# Exchange rate and trade balance linkage: sectoral evidence from Thailand based on nonlinear ARDL

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# Exchange rate and trade balance linkage: sectoral evidence from Thailand based on nonlinear ARDL

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## Abstract

Exchange rate has been managed to improve trade balance in many countries to increase economic growth. However, the relationship between exchange rate and trade balance is inconclusive both in the long-run and short-run. Thus, to improve trade balance effectively, the relationship needs to be studied. Therefore, this paper will examine the relationship in Thailand by applying novel approach NARDL which would give more robust result than former techniques. The paper finds that relationship exists, and that depreciation improves trade balance for the whole country in the long-run but have mixed results for different sectors due to elasticity of demand for import and export. However, trade balance is worsened in the short-run according to J-curve theory. These results imply that there is a tradeoff of depreciation between short-run and long-run, and between exporting sectors and importing sectors. Policymaker could moderately depreciate the currency to boost trade balance but needs to effectively manage the cost incurred.

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## Introduction

Improving trade balance leads to a robust economic growth in many countries. On the opposite, when a country persistently experiences a trade deficit there could be severe negative consequences that can affect economic growth and stability. In addition, a persistent trade deficit can often have adverse effects on the interest rates in that country which could affect investment. In the long run, a trade deficit could lead to the creation of fewer jobs. If the country is importing more goods from foreign companies, prices will go down, and domestic companies may be unable to produce and compete at the lower prices.

To manage trade balance, the relationship between trade balance and exchange rate needs to be studied. If relationship exists, knowledge of the extent to which the exchange rate can be stabilized is important for the management and design of both trade and exchange rate policies. For instance, policy actions aimed at stabilizing the domestic economic system can obtain uncertain results if policymakers fail to realize the degree to which real exchange rates can be applied to control exports and imports.

Currency depreciation comes with costs and benefits. A devaluation of the exchange rate will make exports more competitive and appear cheaper to foreigners, thus increasing demand for exports and enhancing exporting sector. In addition, country's assets become more attractive, causing more foreign investment and higher economic growth. However, currency devaluation has costs as imports becomes more expensive, reducing demand for imports which could damage importing sectors. Moreover, devaluation could push inflation higher as exports becoming cheaper, manufacturers may have less incentive to cut costs. Therefore, costs may increase over time.

Marshall-Lerner's theory show that the effect of exchange rate and trade balance could be positive and negative. According to Marshall-Lerner's elasticity theory, currency depreciation could either improve trade balance or worsen trade in the long-run. This depends on the elasticity of demand of import and export. For the short-run, according to J-curve theory, deprecation is expected to initially worsen trade balance as quantity of demand is inelastic. Over time, trade balance will gradually improve to the point which could be either at a higher or at a lower level of trade balance before depreciation according by Marshall-Lerner theory.

Empirically, studies found that relationship between trade balance and exchange rate is mixed. Some studies found a positive relationship between exchange rate and trade balance, implying that currency depreciation will close the trade gap (Igue & Ogunleye, 2014)(Ahmad, Ahmed, Khoso, Palwishah, & Raza, 2014). Some studies have failed to notice any relationship between the two variables (Liew, Lim, & Hussain, 2003)(Boyd, Caporale, & Smith, 2001). Some studies found that a negative relationship, implying that Marshall-Lerner condition does not hold and quantity demand for import and export are inelastic (Bahmani-Oskooee & Ratha, 2007)(Onafowora, 2003).

Therefore, this research will contribute to the literatures in the following ways. First, as the relationship is mixed, the paper fills this gap by examining the relationship in Thailand. Thailand is chosen because it is a major world's exporting and importing in many products such as rice, fishery. Second, previous researches assume asymmetric effect of exchange rate; however, recent study found that trade balance reacts to exchange rate in asymmetric manner. Thus, we will perform more appropriate NARDL technique which gives more reliable result. Third, we will examine not only in Thailand but also on in its sectors, which would give more robust result on the net effect in a country.

The findings of this research would help policymakers in many ways. First, the research finds out sensitivity of exchange rate to trade balance so that policymakers could take into account this sensitivity when designing trade and exchange rate policy. Second, the finding would show the impact of exchange rate to trade balance in each sector. This finding shows the sectors that are better off and worse off, informing policy makers not only the benefit but also the cost of depreciation.

The research found that depreciation of exchange rate significantly improves trade balance for Thailand as a whole country in the long-run. However, depreciation increases trade balance in Technology, Consumer discretionary, Consumer staples, and Industrails sector but worsens trade balance in Energy and Healthcare sector. In the short-run depreciation decreases trade balance but gradually increase it over time according to J-curve. Thus, moderate depreciation is suggested if needed to boost economic growth and negative effects should not be ignored.

Our research has the following sections: 2. Theory framework, 3. Empirical finding, 4. Data and variable construction, 5. Methodology and result analysis, 6. Conclusion and policy implication

## 2. Theoretical framework

The long-run effect of exchange rate on trade balance is explained by Marshall-Lerner while the short-run effect by J-curve theory.

### Long-run effect

According to Marshall-Lerner theory, depreciation of domestic exchange rate decreases relative price of exporting goods and increases relative price of importing goods. This is called "relative price effect". As a result, domestic goods are relatively cheaper than foreign goods. Foreigners will buy more domestic goods (higher domestic exporting quantity). At the same time, foreign goods are more expensive relatively than domestic goods. As a result, domestic consumers buy less foreign goods (lower domestic importing quantity). The change in the domestic quantity demand of foreign goods and in the foreign quantity demand of domestic good is termed "volume effect".

The net impact of depreciation on value of export depends on the magnitude of price effect and volume effect. If the volume effect (an increase in quantity export) exceeds the price effect (a decrease in exporting price), the value of export increases. Similarly, the net impact on value of import depends on the magnitude of price effect and volume effect. If volume effect (a decrease in quantity import) exceeds price effect (an increase in importing price), the value of import decreases. The net effect on trade balance (difference between value of export and value of import) will depend on the effect of depreciation on value of export and value of import. If depreciation increases value of export and decreases value of import, trade balance will improve.

As we have discussed, value of export and value of import will depend on volume effect. Volume effect depends on the price elasticity of domestic demand on foreign goods (demand for import) and price elasticity of foreign demand on domestic goods (demand for export). When demand is elastic, change in quantity demand is very sensitive to relative price change. A small change in relative price causes a large change in demand. Thus, volume effect is greater than relative price effect.

There are several cases when domestic exchange rate depreciates.

1. Quantity demand for export and import are elastic.

   The volume effect is greater than the relative price effect. Value of export will increase, and value of import will decrease, resulting in higher trade balance.

2. Quantity demand for export and import are inelastic.

   The volume effect is weaker than the relative price effect. Value of export will decrease, and value of import will increase, resulting in a lower trade balance.

3. Quantity demand for export is elastic but demand for import is inelastic.

   The volume effect is stronger than the price effect for export. But price effect is stronger than volume effect for import. Value of export and import will both increase. Trade balance will depend on relative strength of value of export and import. If value of export increase at a greater extent than import, trade balance will increase.

4. Quantity demand for export is inelastic but demand for import is elastic

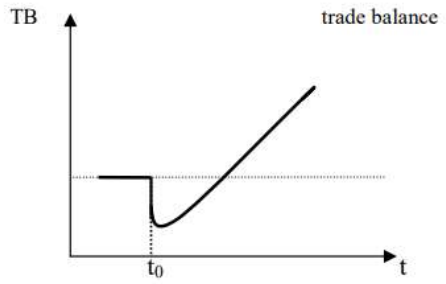
   The volume effect is weaker than the price effect for export. But price effect is stronger than volume effect for export. Value of export and import will both decrease. Trade balance will depend on relative strength of value of export and import. If value of export decrease at a greater extent than import, trade balance will worsen.

**Short-run effect**

The short-run effect is shown by the J-curve. From Figure 1, the J-curve shows how a depreciation of exchange rate affect trade balance over time. Immediately after the depreciation, the domestic importers are facing higher import prices in terms of domestic currency. But demand for export and import are inelastic in the short-run as quantity of import and export needs some time to adjust. Thus, the trade balance will worsen due higher value on the imports in the short-run.As a result, trade balance initially falls. The elasticity of demand is affected by sluggishness in change of people's consumer behavior or the lag of renegotiating contracts.

In the long-run the quantity will adjust to the new price level and the change in exchange rate; hence, the market and home country will experience an increase in its export volume and a decrease in its import volume and the trade balance will improve. The decrease and the recovery take the shape of the letter J, thus the term J-curve effect. The net result in the long run whether trade balance exceed the initial point before depreciation depends on the elasticity of demand from Marshall-Lerner theory as we have discussed.

Figure 1: J-curve effect of currency depreciation




**3. Empirical finding of previous literature (literature review)**

The relationship between exchange rate and trade balance is mixed in the long-run. Igue & Ogunleye (2014) found that exchange rate depreciation have the positive relationship with trade balance in the long-run in Nigeria. Ahmad et al (2014) found that real exchange rate improves trade balance in Pakistan. Liew,Lim and Hussain (2003) found no significant relationship between exchange rate and trade balance in some ASEAN countries. Boyd, Caporale and Smith (2001) failed to find positive relationship in U.S. in the long-run. In contrast, Bahmani-Oskooee (1991) found a negative relationship between trade balance and exchange rate in some of her samples in LCD countries, concluding that in certain cases demand of import and export is inelastic. Onafowora (2003) also found negative relationship in some countries in East Asia.

In the short-run, empirical studies also have mixed result. Boyd, Caporale and Smith (2001) found the presencse of J-curve, showing that depreciation causes worsen trade balance in the very short-run and trade balance gradually improves to the point, not significantly different from the initial point. Thus positve relationship is not found. In contrast, Ahmad et al (2014) found the inverse J-curve in which depreciation initially improves trade balance sharply. Then it

gradually declines over time to the point which trade balance is better off than before depreciation. Bahmani-Oskooee (1991) found no presence of J-curve in some countries of her sample.

These findings of these studies come from different methods, most of which assume asymmetry of exchange rate. However, asymmetry of exchange rate is evidenced as Bussière (2013) points out that non-linearity and asymmetries in the trade balance/exchange rate relationship can be attributed to adjustment cost, price rigidities and quantity restrictions. The asymmetric nature could also be caused by the presence of market power, government interventions and the actions of market participants. Non-asymmetric effect of exchange rate implies that speed of adjustment of trade balance when exchange rate is negatively and positively shocked are different. Assumption that these effects have an equal response from depreciation and appreciation could result in an unreliable result.

However, many previous papers does not take into account asymmetry effect of exchange rate. Igue & Ogunleye (2014) uses ARDL method to examine the relationship but the technique does not take into account the asymtric nature of exchange rate. Ahmad et al (2014) used Johanson's method to explore the relationship. He found the positve relationship but the Johanson's does not take into account of asymetric nature. Bahmani-Oskooee (1991) applied traditional OLS regression which has many limitations. For example, long-run effect is removed and theoretical relationship is assumed. Onafowora (2003) applies Johanson's cointergration technique with LRSM which does not test for asymmetry. Thus, our paper applies NARDL method which gives more reliable result.

## 4. Data and variable construction

Following the existing empirical literature in this area, this research uses four variables. Two main variables are trade balance and real exchange rate while two control variables are real domestic income and real foreign income. The research applies quarterly data from the first quarter of 1994 to the fourth quarter of 2017. Data is collected from Thailand's ministry of commerce and IMF. The long-run equilibrium relationship between the trade balance and the real effective exchange rate, augmented with domestic real income and real foreign income take the following form.

$$TB_t - \alpha_0 - \alpha_1 RER_t - \alpha_2 YTH_t - \alpha_3 YF_t = \epsilon_t$$

$TB_t$ is trade balance calculated by the value of exports divided by the value of imports.

$RER_t$is real effective exchange rate and has a unit of baht per one dollar. An increase in $RER_t$ means currency depreciation. If real exchange rate has a positive coefficient, an increase in $RER_t$ will decrease import and increase export, resulting in higher trade balance.

$YTH_t$ is domestic income or Thailand's income, represented by real GDP of Thailand. If $YTH_t$ has a positive coefficient, an increase in $Y_t$ will increase in trade balance.

$YF_t$ is foreign income which is the sum of real GDP of USA and OECD. If $YF_t$ has a positive coefficient, an increase in $Y_t$ will increase in trade balance. According to the theory, a positive coefficient is expected as higher foreign income will demand more Thai goods, resulting in higher export and lower trade balance.

**5. Methodology and result analysis**

A prerequisite for testing for cointegration is that all variables are nonstationary. Thus, we investigate the time series properties of the individual variables. First all variables are taken log forms to make variance stationary. Then first difference is taken to test whether variables are stationary in difference form. The common practice is to use the augmented Dicky-Fuller (ADF) test. Thus, we perform augmented dicky fuller test to examine the stationary of variables in their log forms and first difference.

From Table 1, ADF shows that the null hypothesis of a unit root can not be rejected for all variables at log-form, indicating that they are nonstationary. However, with the first-differences, each variable indicates rejection of the null hypothesis of a unit root at 5% level, thus they are stationary in the first-difference forms. Then PP test is conducted and found similar result as ADF. From Table 2, all variables are non-stationary in their level form as null hypothesis of unit root cannot be rejected. They become stationary when first differences are taken as null hypothesis are rejected.

Table 1: ADF test for log-form and first-difference form

| | VARIABLE | ADF | T-STAT. | C.V. | RESULT |
|---|---|---|---|---|---|
| LOG FORM | LTB | ADF(1)=SBC | -2.4691 | -3.3607 | Non-Stationary |
| | | ADF(1)=AIC | -2.4691 | -3.3607 | Non-Stationary |
| | LRER | ADF(1)=AIC | -2.2453 | -3.3607 | Non-Stationary |
| | | ADF(1)=SBC | -2.2453 | -3.3607 | Non-Stationary |
| | LYTH | ADF(4)=SBC | -2.1000 | -3.3607 | Non-Stationary |
| | | ADF(4)=AIC | -2.1000 | -3.3607 | Non-Stationary |
| | LYF | ADF(1)=SBC | -1.4742 | -3.3607 | Non-Stationary |
| | | ADF(2)=AIC | -1.6794 | -3.3607 | Non-Stationary |

| | VARIABLE | ADF | T-STAT. | C.V. | RESULT |
|---|---|---|---|---|---|
| 1ST DIFF. FORM | DTB | ADF(1)=SBC | -7.636 | -2.8929 | Stationary |
| | | ADF(3)=AIC | -4.3799 | -2.8929 | Stationary |
| | DRER | ADF(1)=SBC | -7.1637 | -2.8929 | Stationary |
| | | ADF(1)=AIC | -7.1637 | -2.8929 | Stationary |
| | DYTH | ADF(3)=SBC | -4.4015 | -2.8929 | Stationary |
| | | ADF(3)=AIC | -4.4015 | -2.8929 | Stationary |
| | DYF | ADF(1)=SBC | -3.8574 | -2.8929 | Stationary |
| | | ADF(1)=AIC | -3.8574 | -2.8929 | Stationary |

Table 2: PP test for log-form and first difference form

| | VARIABLE | T-STAT. | C.V. | RESULT |
|---|---|---|---|---|
| LOG FORM | LTB | -2.9206 | -3.4268 | Non-Stationary |
| | LRER | -1.7937 | -3.4268 | Non-Stationary |
| | LYD | -3.1065 | -3.4268 | Non-Stationary |
| | LYF | -1.3520 | -3.4268 | Non-Stationary |

| | VARIABLE | T-STAT. | C.V. | RESULT |
|---|---|---|---|---|
| 1ST DIFF. FORM | LTB | -15.0412 | -2.8169 | Stationary |
| | LRER | -9.5310 | -2.8169 | Stationary |
| | LYD | -11.5505 | -2.8169 | Stationary |
| | LYF | -6.4433 | -2.8169 | Stationary |

Then KPSS test is implemented. The null hypothesis of KPSS is different from ADF and PP as the null hypothesis of KPSS is stationary of variable. From Table 3, all variables are non-stationary in their level form as the null hypothesis of stationary is rejected for all variables. They become stationary when first difference is taken. The null hypothesis of stationary is not rejected in first difference form.

Table 3: KPSS test for log-form and first difference form

| | VARIABLE | T-STAT. | C.V. | RESULT |
|---|---|---|---|---|
| LOG FORM | LTB | 0.2206 | 0.1453 | Non-Stationary |
| | LRER | 0.5632 | 0.1453 | Non-Stationary |
| | LYD | 0.3712 | 0.1453 | Non-Stationary |
| | LYF | 0.2981 | 0.1453 | Non-Stationary |

| | VARIABLE | T-STAT. | C.V. | RESULT |
|---|---|---|---|---|
| 1ST DIFF. FORM | LTB | 0.3218 | 0.4003 | Stationary |
| | LRER | 0.2365 | 0.4003 | Stationary |
| | LYD | 0.2981 | 0.4003 | Stationary |
| | LYF | 0.3479 | 0.4003 | Stationary |

Next, we find the order of vector autoregression. From Table 4**,** AIC gives 4 lags, SBC gives 1 lags and adjusted LR test gives 2 lags. We will choose 2 lags suggested by LR test. Choosing 2 lags is also consistent with many researches in this topic.

Table 4: Order of vector autoregression

| Order | LL | AIC | SBC | LR test | Adjusted LR test |
|---|---|---|---|---|---|
| 6 | 1095.4 | 995.3538 | 869.2644 | ------ | |
| 5 | 1083.4 | 999.4239 | 893.5088 | CHSQ(16)=23.8598[.093] | 17.3761[.362] |
| 4 | 1073.7 | 1005.7 | 919.9997 | CHSQ(32)=43.2267[.089] | 31.4803[.493] |
| 3 | 1056.1 | 1004.1 | 938.5754 | CHSQ(48)=78.4239[.004] | 57.1131[.173] |
| 2 | 1038.9 | 1002.9 | 957.4871 | CHSQ(64)=112.9491[.000] | 82.2564[.062] |
| 1 | 1008.1 | 988.131 | 962.9131 | CHSQ(80)=174.4457[.000] | 127.0420[.001] |
| 0 | 976.3377 | 972.3377 | 967.2941 | CHSQ(96)=238.0323[.000] | 173.3496[.000] |

**Cointegration test: Engle Granger and Johansen**

Engle Granger tests the cointegration by examining the error term. If cointegration exists, residual of cointegrating relationship should be stationary. Thus, we run OLS and test for residual. From Table 5, the test shows the presence of cointegration as we reject the null hypothesis of unit root due to high value of test statistic which is greater than critical value.

Table 5: stationary test of residual

| Test | Statistic | LL | AIC | SBC | HQC |
|---|---|---|---|---|---|
| DF | -6.7133 | 111.9958 | 110.9958 | 109.7295 | 110.4845 |
| ADF(1) | -5.6358 | 114.7516 | 112.7516 | 110.219 | 111.729 |
| ADF(2) | -5.5561 | 114.7692 | 111.7692 | 107.9703 | 110.2353 |
| ADF(3) | -5.1071 | 115.5858 | 111.5858 | 106.5206 | 109.5406 |
| ADF(4) | -5.7105 | 118.6116 | 113.6116 | 107.2801 | 111.0552 |
| ADF(5) | -5.8432 | 119.0149 | 113.0149 | 105.4171 | 109.9471 |

The Engle-Granger method has several limitations. Firstly, it identifies only a single cointegrating relation. Another limitation of the Engle-Granger method is that it is a two-step procedure, with one regression to estimate the residual series, and another regression to test for a unit root. Errors in the first estimation are necessarily carried into the second estimation. Finally, the Engle-Granger method estimates cointegrating relations independently of the VECM in which they play a role. As a result, model estimation also becomes a two-step procedure.

From these limitations, we perform Johansen's cointegration test. From Table 6, the null hypothesis of no cointegration is rejected at 5% significant level based on both Maximal Eigenvalue and Traces. After that, the null hypothesis of one cointegration against alternative hypothesis of two cointegration could not be rejected at 5% significant level. Thus, we conclude that there is one cointegration.

Table 6: cointegration test based on maximal eigenvalue and trace of the Stochastic Matrix

| Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix | | | | | |
|---|---|---|---|---|---|
| **Null** | **Alternative** | **Statistic** | **95% Critical Value** | **90% Critical Value** | **Result** |
| r = 0 | r = 1 | 49.924 | 31.790 | 29.130 | 1 cointegration |
| r<= 1 | r = 2 | 12.679 | 25.420 | 23.100 | |
| Cointegration LR Test Based on Trace of the Stochastic Matrix | | | | | |
| **Null** | **Alternative** | **Statistic** | **95% Critical Value** | **90% Critical Value** | **Result** |
| r = 0 | r>= 1 | 74.978 | 63.000 | 59.160 | 1 cointegration |
| r<= 1 | r>= 2 | 25.054 | 42.340 | 39.340 | |

Johansen's test has limitation as this test assumes that all variables are I(1). Moreover, it is sensitive to number of lags in the order of VAR. Changing number of lags will give different result. In addition, stationary test is biased as the test tend to accept the null at 95% of the time. Stationary test could be sensitive to whether trend term is presence or intercept is presence. Therefore, we perform ARDL as this test could be applied with both I(1) and I(0) and bypass many limitations.

**Autoregressive distributed lags (ARDL)**

Introduced by Pesaran et al (2001), the ARDL technique does not require pretests for unit roots. Consequently, ARDL cointegration technique is preferable when dealing with variables that are integrated of different order I(0) and I(1). The long-run relationship of the variables is detected through the F-statistic (Wald test). Long-run relationship of the series is said to be established when the F-statistic exceeds the critical value bound.

From Table 7, we test for long-run relationship and found that F-statistics in trade balance equation and Thailand's income are higher than upper critical bound. Thus, we reject the null hypothesis of no long-run relationship and conclude that there is a cointegration among variables.

Table 7: Test of long-run relationship in ARDL

| Model | F-statistics | Critical bound F statistic (95%) | |
|---|---|---|---|
| TB (TB,RER,YTH,YF) | 5.3076 | I(0) | I(1) |
| RER(TB,RER,YTH,YF) | 1.7301 | 3.539 | 4.667 |
| YTH(TB,RER,YTH,YF) | 3.9394 | | |
| YF (TB,RER,YTH,YF) | 1.1292 | | |

From Table 8 long-run coefficient of ARDL are estimated using the Schwarz Bayesian Criterion. All variables are significant at 5% level, showing long-run effect on trade balance. Real exchange rate (RER) has positive and significant relationship with trade balance at 5% level. This implies that 1% depreciation (increase in RER) will increase trade balance by 1.12%. Intuitively, the devaluation of the Thai baht will decrease prices of Thailand's exports abroad and increase the price of imports at home, inducing export quantity to rise and import quantity to decrease, thereby influencing the trade balance positively.

Domestic income (YTH) has a negative and significant relationship with trade balance as higher income of Thai people will demand more foreign products which increases import. Thus, trade balance is lowered in the long-run. Foreign income has positive and significant relationship with trade balance as foreign income increases, other countries will demand more export from Thailand, resulting in higher net export and trade balance.

Table 8: long-run coefficients of ARDL

| Regressor | Coefficient | P-value |
|---|---|---|
| LRER | 1.12 | 0.001* |
| LYTH | -0.85 | 0.006* |
| LYF | 3.55 | 0.007* |
| INPT | 6.34 | 0.010* |

Cointegration tells us that there is a long-run relationship between variables. However, there could be a short-run deviation from the long-run equilibrium. Cointegration does not tell the process of short-run adjustment to bring about long-run equilibrium. Thus, we will proceed to error-correction model to examine the short-run dynamics.

**Vector Error Correction Model (VECM)**

The short-run dynamics shows how quickly the trade balance responds to changes in the real exchange rate. The speed of adjustment is represented by the absolute value of the error-correction term, which can be interpreted as the change in the trade balance per quarter that is attributed to the disequilibrium between the actual and equilibrium levels.

The coefficient of error-correction model shows feedback effect of the deviation from equilibrium on the dependent variable. When the coefficient is significant, that dependent variable bears the burden to bring about equilibrium. Thus, it is endogenous. If it is not

significant, the dependent variable is exogenous. From Table 9, as error-correction term are significant for trade balance (DTB) and domestic income (YTH) at 5% level, they are endogenous. The significant of error-correction coefficient confirms our finding of a significant long-run cointegrating relationship between variables. The error-correction term is not significant for foreign income (YF) and real exchange rate (RER), so they are exogenous.

Intuitively, foreign income is an exogenous variable because a change in foreign income is an external shock which could not be controlled by one country. Real exchange rate (RER) is exogenous as Thai exchange rate is against dollars which its supply and demand is determined in a global market. Domestic income represented by Thailand's real GDP could be influenced by internal factor such as fiscal and monetary policies. Trade balance is endogenous as it depends on many domestic factors, for example, real exchange rate as depreciation increases net export.

Table 9: coefficients of error correction models

| Dependent variable | ECM(-1) coefficient | P-value |
|---|---|---|
| DTB | -0.22 | 0.03* |
| DRER | -0.26 | 0.15 |
| DYTH | -0.34 | 0.00* |
| DYF | -0.18 | 0.24 |

Now we examine error correction model of our focused variable trade balance. From Table 10, Schwarz Bayesian Criterion gives the ARDL model (2,3,2,3). The size of the coefficient of the error-correction term indicates the speed of short-run adjustment of the dependent variable to bring about the long-run equilibrium. Error correction coefficient is at -0.22 which is highly significant and has a correct sign. The size indicates the moderate adjustment to equilibrium. Approximately, 22.5% departure from equilibrium in the previous quarter is corrected in this quarter to bring long-run equilibrium.

In short run, real exchange rate, domestic income and foreign income has significant impact on trade balance. Real exchange rate is negative at DRER but becomes positive at DRER1 and DRER2. This is consistent with J-curve theory that initially depreciation worsen trade balance in the short-run but gradually improve it afterward over time. Real exchange rate has positive relationship with trade balance as real exchange rate increase (depreciate) will result in higher net export and higher trade balance.

Table 10: Error correction model when DTB is dependent variable

| Regressor | Coefficient | P-value |
|---|---|---|
| DTB1 | -0.23 | 0.14 |
| DRER | -0.35 | 0.00 |
| DRER1 | 0.46 | 0.03 |
| DRER2 | 1.20 | 0.05 |
| DYTH | 2.48 | 0.00 |
| DYTH1 | -1.66 | 0.30 |
| DYF | -7.18 | 0.01 |
| DYF1 | -4.22 | 0.11 |
| DYF2 | 8.00 | 0.00 |
| Ecm(-1) | -0.22 | 0.03 |

However, ARDL model has limitation as it assumes symmetric change of trade balance when exchange rate depreciates and appreciates. However, exchange rate has asymmetric relationship with trade balance. Therefore, we will apply NARDL model.

**Non-linear autoregressive distributed lags (NARDL)**

Bussiere (2013) points out that non-linearities and asymmetries in the trade balance/exchange rate relationship can be attributed to adjustment cost, price rigidities and quantity restrictions. With currency depreciation, exports are cheaper and more competitive in foreign currency terms. Therefore, exporters tend to gain as they increase their exports with an assumption that their prices remain the same in their home currency terms. However, it is not possible to increase the quantity exported due to full capacity or adjustment costs are too high, they may increase their prices instead.

On the other hand, with appreciation, exports become more expensive and less competitive in foreign currency terms. Thus, exporters will lose if they do not change(lower) their prices in domestic currency terms. However, lowering export prices after some point is difficult since falling export prices imply falling profit margins. The downward rigidity of prices suggests a lower response to appreciation than to depreciations. The asymmetric nature could also be caused by the presence of market power, government interventions and the actions of market participants.

Another cause of asymmetry is that when the currency depreciates, exporting firms enter the markets quickly due to higher demand for export which increases production of exporting goods. But when currency appreciates, these firms are more reluctant to cut down production in the short-run as they have put forward a lot of investment in exporting activity. Thus, currency depreciation could affect trade balance at a faster rate than does appreciation. This is one reason why speed of adjustment of trade balance to exchange rate appreciation and depreciation are different

Since the effect of exchange rate is asymmetric, we apply NARDL model of Shin et al. (2014) to Thailand as a whole country and its six major sectors. In addition, this research has value added by studying different sectors to identify the positive and negative effect in each sector. These sectors are Technology, Energy, Industrials, Healthcare, Materials, and Consumer goods. Since NARDL gives more robust result than ARDL, we apply NARDL to six sectors in this section but not apply ARDL to theses sectors. NARDL is main focus of our paper.

Data of these sectors are from Thailand Ministry of Commerce. We will focus on our two focus variables: trade balance (independent variable) and exchange rate (dependent variable) because we want to zoom in on the asymmetric relationship of exchange rate and trade balance without control variables which we have already analyzed in ARDL. This could give us clearer picture of the relationship.

NARDL model enables the investigation of the short-run and long-run relationship when these linkages are non-linear and asymmetric. NARDL model will decompose real exchange rate into its positive $\Delta RER_{t-i}^{+}$ and negative $\Delta RER_{t-i}^{-}$ partial sums for increases and decreases. Introducing the short-run and long-run asymmetries in the standard ARDL model leads to the following general form of NARDL model.

$$\Delta TB_t = \alpha_0 + \alpha_1 TB_{t-1} + \alpha_2 RER_{t-1}^{+} + \alpha_3 \Delta RER_{t-1}^{-}$$

$$+ \sum_{i=1}^{p} \beta\, \Delta TB_{t-i} + \sum_{i=0}^{q} \beta\, \Delta RER_{t-i}^{+} + \sum_{i=0}^{q} \beta\, \Delta RER_{t-i}^{-}$$

From Table 11, Long-run asymmetry is found in Thailand as a whole country, suggesting that there is an unequal response of trade balance to appreciation and depreciation in the long-

run. By examining sectors in Thailand, most sectors are found to have asymmetries. long-run asymmetry is found in Industrials sector and Healthcare sector, implying that there is price-rigidity for industrials goods and healthcare goods. Both long-run and short-run asymmetry exist in Technology sector. This means that there is downward price rigidity for technology goods in both short-run and long-run. Consumer staples and Consumer discretionary sector are symmetry, implying that downward price rigidity is not observed in these sectors.

Table 11: NARDL long-run and short-run asymmetry test

| | Long-run $W_{LR}$ | Short-run $W_{SR}$ | Selected sepcification |
|---|---|---|---|
| Thailand | 11.76* | 0.57 | LR asymmetry |
| | (0.00) | (0.45) | |
| Technology | 3.13* | 9.70* | LR and SR asymetry |
| | (0.04) | (0.00) | |
| Energy | 6.21* | 2.48* | LR and SR asymetry |
| | (0.02) | (0.01) | |
| Industrials | 7.90* | 1.05 | LR asymmetry |
| | (0.00) | (0.31) | |
| Healthcare | 3.48* | 0.16 | LR asymmetry |
| | (0.03) | (0.69) | |
| Consumer staple | 0.01 | 0.23 | Symmetry |
| | (0.90) | (0.63) | |
| Consumer discretioanry | 0.08 | 0.81 | Symmetry |
| | (0.77) | (0.37) | |

Note: P-value is in parenthesis

Result of NARDL is reported in Table 12. Long-run positive coefficient of exchange rate ($L^{+}_{RER}$) is positive and significant at 1.92, showing that depreciation (increase in RER) by 1% will increase trade balance by 1.92 % in the long-run as depreciation of Thai baht would increase demand for export of Thailand goods while lower demand for import. Long-run negative coefficient($L^{-}_{RER}$) is positive and significant at 0.35, showing that appreciation (decrease in RER) leads to a decrease in trade balance as appreciation of Thai baht would decrease demand for export of Thailand goods while increase demand for import. As Thailand is net exporting country, when exchange rate depreciates, trade balance would improve substantially. Positive coefficient of exchange rate is higher than negative coefficient, showing that depreciation (increase in RER) has a stronger effect than appreciation (decrease in RER). This implies that there is asymmetry such as downward price rigidity in Thailand, business adjustment.

The short-run effect of exchange rate on trade balance at ($\Delta RER^{+}_{t}$) is negative and significant, implying that depreciation of exchange rate in the last quarter has a negative impact

on trade balance in this quarter. The short-run effect is positive at lag 2 ($\Delta RER^{+}_{t-2}$)and the coefficient increases from 0.39 to 1.28 from lag 2 to lag 3 ($\Delta RER^{+}_{t-3}$). The result is according to J-curve theory. Initially, depreciation worsens trade balance in the short-run as quantity demands for export and import are inelastic, resulting in negative coefficient. As time passes, demands gradually adjust and trade balance improves which is shown by positive coefficient.

Table 12: NARDL model

| Thailand | | Technology | | Energy | | Industrials | | Healthcare | | Consumer Staples | | Cosumer discretionary | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $TB_{t-1}$ | -0.23 | $TB_{t-1}$ | -0.12 | $TB_{t-1}$ | 0.43 | $TB_{t-1}$ | 0.32 | $TB_{t-1}$ | -0.12 | $TB_{t-1}$ | 0.36 | $TB_{t-1}$ | 1.05 |
| | (0.04) | | (0.16) | | (0.11) | | (0.09) | | (0.24) | | (0.18) | | (0.02) |
| $RER^{+}_{t-1}$ | 1.12 | $RER^{+}_{t-1}$ | 2.48 | $RER^{+}_{t-1}$ | -0.56 | $RER^{+}_{t-1}$ | 1.40 | $RER^{+}_{t-1}$ | -2.56 | $RER^{+}_{t-1}$ | 2.31 | $RER^{+}_{t-1}$ | 0.87 |
| | (0.03) | | (0.02) | | (0.04) | | (0.08) | | (0.33) | | (0.02) | | (0.01) |
| $RER^{-}_{t-1}$ | 0.32 | $RER^{-}_{t-1}$ | 0.98 | $RER^{-}_{t-1}$ | -1.2 | $RER^{-}_{t-1}$ | 0.66 | $RER^{-}_{t-1}$ | -0.23 | $RER^{-}_{t-1}$ | 1.39 | $RER^{-}_{t-1}$ | 0.45 |
| | (0.12) | | (0.13) | | (0.20) | | (0.12) | | (0.07) | | (0.29) | | (0.51) |
| $\Delta TB_{t-1}$ | 0.57 | $\Delta TB_{t-1}$ | 0.89 | $\Delta TB_{t-1}$ | 0.3 | $\Delta TB_{t-1}$ | 0.76 | $\Delta TB_{t-1}$ | -0.82 | $\Delta TB_{t-1}$ | 0.38 | $\Delta TB_{t-1}$ | 0.35 |
| | (0.00) | | (0.00) | | (0.04) | | (0.09) | | (0.08) | | (0.03) | | (0.03) |
| $\Delta TB_{t-2}$ | 0.39 | $\Delta TB_{t-3}$ | -0.21 | | | $\Delta TB_{t-2}$ | -0.23 | $\Delta TB_{t-4}$ | 0.92 | $\Delta TB_{t-3}$ | 0.73 | | |
| | (0.02) | | (0.08) | | | | (0.03) | | (0.00) | | (0.06) | | |
| $\Delta TB_{t-3}$ | 0.11 | | | | | | | | | $\Delta TB_{t-4}$ | 0.13 | | |
| | (0.09) | | | | | | | | | | (0.01) | | |
| $\Delta RER^{+}_{t}$ | -0.57 | $\Delta RER^{+}_{t}$ | -0.43 | $\Delta RER^{+}_{t-1}$ | 0.34 | $\Delta RER^{+}_{t}$ | 0.45 | $\Delta RER^{+}_{t-3}$ | -0.52 | $\Delta RER^{+}_{t-1}$ | 1.3 | $\Delta RER^{+}_{t}$ | -1.04 |
| | (0.08) | | (0.06) | | (0.00) | | (0.00) | | (0.02) | | (0.00) | | (0.09) |
| $\Delta RER^{+}_{t-2}$ | 0.39 | $\Delta RER^{+}_{t-3}$ | 0.23 | $\Delta RER^{-}_{t-4}$ | 1.19 | $\Delta RER^{-}_{t-1}$ | -0.56 | $\Delta RER^{-}_{t-2}$ | 0.71 | $\Delta RER^{-}_{t-3}$ | 2.08 | $\Delta RER^{+}_{t-2}$ | -1.30 |
| | (0.04) | | (0.07) | | (0.07) | | (0.08) | | | | (0.08) | | (0.08) |
| $\Delta RER^{+}_{t-3}$ | 1.28 | $\Delta RER^{-}_{t-1}$ | -0.76 | | | $\Delta RER^{-}_{t-3}$ | -0.76 | | | | | $\Delta RER^{-}_{t-2}$ | -0.41 |
| | (0.04) | | (0.02) | | | | (0.03) | | | | | | (0.06) |
| $\Delta RER^{-}_{t-1}$ | 0.38 | $\Delta RER^{-}_{t-2}$ | 1.22 | | | | | | | | | | |
| | (0.03) | | (0.00) | | | | | | | | | | |
| Const. | 0.53 | Const. | 0.24 | Const. | -0.34 | Const. | 1.65 | Const. | -1.3 | Const. | 0.41 | Const. | 0.83 |
| | (0.00) | | (0.11) | | (0.55) | | (0.03) | | (0.42) | | (0.03) | | (0.00) |
| $L^{+}_{RER}$ | 1.92 | $L^{+}_{RER}$ | 1.45 | $L^{+}_{RER}$ | -0.23 | $L^{+}_{RER}$ | 2.42 | $L^{+}_{RER}$ | -1.25 | $L^{+}_{RER}$ | 1.11 | $L^{+}_{RER}$ | 0.47 |
| | (0.00) | | (0.02) | | (0.00) | | (0.03) | | (0.08) | | (0.04) | | (0.22) |
| $L^{-}_{RER}$ | 0.35 | $L^{-}_{RER}$ | 0.21 | $L^{-}_{RER}$ | -1.19 | $L^{-}_{RER}$ | 0.37 | $L^{-}_{RER}$ | -0.43 | $L^{-}_{RER}$ | 0.83 | $L^{-}_{RER}$ | 0.92 |
| | (0.00) | | (0.08) | | (0.07) | | (0.26) | | (0.45) | | (0.02) | | (0.15) |

For Technology sector, Thailand is major exporter of technology products such as computer parts, telephone parts, electrical appliances etc. Long-run coefficient of exchange rate ($L^{+}_{RER}$) and ($L^{-}_{RER}$) are both positive and significant at 10% level, showing that currency depreciation will increase trade balance as technology products becomes relatively cheaper for foreign importers. These domestic products such as computer parts are used to produce other countries' final products such as laptop. As input cost is lower due to currency depreciation, other countries will have a higher demand for Thailand's technology products, resulting in higher export and trade balance improves.

For Consumer staples sector, Long-run coefficient of exchange rate ($L_{RER}$) are both positive and significant, showing that currency depreciation will improve trade balance. Thailand is a major world's exporter of consumer staples products such rice, fishery products. Currency depreciation will increase Thailand's competitiveness in the world market. As a result, Thailand would export more, for example, rice than its regional competitor such as Vietnam and Myanmar, leading to an improvement in trade balance.

For Consumer discretionary, Thailand is net exporting on goods such as vehicle parts, delivery trucks etc. Both positive and negative long-run coefficient of exchange rate ($L_{RER}$) are positive but not significant. The reason could be that raw materials used to produce these goods mostly are imported goods. Currency depreciation causes higher external demand for exporting goods, resulting in higher export. But at the same time, imported raw materials become more expensive, and the import demand is quite inelastic. The net effect of increase value of export and import cancel out. However, the short-run effect shows that trade balance is worsen. Asymmetry is not observed, implying speed of adjustment to negative and positive shocks are different.

For Industrials sector, long-run positive coefficient of exchange rate ($L^{+}_{RER}$) is positive and significant while negative coefficient ($L^{-}_{RER}$) is not significant, implying that appreciation of currency has no effect on trade balance in the long-run. This sector relies on imports such as cement and industrial machinery, having higher import than export. Thailand tries to increase more domestic production by putting quota on many imported goods in this sector, limiting quantity of imports to help small domestic companies. This explains why appreciation of exchange rate does not increase imports, thus not affecting trade balance. As there are no restrictions on export from its major trading countries, depreciation of currency would increase exports and trade balance.

For Energy sector, exchange rate has significant negative relationship with trade balance as ($L^{+}_{RER}$) and ($L^{-}_{RER}$) are negative and significant. This means that currency depreciation will worsen trade balance in this sector, implying that demand for export and import are quite inelastic. This is importing sector as Thailand depends on energy import such as crude oil, coal etc. Currency depreciation does not reduce quantity of import as demand for energy in Thailand is quite inelastic. Most household own private vehicles; hence, they view energy as necessity

goods. Thus, consumption of energy is not affected by a change in energy price due to currency change.

For Healthcare sector, exchange rate has negative relationship with trade balance. Long-run coefficient of exchange rate ($L^{+}_{RER}$) and ($L^{-}_{RER}$) are both negative but $L^{-}_{RER}$ is not significant. Thailand depends on import of medical product such as medicine, medical equipment. The importing demand is quite inelastic as Thai people value their health and there is a growing demand for medicine as old people live longer. Thus, currency depreciation will not have a strong effect on value of import and thus will worsen trade balance. Currency appreciation does not affect trade balance because when imported medicine costs more, its consumption is not likely to decrease as medicine are necessity goods.

**Variance decomposition**

The error-correction model indicates whether a variable is endogenous/exogenous, but it does not show the relative degree of endogeneity and exogeneity of the variables. Thus, we apply generalized and orthogonalized variance decomposition which examine proportion of the variance of a variable explained by its own past. The variable that is explained mostly by its own shocks is the most exogenous of all variables while that explained the least is the most endogenous. We applied variance decomposition to the whole country Thailand.

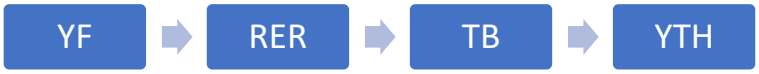
From Table 13 and Figure 2, we establish the causal chain from the most exogenous to the most endogenous variable. Both generalized and orthogonalized give the same ranking of variables. Foreign income (YF) is the most exogenous. Intuitively, this variable represents income of other countries, so it is determined by external factors. Thailand is a small country which could not substantially influence the world's income. Thus, this variable could not be controlled by Thailand's domestic policy. Higher world income could have effect on Thailand's real exchange rate as foreigners demand more Thailand's goods, thus increasing demand for Thai Baht which causes a change in exchange rate.

Table 13: Orthogonalized Variance decomposition

| Generalized Forcast error variance. | | | | | | |
|---|---|---|---|---|---|---|
| Relative variance in Period 4 | | | | | | |
| Variables | TB | RER | YTH | YF | Self-depedent | Ranking |
| TB | 61% | 23% | 14% | 1% | 61% | 3 |
| RER | 3% | 71% | 23% | 2% | 71% | 2 |
| YTH | 13% | 33% | 48% | 6% | 48% | 4 |
| YF | 1% | 0% | 9% | 91% | 91% | 1 |
| Relative variance in Period 8 | | | | | | |
| Variables | TB | RER | YTH | YF | Self-depedent | Ranking |
| TB | 58% | 23% | 18% | 2% | 58% | 3 |
| RER | 2% | 67% | 28% | 3% | 67% | 2 |
| YTH | 14% | 36% | 44% | 6% | 44% | 4 |
| YF | 1% | 0% | 10% | 89% | 89% | 1 |
| Relative variance in Period 12 | | | | | | |
| Variables | TB | RER | YTH | YF | Self-depedent | Ranking |
| TB | 56% | 22% | 19% | 2% | 56% | 3 |
| RER | 1% | 65% | 30% | 3% | 65% | 2 |
| YTH | 15% | 37% | 43% | 6% | 43% | 4 |
| YF | 1% | 0% | 10% | 89% | 89% | 1 |

| Orthogonalized Forcast error variance. | | | | | | |
|---|---|---|---|---|---|---|
| Relative variance in Period 4 | | | | | | |
| Variables | TB | RER | YTH | YF | Self-depedent | Ranking |
| TB | 84% | 10% | 5% | 1% | 84% | 3 |
| RER | 4% | 86% | 5% | 5% | 86% | 2 |
| YTH | 20% | 36% | 41% | 3% | 41% | 4 |
| YF | 1% | 0% | 11% | 88% | 88% | 1 |
| Relative variance in Period 8 | | | | | | |
| Variables | TB | RER | YTH | YF | Self-depedent | Ranking |
| TB | 81% | 10% | 8% | 1% | 81% | 3 |
| RER | 2% | 82% | 8% | 7% | 82% | 2 |
| YTH | 22% | 40% | 35% | 3% | 35% | 4 |
| YF | 1% | 0% | 13% | 86% | 86% | 1 |
| Relative variance in Period 12 | | | | | | |
| Variables | TB | RER | YTH | YF | Self-depedent | Ranking |
| TB | 80% | 10% | 10% | 1% | 80% | 3 |
| RER | 2% | 81% | 9% | 8% | 81% | 2 |
| YTH | 23% | 41% | 33% | 3% | 33% | 4 |
| YF | 1% | 0% | 13% | 85% | 85% | 1 |

Figure 2: Casual chain from exogenous (left) to endogenous (right)




Although Thailand's exchange rate is influenced by the external demand and supply of currency, exchange rate could be to some extent controlled by Thailand monetary policy. Thailand is a managed-floating exchange rate regime. Bank of Thailand occasionally intervenes to change the direction or the pace of change of a country's currency value by buying and selling currencies. In most instances, the central bank acts as a buffer against an external economic shock before its effects become disruptive to the domestic economy.

Trade balance is relative more endogenous, implying that a change in exchange rate would cause a change in trade balance. Real exchange rate could affect Thailand's income as depreciation, for example, could increase income of domestic exporters. The relatively more endogenous variable is Thailand's income which is proxied by GDP of Thailand. Domestic income could be influenced by domestic policy such fiscal policy and monetary policy. Higher domestic will lead to higher import, resulting in an increase in trade balance. The most endogenous is trade balance, implying that Thailand could improve trade balance to some extent by depreciating real exchange rate.

YTH is the most endogenous. Income of the country which is represented by GDP of Thailand is clearly affected by a change in trade balance. As net export is one component of GDP, a change in trade balance would cause a change in income of the country. In addition, GDP of Thailand is highly endogenous as it could be affected by the domestic fiscal and monetary policy.

From both VECM and variance decomposition, the causality between our two focus variables shows that exchange rate is a leading variable while trade balance is a following variable. The result suggests to the policy makers that trade balance could be manipulated by changing exchange rate. Our findings are in line with other research which found impact of real exchange rate on trade balance. To improve trade balance, policymaker could depreciate exchange. The Bank of Thailand could to some extent manipulate exchange rate by controlling the supply or demand of Thai Baht by, for example, issuing bonds to decrease amount of Thai Baht circulation in market. The policymaker could not affect the world income which is the most exogenous.

**Impulse response function**

We applied the generalized IRFs. Impulse response function is a graphical representation of VDC when an equation is shocked by one SD. From Figure 3, when real exchange rate is shocked, trade balance becomes more volatile until approximately 4 quarters and become stable after the fourth quarter. Consistent with earlier results, the trade balance variable is more sensitive to a 1% SD shock to the real exchange rate variable by comparing with sensitivity of exchange rate variable when trade balance variable is shocked in Figure 4. This shows that trade balance is following variable and exchange rate is leading variable.

Figure 3: Generalized impulse responses to one SE shock in the equation of LRER.

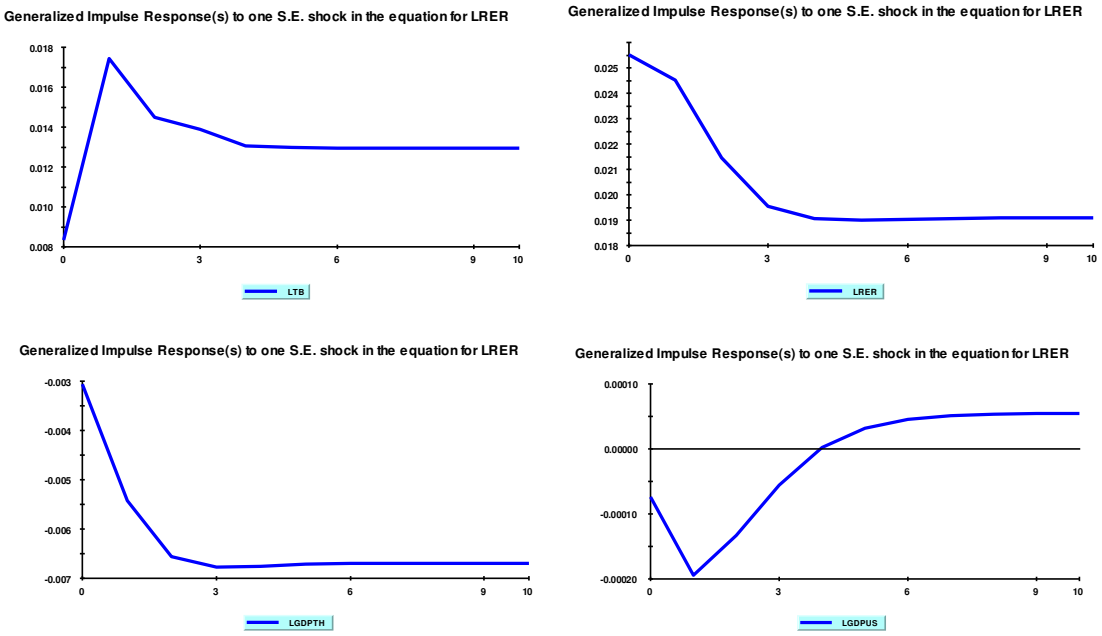
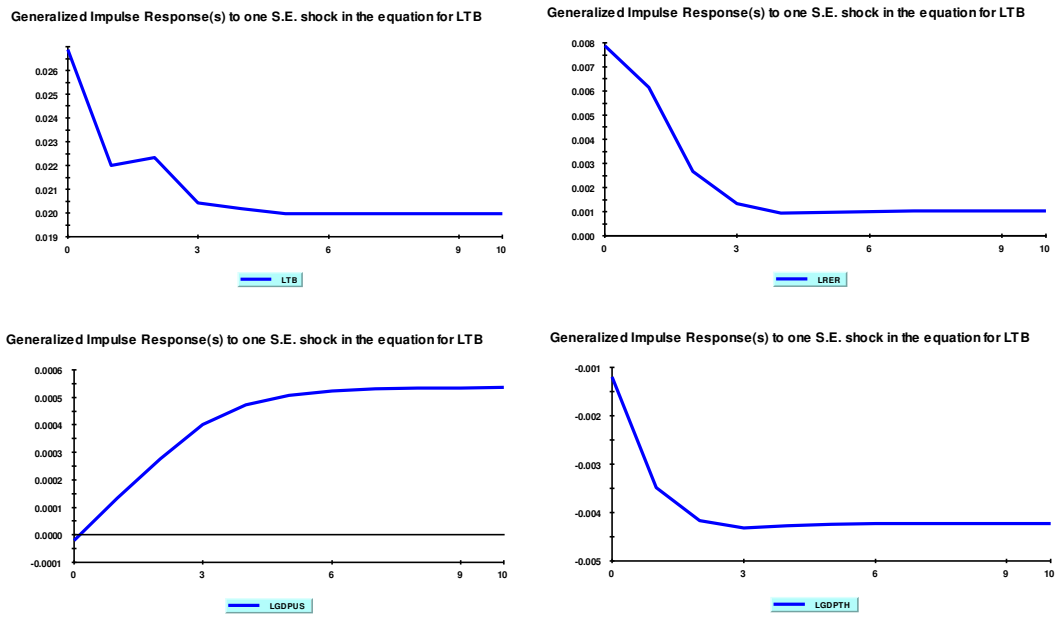


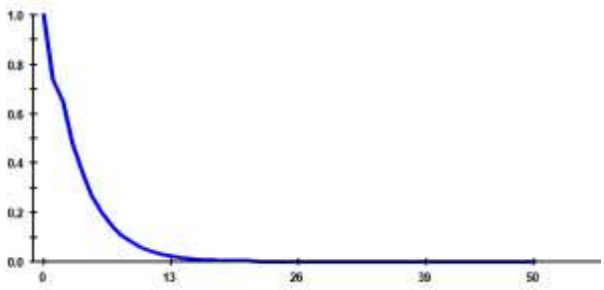

Figure 4: Generalized impulse responses to one SE shock in the equation of LTB.



**Persistence Profile (PP)**

From Figure 5, an application of persistence profile indicates that if the whole cointegrating relationship of Thailand as the whole country is shocked, it will take about 13 quarters (about 3 years) for the equilibrium to be restored.

Figure 5: Persistence profile of the effect of a system-wide shock




## 6. Conclusion and policy implication

As findings of previous literature suggest that effect of exchange rate on trade balance is still inconclusive, the result of this research shows a positive relationship in which exchange rate leads trade balance and confirms the positive relationship of many previous literature. Although Marshall-Lerner theory points out the case that currency depreciation could lead to a negative trade balance, our result implies that, for the country level, negative relationship is not likely as positive the world's demand for import and export are relatively elastic. However, for sector level, the relationship could be different due to specific nature of that market. As many previous literature's model assumes linear and symmetric relationship which is not realistic due to asymmetric effect of exchange rate, our paper addresses this problem by modelling more advance technique NARDL which gives more robust result.

Depreciation of Thai baht will improve trade balance and income of the whole country as Thailand's economy depends largely on exports. Our finding shows that trade balance is quite sensitive to real exchange rate. The long-run coefficient is large and significant, implying that relatively small depreciation will result in relatively larger trade balance. However, policy makers need to take in account the cost of deprecation. Deprecation could worsen trade balance in the short-run as quantity demand for import and export are inelastic, causing lower value of

export and higher value of import. It could take many quarters to realize the full effect of depreciation due to fixed contracting and negotiating terms of domestic exporters.

Policymaker such as Bank of Thailand and relating government agencies should also consider the effect of various sectors. Although currency depreciation benefits many sectors such as Technology and Consumer staples, some sectors such as Energy and Healthcare are negatively affected by worsening of trade balance. In fact, although currency depreciation enhances economy of the whole country, depreciation improve trade balance of net exporting sectors at the cost of net importing sectors. Many companies in importing sectors are small and medium sized domestic companies and many imported goods are used to produce domestic products, a large depreciation could significantly lower competitiveness of these companies and heavily damage these sectors in the long term.

Thus, policy makers are suggested to find the optimal exchange rate that lead to the optimal benefit, considering both short-term and long-term costs. The policy maker could depreciate the currency moderately if needed to boost economic growth but should not ignored the costs. Trade balance would be negatively affected in the short-run and importing sectors would face a higher importing cost. Since trade balance is found to be sensitive to exchange rate, immediate and sharp depreciation is not recommended as it could create a severe negative shock to importing sectors.

Our finding supports the evidence that during economic crisis in 1997 Thailand is heavily damaged when it sharply and immediately depreciates its currency by a large amount, causing short-run and medium-run severe impact to the economy and many small and medium domestic companies. As economic policy usually has tradeoff, when depreciate the currency the government could use some portions of higher revenue gained in net exporting sectors to support less competitive importing countries. A further research needs to be investigated to find the optimal exchange rate and the optimal range in which exchange rate could be depreciated and appreciated. Limitation of this paper is that it covers two main trade theories namely J curve and Marshall's Lerner. Future research could explore more trade theories with Thailand data.

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