Article

The Effect of Real Exchange Rate on Trade Balance in a Resource-Rich Economy: The Case of Mongolia

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Abstract

For resource-rich developing economies, the effect of real exchange rate depreciation on trade balance may differ from the standard findings depending on country specific characteristics. This article employs vector error correction model to examine the effect of real exchange rate on trade balance in Mongolia, a resource-rich developing country. Empirical results show that exchange rate depreciation improves trade balance in both short and long run. In particular, the well-known Marshall–Lerner condition holds in the long run; however, there is no evidence of the classic *J*-curve effects in the short run. The results suggest that the exchange rate flexibility may help to deal effectively with current account deficits and exchange rate risk.

JEL: C32, C51, F14, F32

Keywords

Trade balance model, exchange rate adjustment, Marshall–Lerner condition, *J*-curve, VECM

Introduction

Theoretical models focusing on natural resource-rich economies suggest that the presence of natural resource sector has serious consequences on the effect of real exchange rate depreciation on trade balance and real income. According to

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Lopez's (1989) view, short-run effect of depreciation on trade balance in a resource-rich economy depends on whether the resource is exploited under common or private property. Moreover, Sachs (1999) argues that strong real exchange rate of natural resource-rich economies tends to crowd out capital accumulation in labour-intensive manufacturing sectors (as a consequence, missing out on export-led growth), therefore the resource dependence leads to underlying macroeconomic crisis and stagnation instead of resource-based development.[1]

Given the crucial role of natural resource sector in the Mongolian economy, volatile capital inflows to the sector and commodity price fluctuations create challenges for policy makers. As a resource abundant economy, the external shocks drive exchange rate and business cycle fluctuations in the economy. Large-scale capital inflows in the mining sector (i.e., the Oyu Tolgoi copper/silver/gold mine and the Tavan Tolgoi coal mine) and higher commodity prices have led to significant structural changes and a large-scale mining boom between 2010 and 2013, clocking double-digit growth on the back of two large mining projects (IMF, 2011; Maino, Imam, & Ojima, 2013). However, the resource boom in Mongolia has been followed by the bust. Because of the commodity price weakness and sudden stop of foreign direct investment to the mining sector, the exchange rate has depreciated sharply and economic growth has decelerated since 2013 (Gupta, Li, & Yu, 2015). During the boom–bust cycle, there has been a policy debate on whether policy makers should limit the exchange rate adjustments. The policy recommendation on this issue is not clear without undertaking a careful empirical study on the effect of exchange rate on trade balance.

This article therefore examines the effect of real exchange rate on trade balance in Mongolia, and suggests policy recommendations based on empirical results. To this end, the article employs vector error correction model (VECM) to estimate the trade balance model developed by Boyd, Caporale, and Smith (2001). By studying the case of Mongolia, this article contributes to the literature on examining effect of exchange rate movements on trade balance in resource-rich economies.

Consistent with the imperfect substitutes model (i.e., the 'elasticity approach'), the responsiveness of trade balance to changes in real exchange rate is studied through twin concepts of Marshall–Lerner (ML) condition and the *J*-curve effects driven by the different lagged response of export and imports to real exchange rate changes. The 'elasticity optimists' argue that ML condition—sum of export and import elasticities exceeds unity—is both the necessary and sufficient condition for the improvement of trade balances and the economic rebalancing after the exchange rate depreciation (Adeniyi, Omisakin, & Oyinlola, 2011; Bahmani-Oskooee, 1991; Bahmani-Oskooee & Niroomand, 1998). Empirical evidence is that real exchange rate depreciations do improve the trade balance with time lags due to the *J*-curve effects (Himarios, 1989). Therefore, the real depreciation may initially result in short-run deterioration of trade balance, but eventually lead to long-run improvement in the current account which would deteriorate as price elasticities increase over time (Bahmani-Oskooee & Ratha, 2004). In contrast to the optimism, there is also 'elasticity pessimism' that confirms low trade elasticities, which lead to the failure of the ML condition (Narayan, 2004; Rose, 1990; Rose & Yellen, 1989).

The existing literature suggests that short- and long-run effects of real exchange rate change on trade balance are ambiguous and depend on country-specific properties, including exchange rate regime, level of economic development and export and import structure (Chinn & Wei, 2008; Mahmud, Ullah, & Yucel, 2004). In the case of Mongolia, very few papers have analysed the effect of exchange rate on trade balance. Tokarick (2010) has shown that under a small economy assumption, the Mongolian trade balance elasticity with respect to real exchange rate (as of 2004), is –1.79 for domestic currency measurement and –1.81 for foreign currency measurement using non-econometric approach. This article differs from the existing article not only because of the difference in the sample periods, but also because of the difference in the methodology as it relies on econometric framework.

The rest of this article is structured as follows. The next section presents theoretical and empirical modelling of trade balance. The third section describes the data and reports empirical results. The final section concludes this article with a brief discussion of` policy implications.

The Trade Balance Model

The effect of real exchange rate on trade balance is conventionally studied through the estimation of export and import equations, and the validity of the ML condition is tested through whether the sum of price elasticities of export and import is greater than 1. However, this procedure relies on the difficult identification of several structural parameters and leads to 'elasticity pessimism' result (Boyd et al., 2001). To avoid the difficulty and shortcoming, a number of studies (i.e., Boyd et al., 2001; Gomes & Paz, 2005) suggest an alternative modelling approach, which estimates a reduced form equation for trade balance. This article employs an approach, which allows a direct testing for the effect of changes in relative prices on trade balance by requiring a little knowledge about the structural parameters.

In the model, trade balance (B) is defined as the ratio of nominal exports to nominal imports given by

$$B_t = P_t X_t / P_t^* S_t M_t \tag{1}$$

where X_t is export volume, P_t is domestic price level, M_t is import volume, P_t^* is foreign price level and S_t is nominal spot exchange rate.

Taking the natural logarithm from both sides of Equation 1 will lead to the following expression:

$$b_t = x_t - m_t - e_t \tag{2}$$

where lower case letters present the log of the variables and $e_t = s_t - p_t + p_t^*$ is natural logarithm of real exchange rate. Increase in e_t represents the depreciation of domestic exchange rate.

The long-run export and import demand equations are assumed as follows:

$$x_t = \alpha_x + \beta^* y_t^* + \eta_x e_t + \gamma_x t \quad (3)$$

$$m_t = \alpha_m + \beta y_t - \eta_m e_t + \gamma_m t \quad (4)$$

where α_x and α_m are constant terms; β and β^* are demand elasticities with respect to domestic and foreign incomes, respectively, and η_x and η_m are export and import elasticities with respect to the real exchange rate, respectively. The trend terms ($\gamma_x t$ and $\gamma_m t$) capture terms of trade effects, non-measurable improvements in the quality of the tradable goods and policy measures (i.e., liberalization). Substituting Equations 3 and 4 into Equation 2 yields the long-run trade balance equation as follows.

$$b_t = (\alpha_x - \alpha_m) + \beta^* y_t^* + \beta y_t + (\eta_x + \eta_m - 1)\, e_t + (\gamma_x - \gamma_m)t \quad (5)$$

For a country to be solvent, the long-run relationship shown in Equation 5 should hold. The ML condition can be tested using the coefficient on the real exchange rate, e_t. For instance, the condition is satisfied if the following identity holds: $\eta_x + \eta_m > 1$, implying that depreciation of the exchange rate (increases in e_t) improves trade balance.

This article relies on Johansen–Juselius' (1990) approach when testing co-integration (i.e., long-run) relationship in Equation 5 and employs the VECM to estimate the short- and long-run dynamics of the model. The approach has an important advantage over other existing techniques in modelling co-integration dynamics (i.e., Engle & Granger, 1987; bound testing procedure with autoregressive distributed lag (ARDL) model developed by Pesaran & Shin, 1995; Pesaran, Shin, & Smith, 2001) as it enables one to (a) determine more than one co-integrating (i.e., long-run) relationship among the variables, and (b) study the dynamic effects of deviation from the long-run solvency condition on output, real exchange rate and trade balance within a manageable system (Boyd et al., 2001).

The dynamic adjustment of the model can be written in the form of VECM as follows:

$$\Delta x_t = \mu + \rho z_{t-1} + \sum_{i=1}^{p} \Gamma_i \Delta x_{t-i} + u_t \quad (6)$$

where $x_t = (b_t, e_t, y_t, y_t^*)'$ is the vector of variables in the model, μ represents unrestricted deterministic terms, α is a 4×1 vector of adjustment parameter governing the speed of adjustment to the long-run equilibrium relationship and Γ_i is the matrix of short-run parameters, u_t is the matrix of residuals. The approach assumes that all variables in x_t vector have same order of integration (i.e., $I(1)$) and there exists a co-integration given by the solvency condition. The deviation from the long-run solvency condition, z_t, is given by

$$z_t = \alpha + \beta^* y_t^* + \beta y_t + \eta e_t + \gamma_t - b_t \quad (7)$$

here $\alpha = \alpha_x - \alpha_m$, $\eta = \eta_x + \eta_m - 1$ and $\gamma = \gamma_x - \gamma_m$.

According to the short-run dynamics of the model, it is also expected that the real exchange rate depreciations improve trade balance only after some time because of the *J*-curve effects.

The 'true' form of the VECM is important to determine the co-integrating vector, $\beta' = (1, -\alpha, -\beta^{*}, -\beta, -\eta)$. The weak exogeneity test is conducted to identify the proper specification of the VECM model. In general, the variable is weakly exogenous if an equation of the variable in the system contains no information about the estimation of the co-integrating vector, $\beta' = (1, -\alpha, -\beta^{*}, -\beta, -\eta)$. To explain how the weak exogenous is conducted, the VECM in Equation 6 can be written as follows (for simplicity purpose, the short-run dynamics is ignored):

$$\Delta y_t^{*} = \rho_{y^*} z_{t-1} + \mu_{y^*} + u_{y^*t} \tag{8}$$

$$\Delta y_t = \rho_y z_{t-1} + \mu_y + u_{yt} \tag{9}$$

$$\Delta e_t = \rho_e z_{t-1} + \mu_e + u_{et} \tag{10}$$

$$\Delta b_t = \rho_b z_{t-1} + \mu_b + u_{bt} \tag{11}$$

If the condition, $\rho_j = 0$ where $j = y, y^{*}$ and e is satisfied, then j variable is weakly exogenous, and if the conditions are simultaneously satisfied for j variables and $\rho_b \neq 0$, then the system will move to a single equation (i.e., ARDL) model of trade balance shown in Equation 11. This restriction strategy based on weak exogeneity test will provide efficient estimates of the parameters of interest in the co-integrating vector. If the dynamic effects of deviation from the long-run solvency condition were primarily on the trade balance, the adjustment parameter ρ_b should be negative and large in absolute value.

Data and Empirical Results

Data

The data set includes quarterly time series of domestic GDP, world GDP, domestic total export, total import and real effective exchange rate for the period 2000–2011. Domestic GDP is taken from the database of the National Statistical Office. Total export, total import and real effective exchange rate series are obtained from the Statistical Bulletin of the Bank of Mongolia. The world GDP is approximated using the world real GDP growth published by the International Monetary Fund.[2] Seasonality in the series is examined using F-tests and non-parametric test (i.e., Kruskal–Wallis statistics). The results suggest that most series have a significant seasonality. Therefore, all data are transformed into index number (as base year is 2005), and then seasonally adjusted using Census X11 method. After seasonally adjusted, natural logarithm is taken from all variables. Natural logarithm of trade balance used in the estimation is calculated as the natural log of the ratio of seasonally adjusted export index to seasonally adjusted import index.[3]

Unit Root Test Results

Before setting the VECM model of trade balance, univariate unit root tests have to be conducted in order to make sure that all variables in the model have same order of integration (e.g., $I(1)$). In this article, augmented Dickey–Fuller (ADF)

Table 1. ADF Tests for Unit Root

Variable	Order of Variable	Optimal Lag Length	ADF-stat
Natural log of domestic GDP (y)	level	0	–3.60 [c,t]
	1st diff	0	–6.61*
Natural log of world GDP (y^*)	level	1	–3.44[c,t]
	1st diff	1	–4.03[c]*
Natural log of trade balance (b)	level	2	–0.74
	1st diff	1	–8.10*
Natural log of real effective exchange rate (e)	level	4	–3.80[c,t]
	1st diff	1	–6.20*

Source: Author's estimates.
Notes: c or t in square brackets represents the inclusion of a constant or a time trend in the regression underlying the test, and * denotes rejection of the null hypothesis at the 1% significance level. The optimal lag length of ADF test regression is chosen based on Schwarz Bayesian Information Criterion.

test is applied for testing unit root of these variables, and ADF test statistics are summarized in Table 1.

The ADF test results show that all four variables have same order of integration, which is $I(1)$. For instance, the null hypothesis that the series in level has unit root is not rejected, and the null hypothesis that the first difference of the series has unit root is rejected at the 1 per cent significance level.

However, the univariate unit root tests may have a specification error if series are generated jointly. Fortunately, the co-integration test based on Johansen framework is also a multivariate test of unit root as the test will suggest a number of co-integration vectors equal to the number of endogenous variables if the series does not have a unit root (Gomes & Paz, 2005). The multivariate test is also conducted in the next section.

Testing Cointegration, Multivariate Stationarity and Weak Exogeneity

Prior to co-integration test and estimation, appropriate number of lags for the VECM model has to be determined. For the Vector autoregression (VAR) VAR specification, the VAR lag exclusion Wald test, Likelihood ratio (LR) test and Hannan-Quinn (HQ) information criterion suggest two lags, while Akaike information criterion (AIC) and Schwarz Bayesian information criterion (SBIC) indicate four and one lag, respectively. However, only VAR(2) model simultaneously satisfies all corresponding diagnostic tests, including joint normality, no serial correlation and no heteroskedastcity in residual matrix at the 5 per cent significance level. Thus VECM(1) (i.e., error correction form of VAR(2) model) is employed in further analysis. The trace and Eigen-value co-integration tests are conducted to determine number of co-integration among the four variables in the model.

First, a co-integration equation with both constant and time trend is estimated as suggested in Equation 5 of the theoretical model. However, the trend component

Table 2. Johansen Co-integration Test Results

	Co-integration Equation Includes Constant			
	Trace Test		Eigen-value Test	
H_0 : Number of CE(s)[4]	Statistic	Critical Value (at 1%)	Statistic	Critical Value (at 1%)
None	81.15*	54.68	34.92*	32.72
At most 1	46.22*	35.46	26.29*	25.86
At most 2	19.93	19.94	18.12	18.52
At most 3	1.814	6.635	1.814	6.635

Source: Author's estimates.
Notes: CE represents co-integration equation, and *denotes rejection of the null hypotheses at the 1% significance level.

is not statistically significant, so that the co-integration test equation is estimated without time trend and test results are shown in Table 2.

Both trace and eigenvalue tests suggest that two co-integration vectors exist among these variables at the 1 per cent significance level. The co-integration tests are also conducted with different lag lengths, $p = 1 - 4$, and the results also suggest that there is at least one co-integration equation. The result is robust even though the co-integration equation includes the trend term. Existence of co-integration suggested in Equation 5 is also confirmed by Engle–Granger (1987) approach. For instance, ADF test statistics of z_t series obtained from Equation 6 is –5.17, which is lower than the critical value of Engle–Granger (1987) test at the 1 per cent significance level tabulated by Mackinnon (1991, p. 275).

The result that the number of co-integrating equations is fewer than the number of variables in the system generally suggests that the variables are not stationary.

However, the multivariave test of unit root is conducted using the Johansen framework to make sure that the presence of co-integration is not driven by the inclusion of stationary variables in the system. The multivariate stationarity test results are shown in Table 3.

For all variables, the null hypothesis that the variable is stationary is rejected at the 1 per cent significance level. Therefore, the co-integrating relationships are not caused by the inclusion of a stationary variable. Since co-integrating relationships exist between these variables, suggested by Equation 5, the specification of VECM has to be developed properly.

The weak exogeneity test is used to find the proper specification of the VECM model (i.e., system equations or a single equation). The test results are shown in Table 4. The null hypothesis that the variable is weak exogenous is rejected for trade balance and real exchange rate, while the hypothesis is not rejected for the world and domestic incomes at the 5 per cent significance level. The result is consistent with small open economy assumption and international trade models. As Mongolia is a small open economy, the domestic variables have no influence on the world GDP, and the trade balance is determined by both domestic and foreign variables.

Table 3. Multivariate Stationarity Test Results

H_0: The Variable is Stationary	y	y^*	b	e
LR test statistic [p-value]	$\chi^2(3) = 31.8$ [0.0000]	$\chi^2(3) = 31.5$ [0.0000]	$\chi^2(3) = 18.1$ [0.0004]	$\chi^2(3) = 32.0$ [0.0000]

Source: Author's estimates.

Notes: LR represents the log-likelihood ratio. The restriction is that the co-integrating coefficient on the tested variable is one and other variables' co-integrating coefficients are zero.

Table 4. Testing Weak Exogeneity of the Variables

H_0: The Variable Is Weak Exogenous	y	y^*	b	e
LR test statistic [p-value]	$\chi^2(1) = 0.04$ [0.8469]	$\chi^2(1) = 1.16$ [0.2819]	$\chi^2(1) = 5.44$ [0.0197]	$\chi^2(1) = 5.56$ [0.0184]

Source: Author's estimates.

The weak exogeneity tests also suggest that a system of trade balance and real exchange rate equations (where the world and domestic GDPs are exogenous variables) must be employed in estimating co-integrating vector, β'. To this end, the joint restriction $\rho_y = \rho_{y*} = 0$ (which is accepted by the data as LR test statistics is $\chi^2(2) = 1.16$, p-value of LM test is 0.560) is imposed in the VECM to obtain efficient estimators for the parameters of the co-integrating vector.

Long-Run Effects on Trade Balance

Though there exist two co-integrating vectors among the variables, the theoretical model suggests only one co-integrating equation given by the solvency condition. Therefore, one co-integration equation is assumed in the estimation of the VECM model with one lag and the weak exogenous (i.e., $\rho_y = \rho_{y*} = 0$) restrictions. The estimated long-run equilibrium relationship is found as follows:

$$b_t = 0.44 - 2.16y_t + 6.86y_t^* - 1.78e_t \quad (12)$$
$$(-2.71) \quad (3.97) \quad (-3.43)$$

where t-statistics are shown in parentheses, and an increase in e_t implies appreciation of real exchange rate.

According to the t-test, each long-run coefficient of explanatory variables is statistically significant at the 5 per cent significance level. Joint significance of the coefficient is also confirmed by LR test as the joint hypothesis of all coefficients is zero, is also strongly rejected at the 1 per cent significance level (i.e., p-value is 0.000). Overall, the estimated coefficients have theoretically expected signs and are statistically significant at the 5 per cent significance level, suggesting that the real exchange rate, world and domestic outputs affect trade balance in the long run. Therefore, external and internal shocks, and domestic trade and macroeconomic policies have significant effect on trade balance.

The negative and statistically significant coefficient of real exchange rate ($\hat{\eta} < 0$) implies that the ML condition holds in Mongolia. The estimated long-run coefficient, $\hat{\eta} = -1.78$, is entirely consistent with the result obtained by Tokarick (2010) who shows that the elasticity of trade balance with respect to real exchange rate is about –1.80 in Mongolia.

The long-run coefficient of world income, β^*, is estimated in relatively high magnitude, which is consistent with the fact that Mongolian exports remain heavily dependent on natural resources. Therefore, the trade balance is highly affected by changes in copper, coal, gold and oil prices[5] in the international market, which are determined by the world economic activity. Thus, the world output is a proxy for all of these global variables in the analysis.

The elasticity of trade balance with respect to domestic income, β, is also estimated at a relatively high value since Mongolia is a net importer of non-mineral products, which account for about 70 per cent of total imports. Another interesting result is that VECM feedback takes place through both of the trade balance and real exchange rate adjustments. The error correction coefficients of trade balance ($\alpha_b = 0.55$) and real exchange rate ($\alpha_e = 0.23$) equations have expected sign and are statistically significant at the 5 per cent significance level. The trade balance adjustment is much quicker than real exchange rate adjustment. In trade balance and real exchange rate equations, any deviation from the long-run equilibrium is corrected at the rate of 55 per cent and 23 per cent for each quarter and takes about two and five quarters to return the long-run equilibrium, respectively.

Short-Run Effects on Trade Balance

The short-run dynamic effect of real exchange rate on trade balance can be studied through the Granger non-causality test, impulse response functions and forecasting error variance decompositions (FEVD) of the restricted VECM, which are discussed in more detail.

The results of Granger non-causality test (i.e., block exogeneity Wald test) are reported in Table 5.

Table 5. *P*-Values for Granger Non-Causality Tests

Named Variable	*dy*	*db*	*de*
$dy \rightarrow db$ or de	–	0.53	0.50
$dy^* \rightarrow dy$ or db or de	0.72	0.27	0.01^*
$db \rightarrow dy$ or de	0.96	–	0.76
$de \rightarrow dy$ or db	0.58	0.01^*	–
dy^* & de & $db \rightarrow dy$	0.89	–	–
dy^* & de & $dy \rightarrow db$	–	0.06^{***}	–
dy^* & dy & $db \rightarrow de$	–	–	0.06^{***}

Source: Author's estimates.

Notes: * and *** indicate that the null hypothesis of non-causality is rejected at 1 per cent and 10 per cent levels, respectively.

The results of Granger non-causality test suggest that the domestic output is exogenous in short-run dynamics. The null hypotheses that (a) the world output growth does not Granger cause a change in real exchange rate, and (b) a change in real exchange rate does not Granger cause a change in trade balance in the short run are rejected at the 1 per cent significance level.

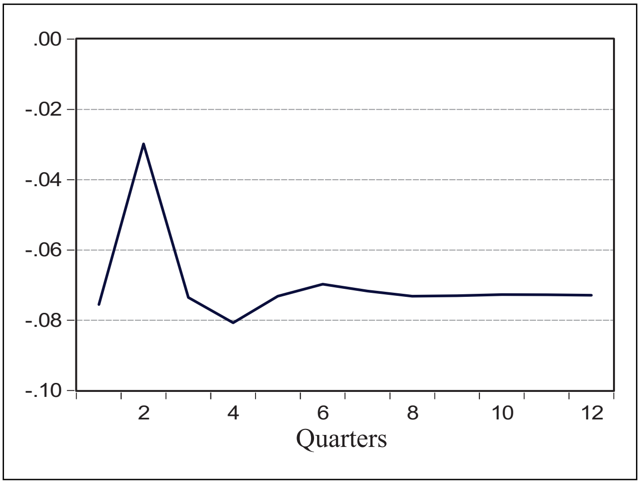
Moreover, the growth of the world and domestic output and change in real exchange rate Granger cause the change in trade balance in the short run. Changes in the world and domestic outputs and real exchange rate also affect the change in trade balance rate at the 10 per cent significance level. The impact of world economic activity on trade balance mainly passes through the real exchange rate.

To examine how trade balance responds to exchange rate adjustments, generalized impulse response (GIR) function of trade balance for a one standard-error appreciation shock is analysed. An advantage of the GIR function over traditional orthogonalized impulse response function is that it does not depend on the ordering of the variables in the VECM system. As the shock is one standard-error permanent appreciation, *L*-curve response of trade balance is expected, suggesting an initial improvement in trade balance followed by a worsening in the long run, an evidence of the *J*-curve in Mongolia.

The GIR functions of trade balance to the permanent appreciation shock and permanent domestic output growth shock are shown in Figure 1.

The GIR of trade balance to the permanent appreciation shock suggests no evidence of the classic *J*-curve effect in Mongolia. For instance, trade balance worsens in the long-run due to quantity adjustments, expected from a *J*-curve effect, but no initial price effect improvement in trade balance was found. However, the *L*-type effect is observed since the short-run coefficient on Δe_{t-1} ($\eta_{\Delta e} = 1.1$) is positive and statistically significant at 5 per cent significance level.

(a) Response of Trade Balance to Exchange Rate Shock



(Figure 1 Continued)

(Figure 1 Continued)

(b) Response of Trade Balance to Output Shock

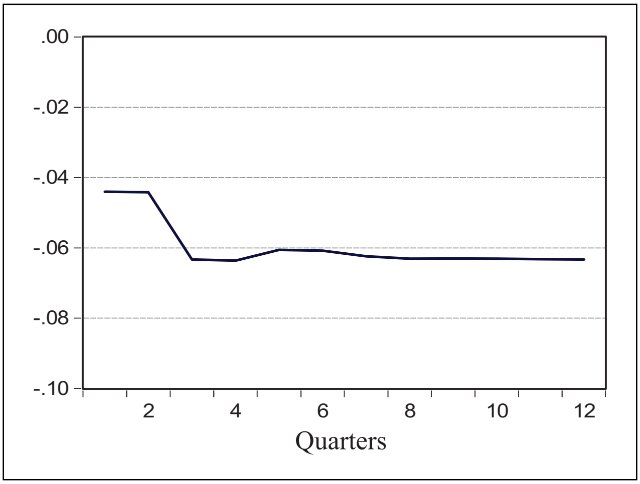


Figure 1. Responses of Trade Balance to Permanent Shock

Source: Author's estimates.

The GIR of trade balance to domestic output shock shows that growth of domestic output worsens the trade balance similar to the findings in the long-run relationships.

Although the impulse responses indicate short-run effect of the shocks to trade balance, they do not represent how important these shocks have been in the trade balance fluctuations. Therefore, to investigate the importance of real exchange rate and domestic output shocks, the FEVD of trade balance are analysed. To this end, the following orthogonal (i.e., Cholesky) factorization is selected based on weak exogenous and Granger non-causality tests: $y^* \rightarrow y \rightarrow e \rightarrow b$. The FEVD of trade balance are shown in Table 6.

Among the explanatory variables, the real exchange rate shock is the most important source of trade balance fluctuations in both the short and long run. The real exchange rate shock explains about 25 per cent of the trade balance variation in the short run, and the proportion is increased to 40 per cent in the medium term. The portion explained by domestic output shock substantially increases with time horizon, consistent with the evidence that the domestic output has significant effect on trade balance in the medium-to-long run. However, the world output shock accounts for only around 0.3–2.4 per cent of trade balance fluctuations, confirming that the direct effect of the world output on trade balance is weak. Another interesting result is that the exchange rate plays a role as external shock absorber in Mongolia as the world output shock accounts 23–41 per cent of the FEVD of the real exchange rate in the short-to-medium term.

Table 6. Variance Decomposition of Trade Balance (b)

Time Horizon (Quarter)	Proportion of FEVD Explained by Shocks to			
	b	e	y^*	y
1	70.04	21.65	0.28	8.03
3	54.32	26.51	0.38	18.78
6	39.27	34.52	0.99	25.22
9	33.21	36.97	1.56	28.26
12	29.91	38.21	1.97	29.92
15	27.78	38.99	2.24	30.98
18	26.32	39.53	2.44	31.71

Source: Author's estimates.
Note: Ordering of the variables in the Cholesky factorization is $y^* \rightarrow y \rightarrow e \rightarrow b$.

These results suggest that shocks to real exchange rate and domestic income are main determinants of trade balance in a resource-rich economy such as Mongolia as the joint shocks explain 50–70 per cent of the trade balance variation in the medium term.

Conclusion

This article employs the VECM model and examines the effect of real exchange rate on trade balance in Mongolia. As a resource-rich economy, the Mongolian economy is frequently hit by external shocks (i.e., terms of trade shock and sudden flows/stop of foreign direct investment). Therefore, policy makers often face a trade-off between exchange rate flexibility and need to limit the exchange rate adjustments. The policy choice should depend on whether the exchange rate depreciation improves trade balance or not.

Empirical results indicate that the exchange rate depreciation improves trade balance in both short and long run. In particular, the well-known ML condition holds in the long run, and the reverse *L*-type response (but not exactly *L*-curve the initial price effect improvements expected from *J*-curve effect is not found) of trade balance to the permanent depreciation shock is found in the short run. The maximum effect of a change in real exchange rate on trade balance occurs four quarters after the shock, and the long-run effect surfaces after eight quarters. Real exchange rate shocks explain about 35 per cent of the eight quarters ahead of FEVD of trade balance. Moreover, the world and domestic outputs do not affect trade balance in the short run, but they have significant effect in the long run. Compared to the world output, the domestic output plays an important role in trade balance fluctuations as domestic output shocks account for about 28 per cent of the eight quarters ahead of FEVD of trade balance.

The results suggest that the exchange rate flexibility may help to deal with current account deficits and exchange rate risk effectively. If there is a high depreciation pressure driven by external shocks, allowing the exchange rate to depreciate may improve the trade balance, which in turn, reduces the pressure and promotes the economic growth. Flexible exchange rate allows the economy to absorb external shock, while creating room for independent monetary policy to stabilize the macroeconomic condition.

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Notes

1. Sachs and Warner (2001) have explained the transmission channels through which resource-rich countries tended to be high-price economies, and thereby systematically failed to achieve strong export-led growth or other kinds of growth.
2. IMF publishes only the quarterly world real GDP growth, per cent change from a year earlier. Thus the approximation of the quarterly world GDP index is calculated by assuming the value of 1 in each quarter of 2005, then applying the annual percent changes going backward and forward.
3. The advantage of using the ratio of exports to imports is that it is insensitive to the units of measurement of export and import (Bahmani-Oskooee, 1991).
4. The trace and Eigen-value test have $H_0: r = a$ versus $H_1: r \geq a + 1$ where r is the number of co-integration equations, and a is set from zero to three sequentially.
5. Oil and its products are main import of Mongolia, and they account roughly for more than 35 per cent of total imports. Demand for the country's exports highly depends on the global and neighbouring countries' economic performance and the world copper, coal and gold prices. For instance, export of copper accounts for roughly half of total export, a quarter of GDP and one third of the government revenue.

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