The impact of macroeconomic factors on trade balance in Vietnam

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ABSTRACT: This study aims to analyze the impacts of macroeconomic factors on trade balance in Vietnam during the period 1986-2014 with data collected from Key Indicators for Asia and the Pacific 2014 (ADB). Based on multivariable model, using Autoregressive Distributed Lag (ARDL) model, we test for cointegration using bound test and measure the long-run impacts of variables. In addition, we use ECM-ARDL model to analyze the short-run impacts. The results show that while short-run and long-run GDP and exchange rate have the positive impacts on trade balance, money supply (M2) has a positive impact in short-run and a negative impact in long-run.

KEYWORDS: trade balance, bound test, ARDL model, ECM model.
JEL CLASSIFICATION: C15 . C22 . F13 . F14 . F17 . F32 . F41.

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1. Introduction

Since the beginning of "Doi moi" in 1986, Vietnam has been implementing a range of innovations under/following market orientation and international economic integration in order to take advantage of economic development opportunities. This is an essential precondition for Vietnam to achieve economic growth and poverty reduction, bringing Vietnam from a low-income country to lower middle-income one. During the period 1986-2011, Vietnam experienced trade deficit owing to the high demands for foreign raw materials, equipment, machines, and technologies. Meanwhile, there existed low capacity of domestic production, limited funds and unbalance between exports and imports. From 2012, Vietnam began shifting trade deficit to a small-scale trade surplus. Figure 1 shows the overall trade balance in Vietnam during 1986-2014.

Figure 1: Trade balance in Vietnam during 1986–2014
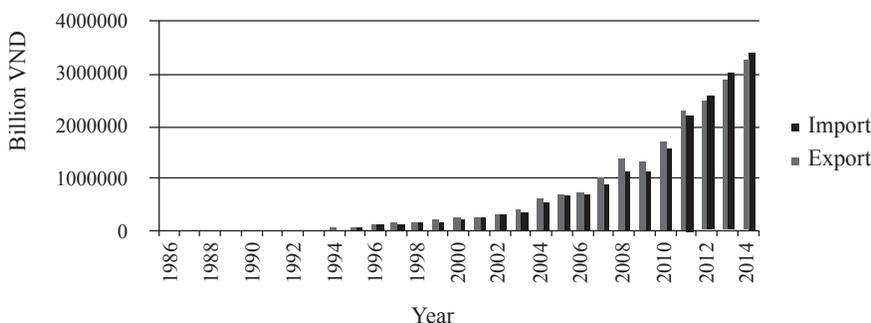
Resource: Key Indicators for Asia and the Pacific 2014 (ADB).

According to Bui Trinh, Kiyoshi Kobayashi & Vu Trung Dien (2010), one of the current macro instabilities in Vietnam is due to the prolonged trade deficit. It puts pressure on Vietnam dong (VND), has negative impacts on exchange rate and inflation; affects the balance of payment; reduces the international reserves that could make a decrease in the effectiveness of exchange rate policy as well as the market confidence; and leads to dollarization that puts more pressure on exchange rate market. The high trade deficit also causes a large surplus in capital and financial accounts, which results in the accumulation of national debt over time.

The control of trade deficits, as well as the selection of macro economic tools for trade balance adjustment have positive effects on the economic stability and growth in the future. Therefore, it is crucial to determine and estimate

economic factors' impacts on trade balance, so that policymakers can control the fluctuation of trade balance in order to develop a suitable foreign trade policy, supporting the economic growth in the context of the increasingly international economic integration of Vietnam in the near future.

In recent years, there are a few studies about trade balance and factors impacting on trade balance in Vietnam. Some notable ones are Ha Thi Thieu Dao & Pham Thi Tuyet Trinh (2013), Phan Thanh Hoan & Nguyen Dang Hao (2007), Tran Hong Ha (2011), Nguyen Huy Tuan (2011). However, these studies mostly concern about one key question– the impacts of exchange rate on trade balance.

Using ARDL model, this study adds an empirical evidence on the impacts of macroeconomic factors on trade balance in Vietnam during the period 1986-2014. Based on the findings of this study, we recommend some solutions to improve the trade balance in Vietnam in the future.

2. Literature review

Trade balance is the difference between the export and import values of an economy in a period of time (Meade, 1951; Mundell, 1968). Statistic data used to calculate trade balance is the monetary value of all products and services exported and imported by a country (Polak, 1957). If a country has a positive trade balance, it has a trade surplus, and in reverse, it has a trade deficit (Dash, 2003).

Trade balance is affected by numerous factors, such as exchange rate, money supply, GDP (Duasa, 2007). The first one is the monetary approach to the balance of payments, especially trade balance, developed by many economists such as Mundell (1968), Magee (1976), Johnson (1976), Miles (1978), Frenkel & Razin (1987), and so on. Trade balance is considered as a monetary phenomenon and its imbalance is rooted in the relationship between money supply and demand. It means that trade balance is affected by money supply and demand. If a country has the supply of money exceeds the demand for money, the excessive money will flow out of the country via exchange commodities, trade deficit increases as a result, and then trade balance becomes worse. On the other hand, if domestic money demand exceeds domestic money supply, international reserves are improved thanks to the positive effect on the trade balance. In addition, Magee (1976) suggests that money supply has an impact on trade balance. A decrease in the domestic money supply will improve the trade balance, while an increase in domestic money supply will have an adverse effect on trade balance (Magee, 1976).

The second approach to trade balance is to analyze the income effects with the consideration that trade balance improvement requires an increase in national income (Harberger, 1950; Meade, 1951; Alexander, 1952, 1959). Within a country, an increase in GDP raises the domestic demand for money. In order to rebalance the currency, the country must boost its export, which has a positive impact on trade balance (Mundell, 1968). According to Solow growth model, at the early stage, a less developed country which borrows foreign debt for investments often achieve a faster economic growth rate. As a consequence, when the economy is close to the steady-state, then the growth rate slows down. Hence, a country with a high-growth rate is the one in the early stage of development and tends to accept current account deficits (Solow, 1956).

The consideration of the impacts of exchange rates on the trade balance is important and has been tested in numerous studies, such as Bickerdike (1920), Robinson (1947), Metzler (1948), Hacker & Hatemi (2004), Chun, Chun & Chih (2012). When exchange rate increases, domestic currency depreciates, foreign goods are more expensive relative to domestic goods, imports decline, exports rise, trade balance then improves (Bickerdike, 1920; Robinson, 1947; Metzler, 1948). The result of Sugema (2005) for Indonesia in the period 1984-1997 supports the devaluation of the exchange rate to improve the trade balance. Moreover, exchange rate also impacts on trade balance under the J-curve effect (Ha Thi Thieu Dao et al., 2013).

Previous studies show that trade balance is affected by macroeconomic factors such as money supply, GDP, exchange rate. A typical study is Duasa's (2007) using the ARDL model to test the effects of exchange rates, money supply and GDP on the trade balance in Malaysia. The result indicates that there is a long-term relationship among trade balance, GDP and money supply but no relationship between trade balance and exchange rate in long-term.

In Vietnam, many researchers concern about the impacts of exchange rates on the trade balance. But money supply is an important monetary factor that affects trade balance. Income is a crucial factor to promote exports and imports and affect trade balance. Therefore, we choose the following factors: money supply, GDP and exchange rate as the variables to analyze impacts on the trade balance.

3. Data and methodology

3.1. Data

The data are collected from annual data in the period 1986-2014 and the Key Indicators for Asia and the Pacific 2014 (ADB). The data contain gross domestic

product (GDP), money supply (M2), exchange rate (E), trade balance variable which is the ratio of export values (X) to import values (M). All variables take natural logarithm form.

Table 1: Variables review

No	Variable	Variable definition
1	LGDP	Natural logarithm of GDP
2	LM2	Natural logarithm of money supply M2
3	LE	Natural logarithm of exchange rates
4	LTB	Natural logarithm of trade balance variable (the ratio of export values to import values)

3.2. Methodology

Firstly, we have to check the stationarity problem for time series data. However, the drawback of stationarity testing is that the tests have low power. With regards to this issue, the autoregressive distributed lag (ARDL) method proposed by Pesaran, Shin & Smith (1996) has received lots of interests. According to Pesaran et al. (1996), while it is necessary to implement the unit root test in cointegration testing, it becomes unnecessary to do so in the ARDL and the existence of the long-run relationship is tested based on two critical value bounds. In particular, the lower bound is the critical value for all variables which are cointegrated of order zero (I(0)) and the upper bound is for those cointegrated of order one (I(1)).

The ARDL $(p_0, p_1, p_2, p_3, ..., p_n)$ model includes two parts: (i) The DL (distributed lag) – lagged explanatory variables potentially affect dependent variables; (ii) The AR (autoregressive) – dependent variable could also correlate to its previous values (it lags). The notation $(p_0, p_1, p_2, p_3, ..., p_n)$ is the number of lags.

Assume Y is the dependent variable, the independent variables are X_1, X_2, ..., X_n respectively. The ARDL $(p_0, p_1, p_2, p_3, ..., p_n)$ model could be rewritten as follows:

$$Y_t = \alpha + \sum_{i=1}^{p_0} \beta_{0,i} Y_{t-i} + \sum_{j=0}^{p_1} \beta_{1,j} X_{1,t-j}$$
$$+ \sum_{k=0}^{p_2} \beta_{2,k} X_{2,t-k} + \sum_{l=0}^{p_3} \beta_{3,l} X_{3,t-l} + ... + \sum_{m=0}^{p_n} \beta_{n,m} X_{n,t-m} + \varepsilon_t \tag{a}$$

The procedure to conduct ARDL can be summarized as follows:

• Step 1: Run unit root tests to ensure that no variable is integrated of order two. The reason is that if the variables are stationary after taking repeated differences 2 times, we yield spurious regressions.

• Step 2: The bound test: According to Pesaran & Pesaran (1997), the bound test is built to test the existence of cointegration relationship between variables, in other words, is to test the existence of long-run relationship between them. In order to do the bound test, we consider the following equation:

$$\Delta Y_t = \alpha + \sum_{i=1}^{p_0} \beta_{0,i} \Delta Y_{t-i} + \sum_{j=0}^{p_1} \beta_{1,j} \Delta X_{1,t-j}$$

$$+ \sum_{k=0}^{p_2} \beta_{2,k} \Delta X_{2,t-k} + \sum_{l=0}^{p_3} \beta_{3,l} \Delta X_{3,t-l} + ... + \sum_{m=0}^{p_n} \beta_{n,m} \Delta X_{n,t-m} \qquad \text{(b)}$$

$$+ \lambda_0 Y_{t-1} + \lambda_1 X_{1,t-1} + \lambda_2 X_{2,t-1} + \lambda_3 X_{3,t-1} + ... + \lambda_n X_{n,t-1} + \varepsilon_t$$

The hypotheses for cointegration testing as follows:

- Null hypothesis H_0: $\lambda_0 = \lambda_1 = \lambda_2 = \lambda_3 = ... = \lambda_n = 0$: the cointegration does not exist, meaning no long-run relationship between variables.

- Alternative hypothesis H_1: $\lambda_0 \neq 0$, $\lambda_1 \neq 0$, $\lambda_2 \neq 0$, $\lambda_3 \neq 0$, ..., $\lambda_n \neq 0$: the cointegration does exist, meaning (some) long-run relationship(s) between variables.

To test the null, we compare the value of computed F-statistic and the critical values of two bounds, which I(0) and I(1) are in accordance with the lower and upper bounds respectively.

- If F-statistic is higher than the upper value bound (in accordance with I(1)), the null hypothesis is rejected. We can conclude that the existence of cointegration is valid.

- If F-statistic is lower than the lower value bound (in accordance with I(0)), the null hypothesis is accepted. We can conclude that there is no cointegration.

- If F-statistic is in middle of bounds, we cannot draw a conclusion. An error correction term is employed to identify the cointegration (Kremers, Ericsson & Dolado (1992)).

• Step 3: Define the optimal lag length: The choice of optimal lag length for all variables in our model could be done by choosing the minimum AIC and SBC criteria.

• Step 4: Estimate the long-run equation.

The long-run equation can be written as follows:

$$\overline{Y} = \varphi_0 + \varphi_1 \overline{X_1} + \varphi_2 \overline{X_2} + \varphi_3 \overline{X_3} + ... + \varphi_n \overline{X_n} \qquad \text{(c)}$$

Of which, long-run coefficients φ_0, φ_1, φ_2, φ_3, ..., φ_n are defined as follows:

$$\varphi_0 = \frac{\alpha}{1-\sum\limits_{i=1}^{p_0} \beta_{0,i}}; \varphi_1 = \frac{\sum\limits_{j=0}^{p_1} \beta_{1,j}}{1-\sum\limits_{i=1}^{p0} \beta_{0,i}};$$

$$\varphi_2 = \frac{\sum\limits_{k=0}^{p_2} \beta_{2,k}}{1-\sum\limits_{i=1}^{p_0} \beta_{0,i}}; \varphi_3 = \frac{\sum\limits_{l=0}^{p_3} \beta_{3,l}}{1-\sum\limits_{i=1}^{p_0} \beta_{0,i}}; ...; \varphi_n = \frac{\sum\limits_{m=0}^{p_n} \beta_{n,m}}{1-\sum\limits_{i=1}^{p_0} \beta_{0,i}} \tag{d}$$

• Step 5: Estimate the short-run coefficients according to the unlimited error correction model.

The ECM-ADRL with $(p_0, p_1, p_2, p_3, ..., p_n)$ lags in Engle – Granger method is written as follows:

$$\Delta Y_t = \alpha - \sum_{i=2}^{p_0}\left[\left(\sum_{i}^{p_0}\beta_{0,i}\right)\times\Delta Y_{t-(i-1)}\right]$$

$$+\beta_{1,0}\Delta X_{1,t} - \sum_{j=2}^{p_1}\left[\left(\sum_{j}^{p_1}\beta_{1,j}\right)\times\Delta X_{1,t-(j-1)}\right]$$

$$+\beta_{2,0}\Delta X_{2,t} - \sum_{k=2}^{p_2}\left[\left(\sum_{k}^{p_2}\beta_{2,k}\right)\times\Delta X_{2,t-(k-1)}\right] \tag{e}$$

$$+\beta_{3,0}\Delta X_{3,t} - \sum_{l=2}^{p_3}\left[\left(\sum_{l}^{p_3}\beta_{3,l}\right)\times\Delta X_{3,t-(l-1)}\right]$$

$$........................$$

$$+\beta_{n,0}\Delta X_{n,t} - \sum_{m=2}^{p_n}\left[\left(\sum_{m}^{p_n}\beta_{n,m}\right)\times\Delta X_{n,t-(m-1)}\right]$$

$$-(1-\sum_{i=1}^{p_0}\beta_{0,i})ECM_{t-1}.$$

Of which ECM_{t-1} is the corrected error, reflecting the adjustment speed to long-run equilibrium.

To ensure that the ARDL is reliable and robust, we need to run relevant diagnostic tests such as: Wald test, Ramsey's RESET test for wrong model identification, Larange multiplier test (LM) for serial correlation, heteroskedasticity test, CUSUM (Cumulative sum of recursive residuals) and CUSUMSQ (cumulative sum of square of recursive residuals) tests for the stability of residuals.

According to Pesaran et al. (1996) and Hamuda, Suliková, Gazda & Horváth (2013), if we are unsure about the unit root's property and/or the stationarity

of data, variables are not integrated of the same order I(0) or I(1), then ARDL procedure is most appropriate for empirical studies. Besides, Pesaran et al. (1996), Hamuda et al. (2013), Tran Nguyen Ngoc Anh Thu & Le Hoang Phong (2014), Le Hoang Phong & Dang Thi Bach Van (2015) agree that ARDL method has more advantages.

Firstly, ARDL model allows us to work with a small sample whereas the Johansen's technique requires a bigger sample in order to obtain significant results.

Secondly, in contrast to conventional methods in finding the long-run relationship, ARDL model does not estimate simultaneous equation. Instead, it deals with the single equation.

Thirdly, while other methods only accept same lags for all variables in a regression, ARDL tolerates different optimal lags.

Fourth, ARDL provides unbiased long-run estimation if there are endogenous variables in the model.

Our ARDL model for this study can be represented as follows:

$$LTB_t = \alpha + \sum_{i=1}^{p_1} \beta_{1,i} LTB_{t-i} + \sum_{j=0}^{p_2} \beta_{2,j} LGDP_{t-j} + \sum_{k=0}^{p_3} \beta_{3,k} LM2_{t-k} + \sum_{l=0}^{p_4} \beta_{4,l} LE_{t-l} + \varepsilon_t. \quad (1)$$

According to Pesaran et al. (1997), the bound test is the first step in ARDL procedure, in order to identify the existence of cointegration/long-run relationship between variables.

$$\Delta LTB_t = \alpha + \sum_{i=1}^{p1} \beta_{1,i} \Delta LTB_{t-i}$$

$$+ \sum_{j=0}^{p2} \beta_{2,j} \Delta LGDP_{t-j} + \sum_{k=0}^{p3} \beta_{3,k} \Delta LM2_{t-k} + \sum_{l=0}^{p4} \beta_{4,l} \Delta LE_{t-l} \quad (2)$$

$$+ \lambda_1 LTB_{t-1} + \lambda_2 LGDP_{t-1} + \lambda_3 LM2_{t-1} + \lambda_4 LE_{t-1} + \varepsilon_t.$$

The hypotheses for testing cointegration between variables as follows: Null hypothesis $H_0: \lambda_1 = \lambda_2 = \lambda_3 = ... = \lambda_n = 0$: no cointegration, no long-run relationship between variables. Alternative hypothesis $H_1: \lambda_0 \neq 0, \lambda_1 \neq 0, \lambda_2 \neq 0, \lambda_3 \neq 0, \lambda_4 \neq 0$: existed cointegration, existed long-run relationship between variables.

In order to test H_0, we compare the computed F-statistic with the critical values of bounds in accordance with standard significances (lower bound and upper one are in accordance with I(0) and I(1) respectively).If F-statistic is bigger than the critical value of the upper bound (in accordance with I(1)), we reject H0, concluding that the long-run relationship between variables exists. If

F-statistic is smaller than the critical value of lower bound (in accordance with I(0)), we accept H0, concluding that there is a long-run relationship between variables.

If F-statistic lies in the middle of bounds, we cannot draw any conclusion, so we need an error correction term to define the cointegration.

The long-run equilibrium equation is written as follows:

$$\overline{LTB} = \varphi_1 + \varphi_2 \overline{LGDP} + \varphi_3 \overline{LM2} + \varphi_4 \overline{LE} \qquad (3)$$

Of which, long-run coefficients are defined as follows:

$$\varphi_1 = \frac{\alpha}{1 - \sum_{i=1}^{p_1} \beta_{1,i}}; \varphi_2 = \frac{\sum_{j=0}^{p_2} \beta_{2,j}}{1 - \sum_{i=1}^{p_1} \beta_{1,i}}; \varphi_3 = \frac{\sum_{k=0}^{p_3} \beta_{3,k}}{1 - \sum_{i=1}^{p_1} \beta_{1,i}}; \varphi_4 = \frac{\sum_{l=0}^{p_4} \beta_{4,l}}{1 - \sum_{i=1}^{p_1} \beta_{1,i}} \qquad (4)$$

Following Engle-Granger, our ECM-ARDL model with lags is as below:

$$\begin{aligned}
\Delta LTB_t &= \alpha - \sum_{i=2}^{p_1} \left[\left(\sum_{i}^{p_1} \beta_{1,i} \right) \times \Delta LTB_{t-(i-1)} \right] \\
&+ \beta_{2,0} \Delta LGDP_t - \sum_{j=2}^{p_2} \left[\left(\sum_{j}^{p_2} \beta_{2,j} \right) \times \Delta LGDP_{t-(j-1)} \right] \\
&+ \beta_{3,0} \Delta LM2_t - \sum_{k=2}^{p_3} \left[\left(\sum_{k}^{p_3} \beta_{3,k} \right) \times \Delta LM2_{t-(k-1)} \right] \\
&+ \beta_{4,0} \Delta LE_t - \sum_{l=2}^{p_4} \left[\left(\sum_{l}^{p_4} \beta_{4,l} \right) \times \Delta LE_{t-(l-1)} \right] \\
&- (1 - \sum_{i=1}^{p_1} \beta_{1,i}) ECM_{t-1} + \mu_t.
\end{aligned} \qquad (5)$$

Where:

$$ECM_{t-1} = LTB_t - \alpha - \sum_{i=1}^{p_1} \beta_{1,i} LTB_{t-i} - \sum_{j=0}^{p_2} \beta_{2,j} LGDP_{t-j} - \sum_{k=0}^{p_3} \beta_{3,k} LM2_{t-k} - \sum_{l=0}^{p_4} \beta_{4,l} LE_{t-l}. \qquad (6)$$

4. Results

Unit root test: This test makes sure that variables are not integrated of order two (2)//there is no integration of order 2 variables//because of mentioned

spurious regression. Table 2 reports the results of ADF unit root test of Dickey & Fuller (1979).

Table 2: Unit root test's results

Variable	T-statistic	Conclusion	Order of integration
LTB	-2.731	Non-stationary process	
ΔLTB	-4.762	Stationary process	I(1)
LGDP	-1.764	Non-stationary process	
ΔLGDP	-11.936	Stationary process	I(1)
LM2	-1.437	Non-stationary process	
ΔLM2	-7.502	Stationary process	I(1)
LE	-9.686	Stationary process	I(0)

As can be seen in Table 2, at the 5% significance level, LTB, LGDP and LM2 are together integrated of order 1, except LE is integrated of order zero. According to Pesaran et al. (1996), Hamuda et al. (2013), applying ARDL is the most appropriate method for doing empirical analysis when we cannot ensure the property of unit root and the stationary of the system, and/or all variables do not have the same integrated order of I(1) or I(0).

Bound test: This test defines the cointegration relationship between variables. The results are presented in Table 3.

Table 3: Bound test's results

Number of regressor	Test statistic	Critical Value Bounds							
k	F-statistic	90%		95%		97,5%		99%	
		I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
3	125.100	2.711	3.800	3.219	4.378	3.727	4.898	4.385	5.615

Table 3 shows that F-statistic is larger than the critical value upper bound at 1% significance level (provided in the appendices of Pesaran et al. (1997). Thus, we can reject the null hypothesis H_0, accepting the alternative one H1: that the cointegration exists between variables, in other words, there is existence of long-run relationship between variables.

Choosing the lag length for ARDL: based on SBC criteria, the optimal lags for our ARDL is ARDL(2.0,2.0) (Table 4).

Our ARDL has R-Squared of 0.979 and R-Bar-Squared of 0.971, meaning

Table 4: ARDL estimation with LTB as dependent variable

Variable	Coefficient	Standard error	T-statistic	P-value
LTB(-1)	0.253***	0.080	3.168	0.005
LTB(-2)	-0.112*	0.059	-1.907	0.072
LGDP	0.203**	0.076	2.676	0.015
LM2	0.168*	0.083	2.011	0.059
LM2(-1)	-0.025	0.121	-0.204	0.840
LM2(-2)	-0.306***	0.081	-3.750	0.001
LE	0.628***	0.049	12.894	0.000
INPT	-6.910***	0.726	-9.514	0.000
R-Squared	0.979	DW-statistic		1.602
R-Bar-Squared	0.971	Schwarz Bayesian Criterion		38.084
F-statistic	125.100	Pob (F-statistic)		0.000

*Note: ***, ** and * are the significance levels of 1%, 5% and 10% respectively.*

that the gross domestic product, exchange rate and money supply can explain up to 97% movement of TB.

Diagnostic tests for the appropriateness of the model: we conduct regarded tests such as: Wald test, Ramsey's RESET test for wrong model identification, Larange multiplier (LM) test for serial correlation, and heteroscedasticity test (see in Table 5).

Besides, we test the stability of residuals by employing the CUSUM (cumulative sum of recursive residuals) and CUSUMSQ (cumulative sum of the square of recursive residuals). The results are graphed in Figure 2 and Figure 3 respectively, indicating that the CUSUM and CUMSQ move within the standard

Table 5: Diagnostic tests' results

No	Test	Statistic	Test-statistic	P-value
1	Wald	CHSQ (7)	875.702	0.000
		F (7. 19)	125.100	0.000
2	Model identification	CHSQ (1)	0.003	0.955
		F (1. 18)	0.002	0.964
3	Serial correlation	CHSQ (1)	0.731	0.393
		F (1. 18)	0.501	0.488
4	Heteroskedasticity	CHSQ (1)	0.841	0.359
		F (1. 25)	0.804	0.379

Figure 2: Cumulative sum of recursive residuals
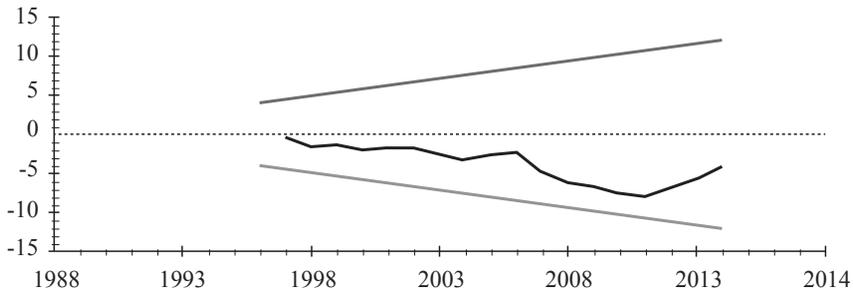
Figure 3: Cumulative sum of square of recursive residuals
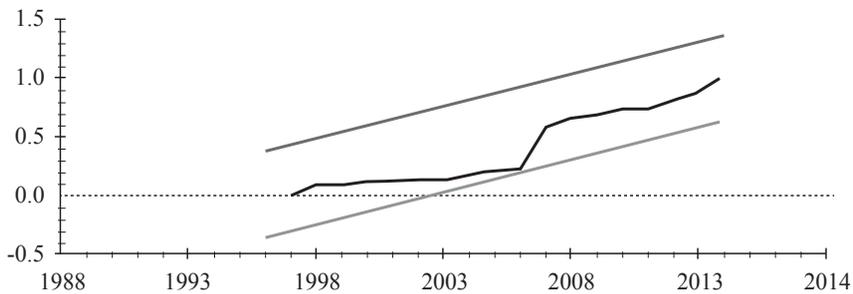
Table 6: Long-run coefficients from ARDL(2,0,2,0)
with LTB as dependent variable

Variable	Coefficient	Standard error	T-statistic	P-value
LGDP	0.236**	0.098	2.412	0.026
LM2	-0.190***	0.066	-2.878	0.010
LE	0.731***	0.108	6.781	0.000
INPT	-8.043***	1.360	-5.913	0.000

*Note: ***, ** and * are the significance levels of 1%, 5% and 10% respectively.*

intervals of 5% significance level. These results suggest that the residuals are stable and thus, our model is stable.

In short, the tests' results indicate that our model is reliable and robust to estimate the long-run and short-run coefficients.

Estimating ARDL's long-run coefficients: Table 6 reports the estimated coefficients of the ARDL(2.0,2.0).

The coefficients show that in the long-run, all variables have statistically

significant effects on trade balance of Vietnam (LTB). Particularly, gross domestic product (LGDP) and exchange rate (LE) have positive impacts whereas money supply (LM2) has a negative one.

Estimating ARDL's short-run coefficients: In order to analyze the influence of short-run movement's tendency on long-run equilibrium, we use the error correction model (ECM). Table 7 gives the results for short-run coefficients of our chosen ARDL.

Where:
ECM = LTB - 0,236 x LGDP + 0,190 x LM2 - 0,731 x LE + 8,043 x INPT   (7)

This result indicates that in the short-run, the difference of gross domestic product, money supply and exchange rate positively affect Vietnam's trade balance. Those effects are statistically significant.

The error correction provides feedback information or the adjustment speeds of short-run coefficients that converge to their long-run equilibrium in the model. The error correction term's coefficient ECM(-1) is statistically significant at 1% level, ensuring the existence of cointegration relationship as found in the Pesaran (1997) bound test. The error correction term's coefficient is -0.859, lying well on the range of (-1;0) and suggesting a fast speed of adjustment. Each year, it has to adjust up to 86% of the difference between short-run and long-run

Table 7: Short-run effects in ARDL–based ECM
with ΔLTB as dependent variable

Variable	Coefficient	Standard error	T-statistic	P-value
ΔLTB(-1)	0.112 *	0.059	1.907	0.071
ΔLGDP	0.203**	0.076	2.676	0.015
ΔLM2	0.168*	0.083	2.011	0.058
ΔLM2(-1)	0.306***	0.082	3.750	0.001
ΔLE	0.628***	0.049	12.894	0.000
INPT	-6.910***	0.726	-9.514	0.000
ECM(-1)	-0.859***	0.100	-8.584	0.000
R-Squared	0.971	DW-statistic		1.602
R-Bar-Squared	0.960	Schwarz Bayesian Criterion		38.084
F-statistic	105.830	Prob (F-statistic)		0.000

*Note: ***, ** and * are the significance levels of 1%, 5% and 10% respectively.*

values. The ECM can explain 96% of variations in the short-run of Vietnam's trade balance.

The impacts of GDP on trade balance valid both in the short-run and in the long-run. This result is in line with the theory that when income (GDP) increases, demand for money increases. To clear the money market, a country must promote exports, generating positive effect on trade balance (Mundell, 1968). According to Solow's growth model (Solow, 1956), in the early stage, a low developed country can enjoy a higher growth rate when it borrows external capitals for investment. Later, the economy is close to its steady state, thus, the growth rate declines. Hence, a higher growth rate suggests that this country is undergoing its initial period of developments and tends to accept current account deficit.

The effects of money supply on trade balance can be explained within the framework of monetary approach. In short-run, an increase in money supply will result in a decrease in trade balance (Magee, 1976). By contrast, the excessive money supply facilitates increasing imports and worsens trade balance (Mundell, 1968; Magee, 1976; Johnson, 1976; Miles, 1978; Frenkel et al., 1987).

In the long-run, exchange rate has a positive impact on trade balance of Vietnam. This result supports ones of Bickerdike (1920), Robinson (1947), Metzler (1948): when exchange rate increases, domestic currency depreciates, foreign goods and services are relatively more expensive than domestic ones, imports decrease, exports increase, and trade balance improves. In Vietnam, the fact that exchange rate has been continuously increasing in the past period deteriorates our trade balance. This result is strengthened when it is in line with the study of Ha Thi Thieu Dao et al. (2013).

5. Conclusion

The empirical results show that up to 97% of trade balance's fluctuation in Vietnam is due to the variations of the gross domestic product, exchange rate and money supply. In the long-run, they all statistically significantly affect trade balance (LTB).

A 1% increase of gross domestic product is associated with 0.24% increase in trade balance at 5% significance level. This result is consistent with the study of Duasa (2007). Based on this, Vietnam needs to focus on growth to improvethe trade balance. According to Mundell (1968), an increase in income (GDP) causes an increase in money demand. To balance the money, the country stimulates exports, generating positive effects on the trade balance.

Money supply has an adverse effect on trade balance at 1% significant level, when money supply increases by 1%, trade balance decreases by 0,19%. This result supports the argument of Magee (1976) that an increase of money supply will create an adverse effect on trade balance. Thus, to stabilize trade balance (a part of the balance of payments), a solid fulcrum for macroeconomic stability, the government should strictly control the money supply. It is very crucial to implement an active, flexible, and prudent monetary policy in order to stabilize the money market, ensure the banking system's liquidity, and meet the capital demand for production and business of which prioritizes export-led sectors. A key point in controlling the money supply is controlling the credit growth. Excessive credit growth relative to nominal GDP growth will soon put pressure on price levels and interest rates. Therefore, the control of money supply must be appropriate with nominal GDP growth rate. In addition, since the financial market has been stable, it is necessary to let market forces determine interest rates. Maintaining a cap on deposit rates for under 6-month savings has led to difficulties in attracting commercial banks' deposits, as well as increasing consumer spending and driving savings to higher yield's asset markets. This may be the cause of imbalance in the capital market. Moreover, both restrictions on maturity and the cap of government bond yields hinder the development of the capital market and the SBV's ability to control money supply and interest rates. Therefore, the priority should be provided to the development of capital markets for the development of financial markets. On the other hand, it is necessary to regulate government expenses, in order to achieve fiscal balances in medium and long-term.

In our study, exchange rate also has a noticeable impact on TB at 1% significance level. For every 1% increase in exchange rate, trade balance rises by 0.73%. For the current exchange rate management mechanism, in order to improve the trade balance, the government should reduce the risks, especially to increase the flexibility of the exchange rate within the permissible limits, towards macroeconomic stability, export promotion, and import restrictions. In the medium term, when the improved domestic financial market is matched with effective financial regulation mechanisms, it is imperative and indispensable to open capital and financial accounts as committed in the roadmap. For that to do, a managed floating exchange rate regime is a reasonable choice.

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