is associated with exchange rate changes. Thus, it would be prudent to examine the impact of high absorption on the exchange rate since Thailand is an export-driven economy.

The results of the study should be interpreted cautiously. The particular relationship observed may be an indictment of regression analysis or the data set. This research might be extended in several directions. First, in a nonlinear framework, it could be carried out for other countries, especially those that have experienced high fluctuations in exchange rates and capital flows. Second, our result could be due to how the real exchange rate is determined. The same framework could be extended to different types of real exchange rate calculations (i.e., macro-balance, behavioral equilibrium, natural rate) and connect these with productivity differentials to examine the relative speed of adjustment of real exchange rates. In future research, country risk variables can be incorporated to broaden the analysis of exchange rate behavior.

Figure 2
CUSUM Squares Graph
Plot of Cumulative Sum of Squares of Recursive Residuals



Author's own calculation using EViews 11 software

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