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The Sources of Indonesia’s Current Account Balance Fluctuations: An Empirical Test of the Vector Error Correction Model (VECM)

Tri Winarno[a]

[a]*Senior Researcher, Bank Indonesia, Jl Thamrin No. 2 Jakarta Pusat, Indonesia (10100)*

Abstract

Identifying the sources of current account balance fluctuations is critical to formulating Indonesia’s macroeconomic policies which maintain both internal and external balance to guarantee sustainable economic development as mandated by The Central Bank of Indonesia Act. This study is an attempt to investigate the long-run relationship between the current account balance (including total trade balance and non oil and gas trade balance), world exports, domestic income (a proxy by industrial production index), and real effective exchange rate in the case of Indonesia’s economy. Based on the traditional approach of elasticity (Marshall Lerner condition) and by applying the VECM method to monthly data for the period January of 2008 up to December 2012, the investigation to examine the existence of a long-run equilibrium relationship between the current account balance and its sources is conducted. Additionally, variance decompositions (VDCs) and impulse response functions (IRFs) are used to draw further inferences. The result of the VECM method indicates that there is a stable long-run relationship between the current account balance and real effective exchange rate, domestic income and world exports variables. The estimated results show that real effective exchange rate depreciation is positively related to the current account balance in the long run, consistent with the Marshall Lerner condition. This study also finds evidence of the J-curve on the Indonesia current account balance. This suggests that following a real effective exchange rate depreciation, the Indonesia current account balance will initially deteriorate but improve in the long-run. Thus the exchange rate policy can help improve the current account balance. Furthermore, the results provide strong evidence that world exports and domestic income play a strong role in determining the behavior of the current account balance.

Keywords: current account balance; total trade balance; non oil and gas trade balance, real effective exchange rate; world export; domestic income; Indonesia; VECM; Marshall Lerner condition

1. Introduction

Indonesia's current account balance worsened in 2012, reflected in a deficit of USD24.2 billion (-2.7% of GDP), in contrast to the USD1.7 billion surplus (0.2% of GDP) in the preceding year (Chart 1). The

*Corresponding author. Tel.: +062-21-3014772 E-maill address: t_winarno@bi.go.id

current account deficit in 2012 was the result of a diminishing goods trade surplus accompanied by persistent deficits in the services and income accounts.One factor contributing to the enlarged deficit in the current account was the contraction in the non-oil & gas trade surplus, a development explained by modest improvement in non-oil and gas exports that contrasted with a significant rise in non-oil and gas imports. Slowing growth in the world demand and plunging export commodity prices in contrast to buoyant domestic demand resulted in a diminished non-oil and gas trade surplus. In addition, soaring oil imports driven by the burgeoning consumption of oil-based fuels and outrage at refineries widened the oil and gas trade deficit. The services deficit also mounted due to the growing numbers of Indonesian residents travelling abroad for vacation or the Hajj pilgrimage.

The non-oil and gas trade surplus plunged to USD13.5 billion from the previous year's surplus of USD35.4 billion (Chart 2). This reduced surplus was explained by a 6.2% contraction in non oil and gas exports while non-oil and gas imports continued to forge ahead at 9.2%. Weak growth in the volume of world trade and demand in trading partner countries compounded by steady decline in commodity prices were the main factors responsible for the comparatively limited gains in non-oil and gas exports. Meanwhile, non-oil and gas imports accelerated further in keeping with strong domestic demand, reflected in 2012 GDP growth of 6.11%. Non-oil and gas exports only reached USD152.6 billion, lower than USD162.7 billion in the preceding year.

Chart 1. Current account balance

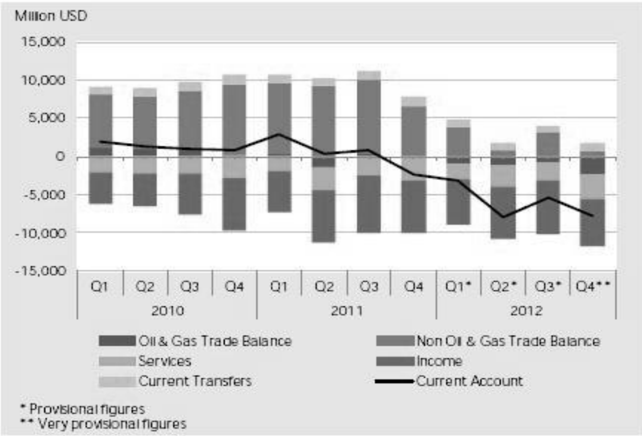
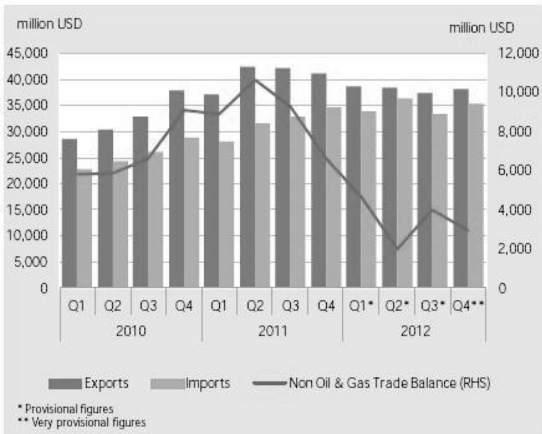


Chart 2. Non oil and gas trade balance



The oil and gas trade balance recorded a USD2.3billion deficit, greater than USD0.8 billion deficit one quarter earlier (Chart 3). This bigger deficit was fuelled by soaring oil imports. With the development during the four quarters of 2102, the oil and gas trade deficit reached USD5.1 billion in 2012, far above the deficitin 2011 of USD0.7 billion.However, the deficit of current account balance was offset by a hefty increase in the capital and financial account surplus over the previous year, enabling Indonesia to chart a balance of payments surplus of US$0.2 billion and maintain a comfortably safe level of international reserves (Chart 4). The increased capital and financial account surplus was driven not only by portfolio investment,but also FDI with an added boost from the growing proportion of export proceeds received through the domestic banking system. In response, international reserves at the end of December 2012 strengthened to US$112.8 billion, equivalent to 6.1 months of imports and government external debt services.

Chart 3. Oil and gas trade balance

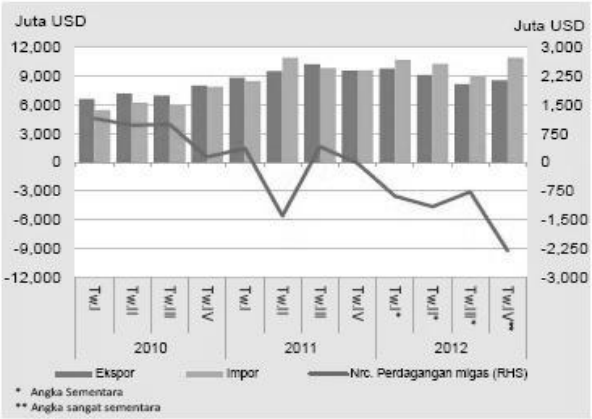
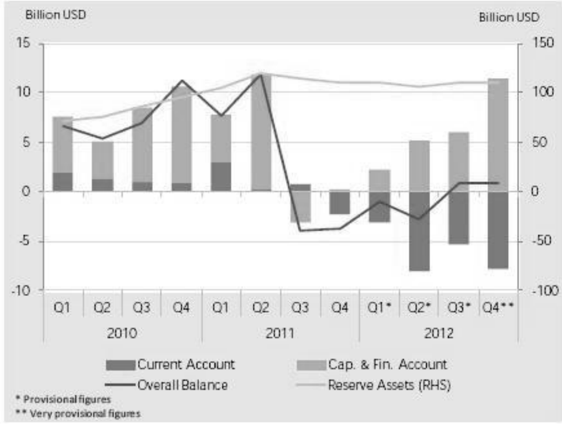


Chart 4. Balance of payments



It is against this background that this paper would investigate the sources of current account balance fluctuation, particularly with respect to a real depreciation of Rupiah. The main objective of the study is to examine the validity of the argument that exchange rate depreciation improves both the current account balance and trade balance. In addition, it attempts to test the short-run and long-run empirical relevance of the elasticity approach by incorporating the varied of domestic income and world expert in the model. Variance decomposition and impulse response analyses are carried out to observe the direction,magnitude, and persistence of the current account balance and trade balance in relation to variations in policy variables such as the real exchange rate and domestic income. Indonesia provides an ideal opportunity to examine this issue as in recent months its current account and trade balance has deteriorated considerably. Indonesia has pursued a managed floating exchange rate policy to maintain external competitiveness since the financial crisis of 1998.

The remainder of this paper is organized as follows. Sections 2 and 3discuss briefly the relevant literature and theoretical framework of the balance of payments from the elasticity approach. Section 4 presents the empirical specification and econometric methodology.Then in section 5 there is a description of data preliminaries, after which in section 6, the empirical findings are reported and discussed. Finally, the paper ends with a concluding and policy implication section.

2. LITERATURE REVIEW

The effects of depreciation in the exchange rate on the trade balance are related to the determinants of the demand and supply elasticity of exports and imports. In the short run, the elasticity is relatively smaller (inelastic demand and supply), than in the long run (elastic) hence the trade balance may deteriorate in the short run, Bahman-Oskooee (2004). Due to currency contracts, initially, the trade balance worsens as a result of a real depreciation since prices and trade volumes are not allowed to change. This situation assumes that exports are invoiced in domestic currency and imports in foreign currency. The degree of foreign and domestic producer's price pass-through to consumers and the scale of supply and demand elasticity of exports and imports, determine the value of the effect, Hsing (1999). The J-curve effect can be explained by both a perfect pass-through domestic import price increases while domestic export price remains unchanged. The resulting effect is deterioration in the trade balance. In zero pass-through situations, domestic export price increase while domestic import price remain constant hence the real trade balance improves following depreciation. According to Bahman-Oskooee (2004), the

Marshall-Lerner condition is the necessary and sufficient conditions for an improvement in the trade balance following a depreciation. For a currency depreciation to have a positive impact on the trade balance, the sum of import and export demand elasticity should be greater than one. The Marshall-Lerner condition is a long-run condition because exporters and importers have enough to adjust to changes in the exchange rate by coming up with alternative choices in demand and supply.

Most studies in the J-curve effect have come up with mixed results. Some results are consistent with the J-curve phenomenon while others depict non existence or new evolution of the J-curve effect. Gupta-Kapoor and Ramakrishnan (1999) used the error correction model and the impulse response function to determine the J-curve effect on Japan using quarterly data from 1975:1 - 1996-4. Their analysis showed the existence of the J-curve on the Japanese trade balance. TihomirStucka (2004) found evidence of the J - curve on the trade balance for Croatia. His study employed a reduced form model to estimate the impact of a permanent shock on the merchandise trade balance. It was found that 1 percent depreciation in the exchange rate improves the equilibrium trade balance by the range of 0.94 percent up to 1.3 percent and it took 2.5 years for equilibrium to be established.

Koch and Rosensweig (1990) studied the dynamics between the dollar and components of US trade. They employed time series-specification tests and Granger tests of causal priority to identify the J-curve phenomenon. Two of the four components portrayed dynamic relationships that are weaker and more delayed than the standard J-curve. In the conventional J-curve, the theory asserts a strong and rapid dependency of import prices in the currency.

Carter and Pick (1989) found empirical evidence indicating the existence of the first segment of the J-curve on the US Agricultural trade balance. The results exhibited deterioration in the trade balance that lasted for about 9 months following a 10 percent depreciation in the US dollar. Using the generalized impulse response function from the vector error correction model to examine the existence of J-curve for Japan, Korea and Taiwan Hsing (2003) found that Japan's aggregate provided evidence of the Phenomenon while Korea and Taiwan did not show any presence of the J-curve effect. He argues that this may be attributed to a small open economic effect. In small open economies like Korea and Taiwan, both imports and exports are invoiced in foreign currency as a result the short run effect of real devaluation is hedged and the trade balance remains unaffected.

Haynes and Stone (1982) estimated the impact of terms of trade on the US trade balance. Their results showed no improvement in the trade balance following a deterioration of the terms of trade for the period between 1947 and 1974. This was a reexamination of McPheters and Stronge (1974) who concluded that there was a lag of about 2 years before the US trade balance could improve following changes in the prices giving evidence of J-curve. Miles (1979) found that devaluations do not improve the trade balance but do improve the balance of payments. He suggests that devaluation results in a readjustment in investment portfolio resulting in an excess in the capital account. The data used was from 14 countries for the period ranging from 1956 to 1972. These results were reexamined by Himarios (1985) and some evidence of J-curve was found. He critiqued Miles' result as to be sensitive to units of measurements, and argued that the real exchange rate is the one that affect the trade flow and not the nominal exchange rate. He went further to state that examining what is happening to the trade balance on average is not the same as examining what is happening to the average trade balance.

Scott Hacker and AbdulansserHatemi-J (2004) used bilateral trade data to estimate the short and long-run effect of exchange rate changes on the trade balance in the transitional Central European economies of Czech Republic, Hungary and Poland against their trade with Germany. Their study employed export to import ratio as the measure of trade balance. Other variables included the industrial production index (as a proxy for foreign and domestic income) and the exchange rate. The use of the industrial production index, allowed them to estimate the statistical parameters using monthly data and there were no reliable and consistent data on GDP. Their findings suggest that in all the three cases, there were some evidence of the J-curve effect after real depreciation of the currencies in question. They also investigated the J-curve effect replacing the real exchange rate with the nominal exchange rate and the relative German price level. The argument for introducing these variables is that real exchange rate changes are either the result of shocks in nominal exchange rate or general domestic price changes. In some case it's a combination of both variables. Nominal exchange rate changes are much more observable than real exchange rate changes. Besides, it is easily controlled by authorities. They found weak forms of the J-curve effect where the trade balance deteriorates and improves later after the shock but the process was not instantaneous as predicted in the conventional theory. Paresh Narayan (2004) investigated the J-curve effect on the trade balance for New Zealand. He found no cointegrating relationship between the trade balance and real effective exchange rate, domestic income and the foreign income during the period of 1970-2000. However, the New Zealand trade balance exhibited the J-curve pattern. Following a real depreciation of the New Zealand dollar, the trade balance worsens for the first three years and improves thereafter. Similar study on the Singapore's trade relations with the US found no significant impact of the Singapore's real exchange rate on the trade balance and little evidence of the J-curve hypothesis. This study was conducted by Wilson and Kua (2000) using the partial reduced form model of Rose and Yellen (1989) derived from two-country imperfect substitute model.

Bahmani-Oskooee et al. (2003) conducted a study on India's trade balance following up on previous studies which did not find any significant results on the subject. Researchers argues that the problem could probably be the used of aggregated data. As a result, they employed disaggregated data to investigate the J-curve hypothesis against India's trading partners. The empirical results of the study did not support the J-curve pattern but the long-run real depreciation of India's rupee had significant effect on the improvement of the trade balance. The Turkish trade balance supported the Marshal-Lerner condition where there was evidence of the long run relationship following real depreciation.

3. THEORETICAL FRAMEWORK

There are a number of theoretical distinct approaches to predicting the outcome of policy changes on balance of payments, particularly on the current account balance including on both trade balance and non oil and gas trade balance. One of this theoretical framework is the elasticity approach on balance of payment which describes the effects of changes in the exchange rate on balance of payment in general. This view is rooted in a static and partial equilibrium approach to the balance of payments that is well known as the elasticity approach (Bickerdike, 1920;Robinson, 1947; Metzler, 1948). It states that, starting from a balanced trade situation, depreciation will improve the balance of payments if the sum of the price elasticity (a measure of how much demand changes in response to a price change) of domestic and foreign demand for imports is larger than one. Depreciation always improves the balance of payments if this condition is satisfied—although it is not a necessary condition of such improvement. The essence of this view is the substitution effects in consumption and production induced by the relative price (domestic versus foreign) changes caused by a depreciation. In particular, the Marshall Lerner Condition states that, for a positive effect of depreciation on the trade balance, and implicitly for a stable exchange market, the absolute values of the sum of the demand elasticity for exports and imports must exceed unity. Assuming that the Marshall Lerner condition is met, when the exchange rate is above the equilibrium there is excess supply of foreign exchange and when the exchange rate is below the equilibrium there is excess demand for foreign exchange.

Furthermore, for simplicity in explaining the theoretical framework, trade balance terminology is used rather than a current account balance or balance of payments.Mathematically such elasticity approach can be elaborated as follows.

In the imperfect substitute model as outlined by Goldstein and Khan (1985), the trade balance comprises only the merchandise component of exports and imports. Domestic income and prices of imports are the main determinants of demand for imported goods. Mathematically, the import demand function can be expressed as follows,

$$M_d = M_d(Y, P_m, P_d) \tag{1}$$

where M_d is the domestic demand for imports, Y is domestic income, P_m is the domestic currency price and P_d is the general price level in the domestic country. Similarly, the supply for domestically produced goods (equivalent to exports demand by foreigners) to the rest of the world is expressed as,

$$X_d = X_d(Y^*, P_x, E, P_f) \tag{2}$$

where X_d is the quantity of export goods to the rest of the world, Y^* is the foreign income, P_x is the foreign currency price paid by domestic importers, P_f is the general price level and E is the nominal exchange rate defined as the number of units of domestic currency per one unit of foreign currency. The key assumptions in equation (1) and (2) are that both domestic and foreign income elasticity are positive, so is the cross price elasticity while the own price elasticity is negative. In this model, demand variables are represented by current income and not permanent or transitory income. This condition makes economist assume homogeneity of the demand function. As a result consumers make their decisions based on real values as opposed to nominal values (money illusion). In order to effect the homogeneity assumption, the right hand sides of equations (1) and (2) are divided by their respective prices and the following equations are derived,

$$M_d = M_d(Y_r, RP_m) \tag{3}$$

where Y_r is the real domestic income and RP_m is relative price of imports and

$$X_d = X_d(Y_r^*, RP_x) \tag{4}$$

where Y_r^* real foreign income and RP_x is relative price of exports. When the foreign currency price of foreign exports P_x is adjusted for exchange rate, it is equivalent to the relative price of imports thus coming up with the following equation,

$$RP_m = \frac{P_m}{P_d} = \frac{EP_x^*}{P_d} = \frac{EP_f}{P_d}\frac{P_x^*}{P_f} = QP_x^* \tag{5}$$

where P_x^* is the real foreign currency price of exports and Q is the real exchange rate, in this formulation, an increase in Q is associated with a depreciation of the domestic currency. Since domestic exports are foreign imports and the collolary is true, domestic import demand is equivalent to foreign export supply and domestic export supply is equivalent to foreign import demand, thus

$$M_d = X_s^*, X_d, = M_s^* \tag{6}$$

where X_s^* and M_s^* are foreign export supply and foreign import supply respectively. We then derive the long-run equation for the trade balance as

$$TB = P_x^* X_d - QM_d \tag{7}$$

Thus the trade balance is the difference between the value of exports and imports. A negative value in the trade balance implies a trade deficit and is associated with an increase in the value of imports relative to exports. The interaction of the variables in equation (7) yield the following reduced form equation in real values

$$TB = TB(Y, Y^*, Q), \frac{\partial TB}{\partial Y} < 0, \frac{\partial TB}{\partial Y^*} > 0, \frac{\partial TB}{\partial Q} > 0 \tag{8}$$

The equation above is the traditional Keynesian function for the trade balance where real domestic income, real foreign income and the real exchange rate are the main determinants of net exports.

4. EMPIRICAL SPECIFICATION AND METHODOLOGY

In equation (7) the definition of trade balance is the difference between the value of exports and imports. In this study, the definition of trade balance ratio of exports (X) to imports (M). This study adopts Gupta-Kapoor and Ramakrishnan (1999) reduced form equation to investigate the J-curve using real variables. When using disaggregated (bilateral) data the trade is a function of domestic income, foreign income and exchange rate. This study looks at the effect of shocks in the real exchange rate and other related variables on the total trade as compared to bilateral trade relations. This study, therefore uses world export as a proxy for world income and real effective exchange rate as a measure of terms of trade. The reason for choosing the world export is none other than the important role of the world trade in determining the fluctuation of world income and the availability of monthly data. Thus the empirical model used in this study is

$$\ln(X / M) = \beta_0 + \beta_1 \ln IP + \beta_2 \ln WE + \beta_3 \ln REER + \mu \tag{9}$$

where ln*(X/M)* is the natural log of trade ratio, ln*IP*is the natural log of a proxy real domestic income (industrial production index), ln*WE* is the natural log of a foreign income proxy (world export), ln*REER* is the natural log of real effective exchange rate, β_0, β_1, β_2 and β_3 are the parameters to be estimated and μ is an error term. The use of export to import ratio as dependent variable over trade balance is of the advantage that taking logs without worrying for the possible negative values of the trade balance in case of trade deficit, Han-Min Hsing (2003). Other than real effective exchange rate, the trade ratio is also affected by real domestic and foreign incomes. All the variables are logged such that the parameter estimates would be interpreted as elasticity. The trade ratio is expected to be negatively related to the domestic real income and positively related to foreign income and the real effective exchange rate. Thus a currency depreciation will lead to a decrease in the export-import ratio in the short run due to price effect. In the long run when the volume effect takes over, the trade ratio improves. A real depreciation has two effects, direct and feedback effects. The direct effect on the trade ratio is demonstrated by taking the partial derivative with respect to the real effective exchange rate. According to Gupta-Kapoor and Ramakrishna (1999), the feedback effects arise from a contemporaneous effect of the exchange rate on both the trade balance as well as the future exchange rate. To capture both the direct and feedback effect, the vector error correction model is used in this study. In order for the VECM to be applicable there need be a stationary relationship among the variables implying that they are cointegrated. The cointergation tests are be carried out as outlined by Johansen (1995). This methodology is advantageous because it allows for analysis in the case of multiple cointegrating vectors. The resulting vector error correction model is

$$\Delta Z_t = \sum_{i-1}^{n-1} \phi_j \Delta Z_{t-1} + \Gamma Z_{t-1} + v_t$$

(1

where Z_t is a vector of variables in equation (9), ϕ_j is a matrix of coefficient for the growth rate of the variables, $\Gamma=\alpha\beta^{|}$ where α is the matrix of the speed of the adjustment parameters and $\beta^{|}$ is the matrix of the cointegrating vectors, i and n are lag order and maximum lag respectively, t is a time index and v_t is the vector of error term.

In estimating the error correction model, it is necessary to select the appropriate lag order that will effect the residuals white noise. The likelihood ratio, SBC and AIC information criteria are used to select the lag order. Of course much emphasis is put on the SBC and AIC because they have small sample properties as characterized by our data. All variables are also tested for unit root using the Augmented Dickey-Fuller test. The choice of the ADF is the fact that the procedure automatically selects for the lag length to be included in the test. The Kwiatkowski,Phillips, Schmidt and Shin (KPSS) test is also used to reaffirm the results of the ADF test. A variable with no unit root is stationary. According to Enders (2004), stationarity implies that a variable has a constant time invariant mean, variance and zero auto covariances. A non-stationary variable can be made stationary by either differencing or detrending. If a variable becomes stationary by differencing once, the variance is said to be integrated of the order one, denoted I(1). Consequently, if a variable is differenced twice in order to attain stationarity, such variable is integrated of the order two, denoted I(2). Unit root testing in macroeconomic data is much more important because it determines the appropriate model for estimating parameters. When nonstationary variables are treated as stationary in a classical regression model, this results in a spurious regression where the t-statistics appear to be significant, with high R-Squared values but the results are of no economic meaning.

The Johansen procedure (Johansen 1995) is employed to test for the existence of long run relationship between the trade ratio and the real effective exchange rate, and other variables based on the VECM framework. The simulation of IRF(impulse response function) and VDC (variance decomposition analysis) for further inferences is conducted. IRF and VDCserve as tools for evaluating the dynamic interactions and strength of causal relations among variables in the system. Moreover, the IRF traces the directional responses of a variable to a one-standard deviation shock to another variable. This means that it can observe the direction, magnitude, and persistence of the trade balance to variations in the REER, domestic income, and world export. The generalized IRF derived from the VECM is used to estimate the J-curve effect and the pattern of other variables impact on trade balance. According to Hsing (2003) the IRF shows the response of current and future trade ratio to one standard deviation change in the real exchange rate and other exogenous variables. The superiority of using the generalized IRF is that the order in which the variables are arranged does not affect the outcome of the results. Furthermore,VDC is used to estimate the forecast error of the trade ratio as attributable to its own innovation as well as innovations in other variables in the system. The main interest in using the VDCin this paper is to estimate the contribution of the shock in the real effective exchange rate to the forecast error of the trade ratio.Thus, from the VDC, the relative importance of the REER, domestic income, and world export fluctuations in accounting for fluctuations in the trade balance variable can be measured.

5. DATA PRELIMINARIES

This VECM framework of Indonesia's current account comprises of seven macroeconomic variables; namely CA(current account), TB(total trade balance), TBNM (non oil and gas trade balance), WE (world export), REER (real effective exchange rate), NER (nominal exchange rate) and IP (industrial production index). As for current account consists of goods and services export (XB) as well as goods and services import (MB); trade balance constitutes the combination of goods export (X) and goods import (M); non oil and gas trade balance is the same as total trade balance minus oil and gas trade balance, so that non oil and gas export and import are total export and import minus oil and gas export and import. The selection of these variables is among others based on the empirical research in this area (e.g. Aziz2012; Boyd2001; Yaya2010).The series used for the analysis of this empirical model are all in US dollars with the exception for the real effective exchange rate and the industrial production index since they are in the form of index, and nominal exchange rate is in Rupiah against US dollars. All variables are expressed in logarithmic form in order to estimate their elasticity.

The variable of the current account balance (including trade balance, non oil and gas trade balance) is measured as the ratio of goods and services export value (X) to goods and services import value (M). The ratio of X to M (i.e., X/M) or its inverse has been widely used in many empirical investigations of trade balance-exchange rate relationship, such as Bahmani-Oskooee and Brooks (1999), Lal and Lowinger (2001), and Onafowora (2003). This ratio is preferable because it is not sensitive to the unit of measurement and can be interpreted as the nominal or real trade balance (Bahmani-Oskooee, 1991). The export and import of goods values are based on FOB prices. The world export is employed as an indicator of international demand of products exported. The industrial production index is used as a proxy for the domestic income variable. The world export and the industrial production index are seasonally adjusted to eliminate potential seasonality. The nominal exchange rate used is the monthly average of the Rupiah against US dollar closing price. Monthly frequency data set are used covering the period from January 2008 to December 2012.

The sources of the data in this study: current account, trade balance, non oil and gas trade balance consisting of export and import both goods and services are drawn from various issues of the Department of Economic and Monetary Statistics of Bank Indonesia. Moreover, the real effective exchange rate comes from an owned calculation of the Department of Economics Research and Monetary Policy of Bank Indonesia. Furthermore, the industrial production index is based on the compilation of the National Statistic Office of Indonesia issued by CEIC. Finally, the data on Rupiah nominal exchange rate and world export are taken from international financial statistics data base published by IMF.

As a preliminary exercise to any VECM framework, this study tests for the stochastic property of the time series. In particular, the Augmented Dickey Fuller (ADF) test developed by Dickey and Fuller (1979, 1981) is adopted to check for the unit root property of the data. The results of the unit root tests are summarized in Table 1. As shown in the Table 1, the ADF test fails to reject the null hypothesis of unit root for all the variables, except for Log(CA) and Log(TBNM). After first differencing, however, these variables are found to be stationary. The Phillips Perron unit root (PP) test is also used to reaffirm the results of the ADF test. As shown in Table 1, the PP test results confirm that the ADF test that the first differences of all variables are stationary. The PP test results, however, indicate that Log(CA), Log(TBTOT) and Log(TBNM) are stationary both at level and first difference, whereas the ADF test results suggest that only Log(CA) and Log(TBNM) are stationary both at level and first difference .

Table 1. Unit root test results

Series		Log (CA)	Log (TBTOT)	Log (TBNM)	Log (REER)	Log (IP)	Log (WE)
ADF	Level	-4.375***	-1.196	-4.059***	-1.901	0.575	-1.456
	First difference	-9.522***	-10.031***	-9.690***	-3.758***	-10.576***	-8.164***
PP	Level	-4.496***	-4.154***	-4.285***	-1.692	0.350	-1.527
	First difference	-22.444***	-12.159***	-12.249***	-6.178***	-12.110***	-8.149***

***, ** and * indicate significance at the 1%, 5% and 10% level respectively
The lag lengths are selected according to the Schwartz information criterion (SIC)

Prior to estimating the cointegrating vectors it is important to select an optimal lag length that will give white noise residuals. This is one of the important stages in this analysis. Lag lengths have significant influence of the outcome of the results. There is always a tradeoff between using too many lags and too few lags. Too many lags tend to make the model less parsimonious and reduce the degrees of freedom while using very few lags leads to a correlation of the residuals. The work of information criteria is to compromise between the number of parameters (Johansen, 1995). This study used theSchwarz information criterion (SC), Hannan-Quinn information criterion (HQ), the Final Prediction Error (FPE), sequential modified LR test statistic (LR), andAkaike information criterion (AIC) to select the optimal lag length. Both the Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ) selected one lag as the optimal lag length for the VECM while the Final Prediction Error (FPE), sequential modified LR test statistic (LR), andAkaike information criterion (AIC) chose the optimal lag length is two.

Next, the Johansen-Juselius (1992) cointegrationtest is applied to determine if the variables are cointegrated with lag 1 and lag 2 as indicated by the Schwarz information criterion (SC), Hannan-Quinn information criterion (HQ) for lag 1; and the Final Prediction Error (FPE), sequential modified LR test statistic (LR), andAkaike information criterion (AIC) for lag 2. As shown in Table 2, both the Trace and Max-Eigenvalue statistics indicateat least one cointegrating vectors at the 5% significancelevel when both lag 1 and lag 2 is used.Because in the level data, not all variables arefound to be stationary at 95% significant level, andthey are cointegrated, therefore VECM framework is applicable instead of VAR framework.Given there is two results of lag length optimal, the strategy of this study is to accept the VECM framework with lag length which exhibits higher adjusted R-squared and economically meaningful. With regard to the laglength selection in the estimation of the VECM, although lag length tests suggest 1 lag and 2 lags, the study sets the lag length at 2 in the VECM estimation to make sure the results are robust.

Table 2. Cointegration test results (Series: LOG(CARATIO) LOG(REER) LOG(WE_SA) LOG(PI_SA))

Series: LOG(CARATIO) LOG(REER) LOG(WE_SA) LOG(PI_SA)				
Hypothesized No. of CE(s)	Trace Statistic	5% Critic Val	Max-Eigen Statistic	5% Critic Val
None*	57.39	55.25	39.86	30.82
At Most 1	17.53	35.01	11.63	24.25
At Most 2	5.91	18.40	5.88	17.15
Hypothesized No. of CE(s)	Trace Statistic	5% Critic Val	Max-Eigen Statistic	5% Critic Val
None*	55.44	55.25	38.30	30.82
At Most 1	17.14	35.01	11.21	24.25
At Most 2	5.92	18.40	5.92	17.15
Series: LOG (TBNMRATIO) LOG (REER) LOG(WE_SA) LOG (PI_SA)				
Hypothesized No. of CE(s)	Trace Statistic	5% Critic Val	Max-Eigen Statistic	5% Critic Val
None*	67.88	55.25	46.66	30.82
At Most 1	21.22	35.01	14.77	24.25
At Most 2	6.45	18.40	6.41	17.15

The tests indicate 1 cointegrating eqn at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level

Table 3. Estimated Cointegration Vector for Current Account Ratio

Standarized β' eigenvectors	CARATIO	REER	IP	WE	Constant
	1.000	-0.507	1.861	-0.023	-6.432
		(-0.158)	(-0.261)	(-0.060)	
Standarized α coefficients	Variable	CARATIO	REER	IP	WE
	Value	-1.259	-0.004	-0.192	0.183
	T-Statistics	-4.637	-0.039	-2.104	1.128

Note: Standarized β' eigenvectors are normalized on CARATIO and the Standarized α coefficients are the speed of adjustment parameters. Standard errors are enclosed in parentheses.

Table 4. Estimated Cointegrating Vector for Total Trade Balance

Standarized β' eigenvectors	TBTOT	REER	IP	WE	Constant
	1.000	-0.722	2.375	-0.008	-8.183
		(-0.191)	(-0.315)	(-0.073)	
Standarized α coefficients	Variable	TBTOT	REER	IP	WE
	Value	-1.259	-0.004	-0.192	0.183
	T-Statistics	-4.637	-0.039	-2.104	1.128

Note: Standarized β' eigenvectors are normalized on TBTOT and the Standarized α coefficients are the speed of adjustment parameters. Standard errors are enclosed in parentheses.

Table 5. Estimated Cointegrating Vector for non oil n gas Trade Balance

Standarized β' eigenvectors	TBNM	REER	IP	WE	Constant
	1.000	-0.775 (-0.189)	2.812 (-0.309)	-0.055 (-0.071)	-9.462
Standarized α coefficients	Variable	TBNM	REER	IP	WE
	Value	-1.056	-0.074	-0.168	0.232
	T-Statistics	-4.382	-0.996	-2.451	1.918

Note: Standarized β' eigenvectors are normalized on TBNM and the Standarized α coefficients are the speed of adjustment parameters. Standard errors are enclosed in parentheses.

6. EMPIRICAL FINDINGS

6.1. Long-Run Equilibrium Relationships

The empirical results of the long-run equilibrium relationships of current account obtained by VECM approach are presented in Table-3.As for total trade balance and non oil and gas trade balance are presented in Table-4 and Table-5, respectively. The beta coefficients on the long-run model for current account (including total trade balance and non oil and gas trade balance) are all consistent with theory. The impact of the real effective exchange rate on the current account balance, on the total trade balance and on the non oil and gas trade balance is positive and statistically significant. It suggests an important determinant of exchange rate on current account, on trade balance and particularly on non oil and gas trade balance fluctuation. It implies that the Marshall-Lerner condition holds in the long run in the case of Indonesia. The current account, the total trade balance and the non oil and gas trade balance is related to the real effective exchange rate with an elasticity of 0.507; 0.722 and 0.775 respectively. The depreciation or devaluation of domestic currency by 1% on average improves the current account balance, the total trade balance and the non oil and gas trade balance by 0.507 %; 0.722% and 0.775% respectively in the long run.The implication of this relationship is that real depreciation or devaluation will improve current account, trade balance and non oil and gas trade balance in the long run.It indicates that the sum of elasticity ofexports and imports both goods and services exceeds unity in the long run.

Furthermore, the coefficients on domestic and foreign income bear the expeed signs. This suggests that in Indonesia case, exports and imports of goods and services are determined by demand side effects. The results indicate that the domestic income level as measured by the industrial production index is an important source of current account balance fluctuation. Every 1% increase in industrial production yieldsanaverage 1.861% deterioration in the current account balance through a rise in goods and services imported in the long run.

Similarly, the sign of the foreign factor variable is consistent with the elasticity approach to the current account balance. The theory indicates that a rise in foreign income increases the demand for goods and services exported and will therefore increase the current account balance.The current account balance is related positively to the foreign income as measured by world exports with an elasticity of 0.023.The results indicate that every 1% increase in world export yields an average 0.023% improvement in the current account balance through a rise in goods and services exported in the long run.

The alpha coefficients represent the adjustment parameters of variables analyzed. The t-values suggest that the current account balance and the real domestic income are the variables that adjust to deviation from the long-run equilibrium. The estimators but current account balance are fairly small in size implying that they characterize a slow adjustment to the disequilibrium. At conventional significance levels all variables but the exchange rate are strongly exogenous.

6.2. *Impulse Response Functions (IRFs)*

From an estimated VECM, the simulation of Impulse Response Functions (IRFs) and the computation of Variance Decompositions (VDCs) are conducted, which serve as tools for evaluating the dynamic interactions and strength of causal relations among variables in the system. In simulating IRFs and VDCs, it should be noted that VECM innovations may be contemporaneously correlated. This means that a shock in one variable may work through the contemporaneous correlation with innovations in other variables. The responses of a variable to innovations in another variable of interest cannot be adequately represented since isolated shocks to individual variables cannot be identified due to contemporaneous correlation (Lutkepohl, 1991).Therefore, to solve this identification problem, factorization which orthogonalizes the innovations is suggested. The most popular way of orthogonalizing the shocks is the use of the Cholesky decomposition. The setback with using this method is that the ordering of the variables in the VECM system affects the outcome and the magnitude of the shocks. Consequently, the shocks are not unique. To correct this problem, the impulse responses are identified by imposing restrictions on the VECM system. Such restrictions are based on either economic theory or statistical acceptability. One alternative method to the traditional impulse response analysis is the generalized impulse response analysis suggested by Persaran and Shin (1998). The advantage of this approach is that the impulse responses are unique since the ordering of the variables in the system does not affect the outcome of the impulse responses and fully take account of the historical patterns of correlations observed amongst different shocks. According to ElifAkbostanci (2004), the generalized impulse responses are expressed as conditional expectations based on historic information.

Having discussed the theoretical aspects of impulse response analysis at a glance,then investigation of the impulse responses of the current account balance and trade balance based on the generalized impulse response approach will be conducted. Figure 1 presents the impulse responses of the current account balance to one standard deviation shock in the real effective exchange rate, world export variable and real domestic income. Figure 2 and Figure 3 present for total trade balance and non oil and gas trade balance impulse response functions, respectively.

6.3. *Exchange Rate Shock*

First of all, in the short run (Figure 1, section 1), Indonesia’s current account balance deteriorates by a maximum of about 0.0052% due to a 1% real depreciation in the Rupiah, which occurs three months after the first shock. The deterioration of the current account balance is due to price effect which implies that the unit value of imports against a constant or an insignificant change in the value of exports. About four months after the initial shock, the current account balance starts to improve. At this time the impact of depreciation is almost decimated, thus the price effect is now approximately equal zero. The improvement in the current account balance is due to volume effect here both supply and demand elasticity increase in absolute values. The domestic export volume has increased due to a decrease in price in foreign currency and a decrease in import volume due to price increase in domestic currency. On average the current account balance ratio adjust to its equilibrium paths at about 0.51% above the old equilibrium level. As such at the given confidence interval, Indonesia's current account balance J-curve seems to be significant. Therefore, the hypothesis about the existence of the J-curve in Indonesia's current account balance is empirically proved. Furthermore, the rate at which the current account balance responds to the shock in the real effective exchange rate has been rapid and strong which imply a strong form of the J-curve as textbooks suggest.

The total trade balance impulse response to real depreciation of Rupiah suggests a similar pattern with the current account balance (Figure 2, section 1). The total trade balance deteriorates by a maximum of about 0.0062% due to a 1% real depreciation in the Rupiah, which occurs three months after the first shock. About four months after the initial shock, the total trade balance starts to improve. On average the total trade balance adjust to its equilibrium paths at about 0.72% above the old equilibrium level.Thus, the hypothesis about the existence of the J-curve in Indonesia's total trade balance is empirically also proved.

The non oil and gas trade balance impulse response to real depreciation of Rupiah suggests a similar pattern with the current account balance too (Figure 3, section 1). The non oil and gas trade balance deteriorates by a maximum of about 0.0061% due to a 1% real depreciation in the Rupiah, which occurs two months after the first shock. About four months after the initial shock, the non oil and gas trade balance starts to improve. On average the non oil and gas trade balance adjust to its equilibrium paths at about 0.77% above the old equilibrium level. Therefore, the hypothesis about the existence of the J-curve in Indonesia's non oil and gas trade balance is empirically also proved.

6.4. *World Export Shock*

Moreover, in the short run (Figure 1, section 2), Indonesia's current account balance improves by a maximum of about 0.0068% due to a 1% world export rise, which occurs two months after the initial shock. The positive impact of world export on current account balance lasts for three months before eventually to fade. About four months after the first shock, the current account balance starts to decline. On average the current account balance adjust to its equilibrium paths due to this shock at about 0.02% above the old equilibrium level.

As for total trade balance improves by a maximum of about 0.0021% due to a 1% world export rise, which occurs one month after the initial shock (Figure 2, section 2). The positive impact of world export on trade balance lasts for two months before eventually to fade. About two months after the first shock, the trade balance starts to decline. On average the trade balance adjust to its equilibrium paths due to this shock at about 0.008% above the old equilibrium level.

Finally, for non oil and gas trade balance improves by a maximum of about 0.011% due to a 1% world export rise, which occurs one month after the initial shock (Figure 3, section 2). The positive impact of world export on non oil and gas trade balance lasts for three months before eventually to fade. About three months after the first shock, the non oil and gas trade balance starts to decline. On average the non oil and gas trade balance adjust to its equilibrium paths due to this shock at about 0.055% above the old equilibrium level.

6.5. *Industrial Production Shock*

Eventually, in the short run (Figure 1, section 3), Indonesia's current account ratio decreases by a maximum of about 0.031% due to a 1% additional industrial production, which occurs four months after the initial shock. The negative impact of industrial production on current account balance begins from the first month of the shock. About five months after the first shock, the shock on current account balance starts to be stable and to decline. On average the current account balance adjust to its equilibrium paths due to this shock at about 1.86% below the old equilibrium level.

Furthermore, the total trade balance decreases from a maximum of about 0.039% due to a 1% additional industrial production, which occurs four months after the initial shock (Figure 2, section 3). The negative impact of industrial production on trade balance begins from the first month of the shock. About ten months after the first shock, the shock on trade balance starts to be stable and to decline. On average the trade balance adjust to its equilibrium paths due to this shock at about 2.37% below the old equilibrium level.

Finally, non oil and gas trade balance decreases by a maximum of about 0.042% due to a 1% additional industrial production, which occurs four months after the initial shock (Figure 2, section 3). The negative impact of industrial production on non oil and gas trade balance begins from the first month of the shock. However, about ten months after the first shock, the shock on non oil and gas trade balance starts to be stable and to decline. On average the trade balance adjust to its equilibrium paths due to this shock at about 2.81% below the old equilibrium level.

Figure 1. Impulse response of current account balance
Shocks to

REER	WE	IP
Section 1	Section 2	Section 3

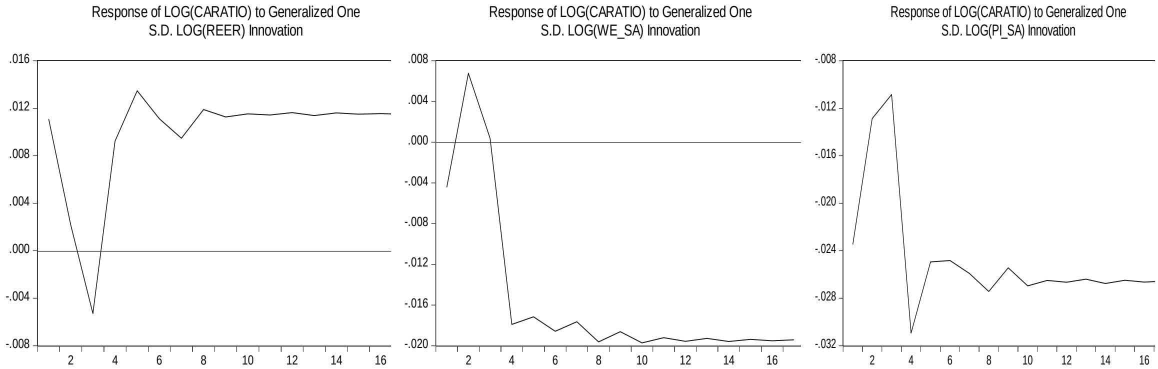


Figure 2. Impulse response of total trade balance
Shocks to

REER	WE	IP
Section 1	Section 2	Section 3

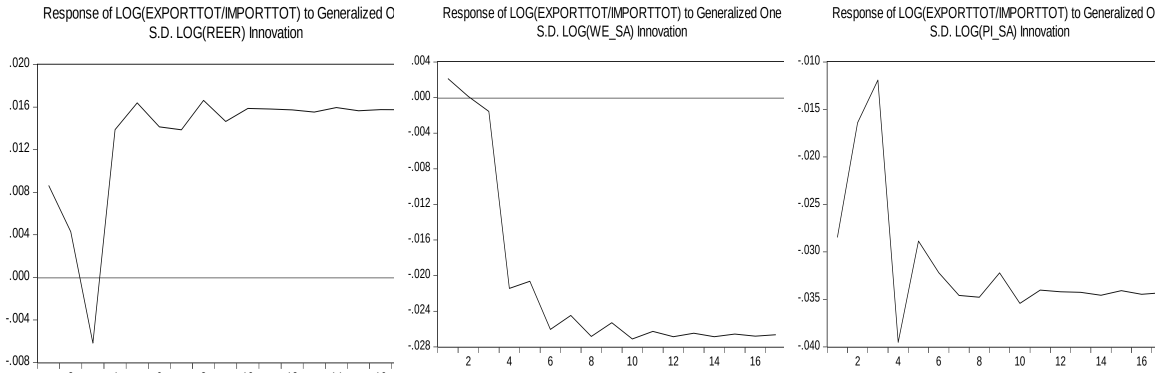
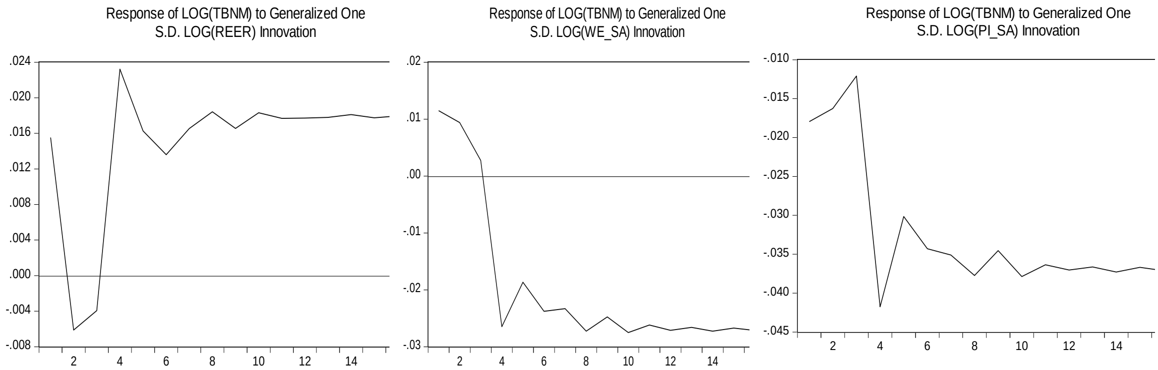


Figure 3. Impulse response of non oil and gas trade balance

Shocks to

REER	WE	IP
Section 1	Section 2	Section 3



6.6. Variance Decompositions (VDCs)

While impulse responses are useful in assessing the signs and magnitudes of responses to specific shocks,the relative importance of different shocks for a particular variable's fluctuation can be traced only through the variance decomposition analysis (VDCs). VDCs are an alternative method to IRFs for examining the effects of shocks on dependent variables. It shows how much of the forecast error variance for any variable in a system is explained by innovations to each explanatory variable over a series of time horizons. Usually, own series shocks explain most of the error variance, although the shock will also affect other variables in the system.

As such,the impacts of the shocks on the currentaccount balance are also analyzed through the variancedecompositions of the forecast errors based on the VECM (Table 6).Similarly, the impacts of the shocks on the total trade balance (Table 7) and non oil and gas trade balance (Table 8) are also investigated.The results based on the variance decompositionanalysis are supportive of the earlier findings based onthe impulse response functions.As shown in the tables,the VDCssubstantiate the significant role played by industrial production, world export, and real effective exchange rate in accounting for fluctuations in the Indonesia's current account, total trade balance, and non oil and gas trade balance.

As typical of VECM framework, the contribution of the dependent variables: current account balance, total trade balance and non oil and gas trade balance in explaining the forecast error variances in itself remained significant throughout the time horizon. However, the results show that the significance of current account balance, total trade balance and non oil and gas trade balance in explaining the forecast error variance in itself becomes decreasingly significant at longer time horizons and at rapid path.

At the beginning of the shocks, which is at the third month horizon, the fraction of Indonesia's current account balance forecast error variance attributable to variations in industrial production, real effective exchange rate and world exportare20.84%, 4.73%, and 1.45%, respectively (Table 6). Moreover, at the third month horizon, the fraction of Indonesia's total trade balance forecast error variance attributable to variations in industrial production, real effective exchange rate, and world export are 24.77%, 4.23%, and

0.125%, respectively (Table 7). Furthermore, at the third month horizon, the fraction of Indonesia's non oil and gas trade balance forecast error variance attributable to variations in industrial production, real effective exchange rate, and world export are 21.19%, 7.59%, and 3.67%, respectively (Table 8).

The explanatory power of all variables increases further at the 17-months horizon.However, the percentage of current account balance (including total trade balance and non oil and gas trade balance) forecast variance explained by innovations in real effective exchange rate is beginning to decline and smaller than explained by innovations in other variables starting at the fourth month horizon. The percentage of forecast variances in the current account balance (including trade balance), is largely explained by innovations in industrial production among other explanatory variables.Industrial production maintains higher percentages than the others and it increases continuously over longer horizons. Finally, the contribution of industrial production in accounting for the forecast error variance of current account balance, total trade balance and non oil and gas trade balance surpasses its own innovations at ninth month, at seventh month and at eight month horizon respectively.

Table 6. Variance decomposition of current account

Forecast Horizon (Months)	Percentage of the variance attribute to			
	Current Account	Real Exchange Rate	World Export	Industrial Production
1	81.89	3.77	0.50	13.85
2	75.19	4.49	1.53	18.80
3	72.97	4.73	1.45	20.85
4	59.81	4.19	6.86	29.14
5	53.40	4.86	10.40	31.34
6	47.85	4.82	14.01	33.32
7	43.60	4.58	16.40	35.42
8	39.49	4.56	18.91	37.04
9	36.54	4.55	20.82	38.10
10	33.74	4.49	22.64	39.13
11	31.54	4.46	24.04	39.96
12	29.55	4.44	25.35	40.67
13	27.89	4.41	26.43	41.28
14	26.38	4.39	27.41	41.83
15	25.09	4.37	28.25	42.29
16	23.91	4.35	29.02	42.71
17	22.88	4.34	29.69	43.09

Table 7. Variance decomposition of trade balance

Forecast Horizon (Months)	Percentage of the variance attribute to			
	Trade Balance	Real Exchange Rate	World Export	Industrial Production
1	78.07	3.18	0.09	18.67
2	73.22	3.67	0.08	23.04
3	70.88	4.23	0.12	24.77
4	56.41	4.18	5.97	33.43
5	50.00	5.00	9.97	35.02
6	43.65	4.76	15.31	36.29
7	39.13	4.55	18.38	37.95

8	34.94	4.61	21.61	38.84
9	32.03	4.55	23.99	39.43
10	29.27	4.49	26.13	40.11
11	27.16	4.49	27.79	40.56
12	25.27	4.46	29.35	40.91
13	23.73	4.43	30.57	41.26
14	22.35	4.42	31.68	41.55
15	21.18	4.41	32.64	41.78
16	20.12	4.39	33.49	42.00
17	19.20	4.38	34.23	42.19

Table 8. Variance decomposition of non oil and gas trade balance

Forecast Horizon (Months)	Percentage of the variance attribute to			
	Non oil and gas	Real Exchange Rate	World Export	Industrial Production
1	77.65	8.44	2.45	11.47
2	70.08	7.73	3.69	18.50
3	67.54	7.59	3.67	21.19
4	52.16	8.20	10.86	28.78
5	46.99	8.37	13.12	31.52
6	41.39	7.67	16.66	34.28
7	37.28	7.41	18.95	36.36
8	33.12	7.17	21.84	37.87
9	30.35	6.99	23.73	38.94
10	27.62	6.80	25.68	39.90
11	25.59	6.68	27.08	40.65
12	23.74	6.53	28.45	41.27
13	22.25	6.44	29.52	41.80
14	20.89	6.35	30.52	42.25
15	19.75	6.27	31.35	42.64
16	18.71	6.20	32.11	42.98
17	17.82	6.14	32.76	43.28

7. CONCLUSION

This paper investigates the long-run equilibrium relationship between the current account balances, world exports, industrial production, and real effective exchange rate and determines if it is consistent with the elasticity approach interpretation of balance payments fluctuations. The elasticity approach interpretation proposes that exchange rate and world export shocksmove current account balance in the same direction, whereas industrial production shocks move current account balance in the opposite direction in the long run. The paper adopts both the cointegration analysis and vector error correction model (VECM) in the estimation.

The results of this study show that the behavior of the current account, trade balance and non oil and gas trade balance in Indonesia is consistent with the dynamic transmission of exchange rate, world export and industrial production shocks through the mechanisms described in the elasticity approach theory. It means that exchange rate, world export and industrial production are sources of current account balance fluctuations.

From the long-run equilibrium perspectives, the current account balance, total trade balance and non oil and gas trade balance are positively related to the real effective exchange rate. This implies that real Rupiahdepreciation will lead to a long-run improvement in the current account balance. It signifies that exports increase more than imports and the current account balance is expected to be positive. It is also found that the current account balance is positively and negatively related to world export and industrial production respectively. This is consistent with the theory in the framework about demand as the driving force of both exports and imports. As such, domestic income represented by a proxy of industrial production is negatively related to the current account balance. Also, foreign demand represented by a proxy of world export is positively related to the current account balance.The results provide strong evidence that real effective exchange rate, industrial production and world export play a strong role in determining the long run behavior of the current account balance in Indonesia.

The empirical results about the generalized impulse response function from the vector error correlation model suggest that Indonesia supports the J-curve hypothesis that soon after a real depreciation, the current account balance deteriorates as a result of price effects. The unit value of imports increases relative to exports but as time passes by, the volume effect takes over and the current account balance starts to improve.

These results are further supported by the variance decomposition analysis, which indicates increasing effects of exchange rate, industrial production and world export on current account balance. In conclusion, the empirical findings of this study lend support to the relevance of the elasticity approach in the current account balance considerations in the Indonesia case.

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