Exchange Rate Depreciation and Balance of Trade in Developing Countries: Evidence from Ghana

Xin WANG
School of Finance and Economics
Jiangsu University[1], P.R. China
13852985800@163.com wangxin66666@tom.com

Rahmatu CHIBSAH
School of Finance and Economics
Jiangsu University, P.R. China
chibsah55@gmail.com rahmatuchibsah@gmail.com

Evans GARTI
School of Finance and Economics
Jiangsu University, P.R. China
egarti2018@gmail.com

Article's history:

Received 14th of May 2020; *Received in revised form* 20th of June 2020; *Accepted* 15th of July, 2020; *Published* 30th of September, 2020.

Suggested citation:

Wang, X., Chibsah, R., Garti, E. 2020. Exchange Rate Depreciation and Balance of Trade in Developing Countries: Evidence from Ghana. *Journal of Applied Economic Sciences*, Volume XV, Fall, 3(69): 647-653.

Abstract:

This study seeks to explore the relationship between international trade and currency devaluations using quarterly time series data from Ghana from 2000Q1 to 2017Q4. The study employed the autoregressive distributed lag (ARDL) approach to establish both the long run and short run relationship. The study found that, real domestic income and real exchange rate have a positive relationship with imports in Ghana implying that, depreciation will increase exports whiles appreciation increase imports. Therefore, currency devaluations in Ghana will improve the Trade balance of Ghana. The study therefore recommends that, government and policy makers should pay more attention to stabilizing the real exchange rate given that, the Ghanaian economy is import driven and continuous devaluations will deteriorate the import sector thereby deteriorating the Economy as a whole since most sectors of the economy depends on import for production therefore causing economic growth.

Keywords: real exchange rate; devaluation; exports; imports; autoregressive distributed lag.

JEL Classifications: F10; F14; F31.

Introduction

Exchange rate depreciation have been an economic worry for most developing economies who depends heavily on import which leads to balance of trade deficit. Currency devaluation is usually considered a tool for clearing deficits from trade therefore stabilizing the foreign sector of the economy, since according to the J-curve effect and the Marshall-Lerner condition, a devaluation will improve the balance of trade by increasing the export of the devaluing country.

Currency devaluation (depreciation) as a policy tool to improve a country's trade balance, especially for a country facing persistent trade deficit, has been extensively studied in the trade literature. Alexander (1952) points out that the improvement of trade balance may be a result of switching expenditure from foreign to domestic goods due to a change of terms of trade following currency devaluation. Krugman and Taylor (1978), argued that a nominal devaluation will results in expenditure switching which will increase the production of tradable goods which will in turn leads to higher exports thus improvement in the foreign sector of the country.

The Ghanaian currency have experienced experience continuous depreciation since independence until 2007 where the Government of Ghana, through the Central Bank of Ghana decided to devaluate the currency as a way of boosting exports and causing macroeconomic stability. The exercise was to make exports of Ghana cheaper relatively to its trading partners' currency. However, the cedi has continuously depreciated against the major trading currencies despite the devaluation in 2007, yet Ghana continues to have balance of trade deficit

[1] Zhenjiang, 212013, P.R. China

which causes worry for both government and policy makers. Therefore, this study finds out to explore the relationship between devaluations and trade balance in a developing country like Ghana who depends heavily on trade and suffers heavy trade deficit as the economy is import driven and also depends heavily on its traditional exports for growth using quarterly time series data from Q1 of 2000 to Q4 of 2017.

The rest of the paper is therefore structured as follows; section 1 presents a brief literature review, section 2 presents the exchange rate situation of Ghana, section 3 presents methodology and estimations procedures, section 4 presents the results interpretation and discussions and finally section 5 presents the conclusions and policy recommendations.

1. Brief Literature Review

There have been many empirical studies on exploring the relationship between trade and currency devaluations in the literature. An increase or decrease in the real exchange rate might result in either an increase or a decrease in the volume of trade thereby affecting the balance of trade of an economy. Many theories exist in the literature where currency devaluations are used to correct the balance of trade of most economies, both developing and developed.

Empirical studies such as (Magee 1973) and (Haynes and Stone 1982) examine the effectiveness of using devaluations to improve the trade balance by employing the trade balance approach. Other empirical works like the work of Rose and Yellen (1989), Bahmani-Oskooee and Brooks (1999), Boyd, Caporale and Smith (2001), Onafowora (2003), Bahmani-Oskooee, Harvey and Hegerty (2014) also used the balance of payment approach to estimate the trade balance function in order to validate the Marshall-Lerner condition which states that, depreciation of currency will improve the trade balance providing that the price elasticity of both export and import demands exceed unitary. However, downside of this approach is that it only focuses on the net change of trade balance and fails to capture the dynamic responses of each individual export and import function to an exchange rate shock.

In the recent literature, most studies have made use of the elasticity approach to balance of payment where export demand elasticity and import demand elasticity are modeled in two separate equations. Several authors such as Houthakker and Magee (1969), Goldstein and Khan (1978), Senhadji (1998), Senhadji and Montenegro (1999), Wang and Lee (2012) employed the elasticity approach in order to extract directly the price elasticity of each sector. This approach gives room for the price elasticity of each sector to be determined so as to formulate policies regarding each sector with ease.

Empirical findings of using currency devaluations as a policy tool are still mixed irrespective of the approach or method employed. Some empirical studies like Taylor and Rosenweig (1984) found that, devaluations as a policy tool have an expansionary effect on the economy whereas Gylfason and Risager (1984), and Branson (1986), found that devaluations as a policy tool to improve the trade balance has contractionary effect. However, the empirical work of (Edwards 1986) revealed that, devaluations improves the trade balance depending on the time period. Edwards 1986 further stated that, devaluation can be contractionary in the first year, expansionary in the second year and neutral in the long run.

From the empirical literature, we can conclude that, most studies are concentrated on advance economies whereas studies on developing economies where trade deficit are the order of the day are still limited. Also, most studies employ simple OLS estimation approaches which have proven to be inadequate to cope and account with some of the statistical properties that the samples might often contain, such as unit roots and cointegration of different orders. As a result, inadequate estimates might be obtained.

2. Exchange Rate Situation in Ghana

Ghana as a developing economy in West Africa adopted the fixed exchange system in the 1960s, immediately after independence of which the Bretton Woods system supported. Due to the inheritance of huge foreign exchange reserves from the colonial era, Ghana exercised practically no control over the foreign exchange markets, which were in the hands of a few commercial banks. During this period, the Ghanaian Cedi (¢) was pegged to the main convertible currencies, notably the British Pound and the American Dollar.

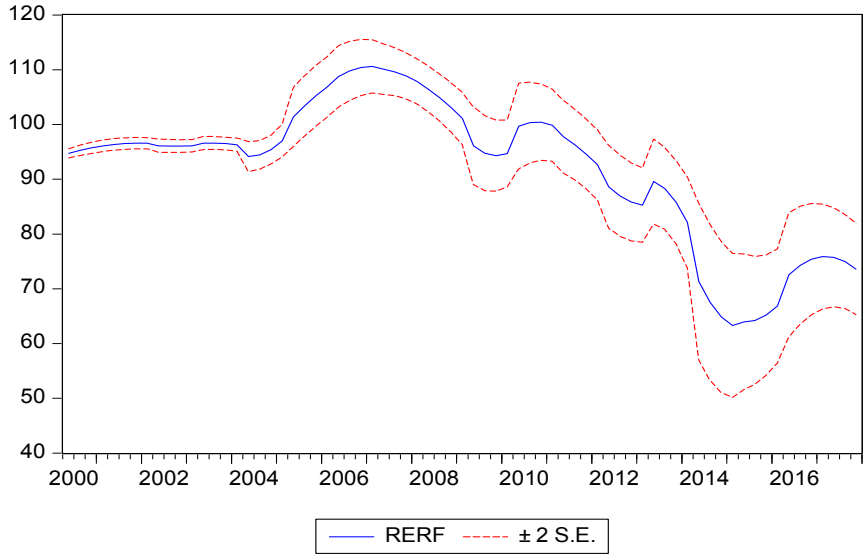
The Exchange rates system of Ghana went through series of changes since independence in 1957 until 1992 where the Bank of Ghana introduced the inter-bank market where exchange rates are managed by commercial Banks. Since then both the Commercial and Forex Bureau have operated in a competitive environment.

The Ghana cedi weakened against all the major trading currencies in 2007 as a result of demand pressures from energy-related import expenditures and infrastructural developments. On the interbank market, the Ghana cedi depreciated against the US dollar by 4.8% compared with 1.1% in 2006. With regard to the British pound, it depreciated at a much lower rate of 7.2% in 2007 compared with 13.4% in 2006. Against the euro however, the Ghana cedi depreciated significantly by 15.7% compared with 10.9% in 2006, Bank of Ghana Annual Report (2007).

The Cedi was redenominated on July 3, 2007 with the issuance into circulation of new currency, thus the Ghana Cedi and the Ghana Pesewas. It was designed to address one important lingering legacy of past inflation and macroeconomic instability. During that period, the Cedi had 17% inflation rate and was said to have lost about 75% of its value. This loss of value is supposed to boost exports of Ghana in the foreign market.

Since the devaluation of the cedi, there have been a persistent upward and downward movement in the real exchange rate yet, trade balance continues to be in deficit. These constant fluctuations of exchange rate and the instability of the real exchange rate of the Cedi is shown in the Figure 1 below.

Figure 1. Real exchange rate of Ghana from 2000Q1 to 2017Q4



3. Methodology and Estimation Procedure

3.1. Data Type and Sources

The study will employ mainly secondary macroeconomic time series data in its analysis. Quarterly time series data will be collected from quarter one of 2000 to quarter four of 2017 representing 68 observations. All data to be used in the analysis were taken from Government Finance Statistics, International Financial Statistics of IMF, the World Bank Development Indicators and The State of the Ghanaian Economy (various issues) and The Bank of Ghana Annual Reports (various issues).

3.2. Estimation Procedure

To investigate the effectiveness of currency devaluation as a policy tool to improve a country's trade balance, the conventional practice is to estimate the exchange rate (price) elasticities. The elasticity approach to trade is therefore modeled as follows:

$$\ln X_t = \alpha_0 + \alpha_1 \ln y^*_t + \alpha_2 \ln rer_t + \mu_t \quad (1)$$

$$\ln \mathrm{M_t} = \beta_0 + \beta_1 \ln \mathrm{y_t} + \beta_2 \ln \mathrm{rer_t} + \omega_\mathrm{t} \quad (2)$$

where: X_t and $M_t$are the export and import demand functions in real terms, y^*_t is the foreign income, y_t is the domestic income, rer_t is the real exchange rate and $\omega_t$and μ_t captures the random error term.

The log-linear form will help estimate the elasticities of both export and import demand.

3.3. Autoregressive Distributed Lag Model

The study will employ the Autoregressive Distributed Lag approach proposed by Pesaran and Shin (1999) and Pesaran *et al.* (2001) to institute both the long run and short run relationship for both export and import demand elasticity models. The unrestricted Error Correction (ARDL) model is modeled for both export and import demand equations as follows:

$$\Delta \ln X_t = \alpha_1 + \beta_{0t} + \theta_1 \ln X_{t-1} + \theta_2 \ln y^*_{t-1} + \theta_3 \ln rer_{t-1} + \sum_{i=1}^{l1-1} \beta_{1i} \Delta \ln X_{t-i} + \sum_{i=1}^{l2-1} \beta_{2i} \Delta \ln y^*_{t-i} + \sum_{i=1}^{l3-1} \beta_{3i} \Delta \ln rer_{t-i} + \mu_t \quad (3)$$

where: the long-run coefficients of the variables are $\theta_1 - \theta_3$ and the short-run coefficients are $\beta_1 - \beta_3$ for the Export demand equation.

$$\Delta ln\, M_t = \alpha_1 + \gamma_{0t} + \varphi_1\, ln\, X_{t-1} + \varphi_2\, ln\, y_{t-1} + \varphi_3\, ln\, rer_{t-1} + \sum_{i=1}^{l1-1} \gamma_{1i}\, \Delta\, ln\, X_{t-i} + \sum_{i=1}^{l2-1} \gamma_{2i}\, \Delta\, ln\, y_{t-i} + \sum_{i=1}^{l3-1} \gamma_{3i}\, \Delta\, ln\, rer_{t-i} + \omega_t \quad (4)$$

where: Δ is the first difference operator and l is the lag order. The ARDL approach to cointegration allows different level variables, that is $I(0)$ and $I(1)$ variables and can assign different lag lengths to the variables as they enter the model (Pesaran and Shin 1999, Pesaran *et al.* 2001).

Also, ARDL model has a comparatively forecasting performance compared to other techniques based on cointegration.

4. Empirical Analysis and Results Discussion

Quarterly series from 2000q1 to 2017q4 was used in this study to establish the relationship between International trade and currency devaluations in Ghana. The choice of the data period was informed by the fact that, the Ghana cedi during this period was termed to be in free fall, where export prices of major export commodities were falling and the cedi was also losing its value against all major trading currencies. This period was known as the free fall era of the Ghana Cedi.

4.1. Unit root test

Given that most time series variables are characterized with the presence of unit roots and are mostly non-stationary at the levels, unit roots test becomes important and necessary in order to determine the order of integration of the variables under study to be able to institute a relationship among them. Therefore, this study will employ the Augmented Dickey-Fuller unit root test to check for the presence of unit root.

Table 1. Gives the results of the ADF unit root test

Levels			First Difference		
Variable	Test Statistics	P-value $I(0)$	Variable	Test Statistics	P-value $I(1)$
$lexport$	0.539	0.9860	$lexport$	-4.195	0.0007**
$limport$	-0.107	0.9488	$limport$	-4.335	0.0004**
$lgdp$	0.604	0.9877	$lgdp$	-3.203	0.0085**
ly^*	-0.321	0.9224	ly^*	-4.196	0.0107**
$lrer$	-0.984	0.0007*	$lrer$	**	**

Source: Author's own computation from Stata, where ** and * represent significant at 5% and 10% respectively.

From the ADF unit root test results above, it could be seen that all the variables were not stationary at the levels except for the real exchange rate which was stationary at the level, however, all variables became stationary after the first difference. This gives the combination of both *I(0)* and *I(1)* variables which makes the ARDL approach a necessary tool for cointegration.

4.2. ARDL Bounds Test Cointegration

Table 2. Gives the results of the Bounds test cointegration for both export and import equation

Model	Number of regressors	Sample size	Test statistics	Critical Bounds values					
	K	n	f-statistics	10%		5%		1%	
				I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
ARDL (2, 0, 2)	2	70	12.586	2.72	3.77	3.23	4.35	4.29	5.61
ARDL (3, 3, 1)	2	69	13.440	2.72	3.77	3.23	4.35	4.29	5.61

Source: Author's own computation from Stata

The results of the bounds test above show that, all the variables under study, both from the export and import equations show the existence of a long-run equilibrium relationship. This is informed by comparing the F-statistic with the (upper) $I(1)$ bound to establish a cointegration relationship. These results give a necessary rational to estimate the error correction model and the long-run estimates given the existence of a cointegration among the variables.

4.3. Error Correction Model and Long Run Estimates

Table 3. Gives the results of the long run estimates of both the export and import equation

Variable	Adj. Parameter (ECT)	Variable	Adj. Parameter (ECT)
$lexport$ $l1$	-0.1063 (0.007)**	$limport$ $l1$	-0.1719 (0.003)**
lexport	Coefficient	p-value	
Long run			
ly^*	4.051406	0.000**	
$lrer$	-1.004295	0.016**	
Short run			
$lexport$			
lD	0.7188	0.000**	
$lrer$			
D_1	-0.9615	0.000**	
lD	0.8178	0.000**	
cons	-3.5531	0.036**	
limport	Coefficient	p-value	
Long run			
$lgdp$	2.944762	0.000**	
$lrer$	0.2377234	0.024**	
Short run			
$limport$			
lD	0.4789	0.000**	
l_2D	0.2636	0.050*	
$lgdp$			
D_1	2.2904	0.000**	
lD	-1.5223	0.035**	
l_2D	-0.9134	0.184	
$lrer$			
D_1	0.1985	0.075*	
cons	0.3942	0.1653	

Source: Author's own computation from Stata Where ** and * represent significant at 5% and 10% respectively

From the error correction estimates, the error correction term (ECT) for both export and import demand elasticity equations show a negative sign and it is statistically significant at 5% significance level as it is desirable for the long run, which represent the speed of adjustment towards equilibrium. This means that, any deviations from equilibrium in the model during the short run will be corrected in the long run at a magnitude of about 10% for export equation and 17% for import equation, all other things being equal.

From the export demand equation, in the long run, real world income has a positive relationship with exports which means that, an increase in real world income will increase exports in Ghana and real exchange rate has a negative relationship with exports in the long run which implies that, the depreciation of the local currency will increase exports in Ghana and all their coefficients are statistically significant, all other things being equal. Also, from the import demand, in the long run domestic income, real exchange rate and exchange volatility all have a positive relationship with import in the long run and they are all statistically significant. This means that, when domestic income increases and real exchange also increases (appreciation) in Ghana, import will also increase all other things being equal.

The short run estimates also show that, real exchange rate for the export demand, price elasticity of export $(PEDx)$ is negative and statistically significant but, there is no income effect. The price elasticity of import $(PEDm)$ is positive and statistically significant and the income effect is positive given that, real domestic income coefficient is positive. This implies that, depreciation will increase export and an increase in domestic income will increase import trade in Ghana.

4.4. OLS Estimates of the Error Correction Model

Table 4. Gives the OLS estimates of the ECM from the *Export* demand model

lexport	cons	Ly*	lrer
l_1 1.6851 (0.000)**	-3.5531 (0.036)**	0.1366 (0.033)**	-0.9953 (0.000)**
l_2 -0.7188 (0.000)**			l_1 1.7792 (0.000)** l_2 -0.8177 (0.000)**

Note: N = 70; F (6, 63) = 1360.85; P-Value = 0.000; R-squared = 0.9992; Adj.R-squared = 0.9982.

Table 5. Gives the OLS estimates of the ECM from the *Import* demand model

limport	cons	lgdp	lrer
	-0.5365 (0.198)	2.7966 (0.000)**	0.1576 (0.017)**
l_1 1.3069 (0.000)**		l_1 3.8127 (0.001)**	l_1 0.1985 (0.075)*
l_2 -0.2152 (0.301)**		l_2 0.6089 (0.602)	
l_3 0.2636 (0.050)		l_3 0.9133 (0.184)	

Note: N = 69; F (9, 59) = 4801.28; P-Value = 0.000; R-squared = 0.9986; Adj.R-squared = 0.9984.
Source: Author's own computation from Stata, where ** and * represent significant at 5% and 10% respectively.

From the error correction estimates of the elasticity model, it could be seen that, foreign income has a positive significant relationship with exports while real exchange rate has a negative significant relationship with exports. This implies that, a percentage increase in foreign income will increase export trade while a decrease in real exchange rate (depreciation) will increase export trade, all other things being equal.

Also, real domestic income and real exchange rate have a positive significant relationship with imports in Ghana. This means that, a percentage increase in real domestic income will increase import as consumers have higher demand as a result of an increase in the disposable income and exchange rate appreciation has an increasing effect on imports as foreign goods becomes relatively cheaper compared to domestic goods therefore increasing import trade, all other things being equal.

Given the results of the elasticity models above, it could be seen clearly that, the sum of the price elasticity of both export and import exceed unitary, that is (0.9953 + 0.1576 > 1) therefore the Marshall-Lerner condition is satisfied and consistent with the J-curve theory. This implies that, devaluations in Ghana will improve trade balance.

Conclusions and Policy Recommendations

The study seek to explore the relationship between international trade and currency devaluation in Ghana employing quarterly time series data from 2000Q1 to 2017Q4. The study employed the autoregressive distributed lag (ARDL) model and the vector error correction model to establish both the long-run and short-run economic relationship between real exchange rate and international trade by setting the elasticity model for both export and import trade.

The study found that, there is a stable long run equilibrium among the variables under study for both import and export elasticity models. Therefore, the error correction estimates showed that, any disequilibrium in the trade sector during the short run will be corrected back to equilibrium in the long run, all other things being equal. Also, in the long run, real exchange rate has a negative relationship with export and positive with import demand while both domestic and foreign income have positive relationship with both import and export demand.

The study concluded that, the income elasticity of demand for both import and export is positive while price elasticity is negative for export demand and positive for import demand. This means that, when the local currency of Ghana (The Ghanaian Cedi) depreciates and foreign income increase, exports of Ghana to the rest of the world will increase and an increase in the domestic income coupled with an exchange rate appreciation will increase import trade. Given that, the sum of the price elasticity of both export and import demand exceed unitary, currency devaluations will improve trade balance in Ghana which is consistence with the J-curve effect and therefore satisfies the Marshall-Lerner Condition.

The study will therefore recommend that, government and policy makers should formulate and implement policies towards currency stabilization given that, the economy of Ghana heavily depends on trade for trade and

also more attention should be focused on the import sector, since the Ghanaian economy is import driven. Continuous devaluations will deteriorate the import sector thereby deteriorating the Economy as a whole since most sectors of the economy depends on import for production therefore causing economic growth.

References

[1] Alexander, S.S. 1952. Effects of a devaluation on a trade balance. *Staff Papers-International Monetary Fund*, 2(2): 263-278.

[2] Bahmani-Oskooee, M. 1985. Devaluation and the J-curve: Some evidence from LDCs. *The Review of Economics and Statistics*, 67(3): 500-504. DOI: 10.2307/1925980

[3] Bahmani-Oskooee, M., and Brooks, T.J. 1999. Bilateral J-curve between US and her trading partners. *Weltwirtschaftliches Archiv*, 1: 156-165.

[4] Bahmani-Oskooee, M., Harvey, H., and Hegerty, S.W. 2014. Brazil–US commodity trade and the J-Curve. *Applied Economics*, 46(1): 1-13.

[5] Boyd, D., Caporale, G.M., and Smith, R. 2001. Real exchange rate effects on the balance of trade: Cointegration and the Marshall–Lerner condition. *International Journal of Finance & Economics*, *6*(3): 187-200.

[6] Branson, W.H., and Love, J.P. 1986. *Dollar appreciation and manufacturing employment and output.* National Bureau of Economic Research, No. w1972.

[7] Edwards, S. 1985. *Are devaluations contractionary?* National Bureau of Economic Research, No. w1676.

[8] Goldstein, M., and Khan, M.S. 1978. The supply and demand for exports: A simultaneous approach. *The Review of Economics and Statistics*, 60(2): 275-286.

[9] Gylfason, T., and Risager, O. 1984. Does devaluation improve the current account? *European Economic Review*, *25*(1): 37-64.

[10] Haynes, S.E., and Stone, J.A. 1982. Impact of the terms of trade on the US trade balance: A reexamination. *The Review of Economics and Statistics*, 64(4): 702-706.

[11] Houthakker, H.S., and Magee, S.P. 1969. Income and price elasticities in world trade. *The Review of Economics and Statistics*, *MIT Press*, 51(2): 111-125.

[12] Krugman, P., and Taylor, L. 1978. Contractionary effects of devaluation. *Journal of International Economics*, 8(3): 445-456

[13] Magee, S.P. 1973. Currency contracts, pass-through, and devaluation. *Brookings Papers on Economic Activity*, 1: 303-325.

[14] Onafowora, O. 2003. Exchange rate and trade balance in East Asia: is there a J-curve. *Economics Bulletin*, 5(18): 1-13.

[15] Pesaran, M.H., and Shin, Y. 1998. An autoregressive distributed-lag modelling approach to cointegration analysis. *Econometric Society Monographs*, 31: 371-413.

[16] Pesaran, M.H., Shin, Y., and Smith, R.J. 2001. Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3): 289-326.

[17] Rose, A.K., and Yellen, J.L. 1989. Is there a J-curve?. *Journal of Monetary Economics*, 24(1): 53-68.

[18] Senhadji, A.S. 1998. Dynamics of the trade balance and the terms of trade in LDCs: The S-curve. *Journal of International Economics*, 46(1): 105-131.

[19] Senhadji, A.S., and Montenegro, C.E. 1999. Time series analysis of export demand equations: A cross-country analysis. *IMF Staff Papers*, 46(3): 259-273.

[20] Taylor, L., Rosenweig, J.A. 1984. *Devaluation Capital Flows and Crowding-Out: A Computable General Equilibrium Model with Portfolio Choice for Thailand*, Department of Economics, OCLC Number: 77022834.

[21] Wang, Y.H., and Lee, J.D. 2012. Estimating the import demand function for China. *Economic Modelling*, *29*(6): 2591-2596.