Real Effective Exchange Rate Dynamics in Ghana

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Abstract:
This study seeks to analyse the long term competitiveness of the Ghanaian economy in relation to her trading partners. The study relied on secondary data obtained from the World Bank database on Ghana. Specifically, the study makes use of annual real effective exchange rate, import and export of goods and services of Ghana between 1980 and 2013. We employed the techniques of robust regression to estimate the parameters and use difference equation to analyse the resulting equations. The study reveals that Ghanaian economy will continue to be uncompetitive for a long time to come as shown by the falling real effective exchange rate as time approaches infinity, though it converges.

Keywords: Real, effective, exchange rate, dynamics, competitiveness, Ghanaian, economy

1. Introduction

Exchange rate is one of the important macroeconomic indicators. It is important because it serves as a link between a country and its trading partners. The volume of empirical studies on the subject attests to this assertion (Calderon and Duncan, 2003; Cheung and Lai, 2001; MacDonald, 1993; Sarno and Taylor, 1998). It is the transmission mechanism by which economic and commercial policies of one country is channeled to her trading partners and vice versa.

Exchange rate regime in Ghana until 1983 was generally fixed with intermittent adjustments. This meant the exchange rate was to a large extent determined at the discretion of the government of the day.

Ghana in April 1983 embarked on an economic recovery programme (ERP) with the aim of removing distortions in the economy which had prevented efficient allocation of resources. The reforms sought to arrest and reverse the economic decay witnessed in the late 1970s and early 1980s as well as structurally transform many sectors of the country (Dordoonu, 1994). As part of the measures embarked on under the adjustment programme, trade was liberalised, price controls were dismantled and exchange rate policy reforms were introduced. The reforms sought to replace controls with the market in the allocation of resources. This recovery programme involved several structural reforms including the exchange rate regime.

Tampering with the exchange rate, especially devaluation, in periods preceding the ERP had serious political consequences. As a result, gradual, systematic approach was adopted towards the liberalisation of the exchange rate during the reforms (Aryeetey, Harrigan and Nissanke, 2000). By 1992, the entire foreign exchange reform process came to its logical end with the replacement of Wholesale auction by the Interbank Market. Under the interbank market, authorised dealer banks may trade in foreign exchange among themselves or with their final-user clients.

2. Motivation of the Study

Ghana's economy has been experiencing balance of payments deficit since 1960s. This has resulted in the continuous decline in the international value of the Cedi, the legal tender of Ghana. With Ghana's heavy dependence on imports for the supply of its essential commodities, the welfare of the citizens deteriorates with depreciation, especially if increment in incomes lags behind inflation brought about by the fall in the value of the Cedi. This situation of continuous depreciation is as a result of the uncompetitive nature of locally produced goods both at home and international markets. What this study seeks to do is to establish if there is a glimmer of hope that Ghana will one day be competitive and turn the tide of deficits to that of surplus in its international transactions.

3. Review of Literature

There are several studies on the relationship between trade balance and real effective exchange rate. Genc and Artar (2014) demonstrated that indeed there is a long run relationship between real effective exchange rate, exports and imports. Oteng-Abayie and Appiah-Nkrumah (2009) established that real gross domestic product and nominal exchange rate stimulate increased demand for imports in Ghana. Stučka (2004) in a study on the effects of real exchange rate on the trade balance in Croatia shows that 1% depreciation of the domestic currency results in 0.94% improvement of the trade balance. This means real depreciation boosts supply for export and dampen demand for imports. There are similar studies showing the same results (Petrović, 2009; Yaya and Lu, 2012). In the case of Petrović (2009), the trade balance initially deteriorates before improving later, mimicking the J-curve phenomenon.

4. Theoretical Framework

The determination of the exchange rate is the interaction between demand for imports and supply of exports. One crucial factor that influences a country's international trade pattern is its real effective exchange rate. Maciejewski (1983) argued that real effective exchange rate (REER) is an appropriate indicator of international competitiveness of a country in relation to its trading partners. Movements in a country's real effective exchange rate directly affect imports and exports. In this study, we construct a market model in which current real effective exchange rate determines current imports while previous period real effective exchange rate determines current exports. It is assumed that exporters produce for the future based on incentives created by the current level of real effective exchange rate. In notation, we have

$$M_t = \alpha_0 + \alpha_1(REER)_t + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots\dots(1)$$
$$X_t = \beta_0 + \beta_1(REER)_{t-1} + u_t \dots\dots\dots\dots\dots\dots\dots(2),$$

Theoretically, we expect

$$\frac{dM_t}{d(REER)_t} < 0, \ and \ \ \frac{dX_t}{d(REER)_{t-1}} > 0$$

Where M_t, X_t and $REER_t$ denote imports, exports and real effective exchange rates at time t. The parameters to be estimated are $\alpha_0, \alpha_1, \beta_0$ and β_1 while ε_t and u_t are the usual stochastic disturbance terms. In equilibrium, we expect imports to equal exports. That is, we equate equations (1) and (2), resulting in

$$M_t = X_t \implies \alpha_0 + \alpha_1(REER)_t = \beta_0 + \beta_1(REER)_{t-1}.$$
$$\implies \alpha_0 + \alpha_1(REER)_t = \beta_0 + \beta_1(REER)_{t-1} \dots\dots\dots\dots\dots\dots(3)$$

Solving for $REER_t$ from equation (3), we have

$$(REER)_t = \eta_0 + \eta_1(REER)_{t-1}\dots\dots\dots\dots\dots\dots\dots\dots(4), \ where$$
$$\eta_0 = \frac{\beta_0 - \alpha_0}{\alpha_1} \ ; \ \eta_1 = \frac{\beta_1}{\alpha_1}$$

Clearly, equation (4) is a difference equation which, when solved, will produce a real effective exchange rate that either converges or diverges with time. Solving equation (4), we have the general solution

$$(REER)_t = (\eta_1)^t (REER)_0 + \frac{\eta_0}{1-\eta_1}\dots\dots\dots\dots\dots\dots(5)$$
$$Where \ \eta_0 = \frac{\beta_0 - \alpha_0}{\alpha_1} \ ; \ \eta_1 = \frac{\beta_1}{\alpha_1}$$

The solution to equation (4) has a long term implication for the competitiveness of Ghanaian products in home and overseas markets. Here, the particular solution $\frac{\eta_0}{1-\eta_1}$, expresses the intertemporal equilibrium level of real effective exchange rate while the complementary solution $(\eta_1)^t (REER)_0$, represents the deviation from equilibrium level. As the real effective exchange rate increases with time, it means there is a real depreciation of the local currency, the Cedi. This real depreciation increases the competitiveness of domestically produced goods home and abroad. On the other hand, as the real effective exchange rate decreases with time, the local currency will appreciate in real terms, decreasing the competitiveness of locally produced goods in both home and foreign markets.

5. Data and Methodology

This study makes use of secondary data obtained from the World Bank database on Ghana. It is an annual data on imports (M) and exports (X) of goods and services as well as real effective exchange rate (**REER**) covering the period 1980 to2013.

Real effective exchange rate is the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs. In other words, real effective exchange rate is the weighted average of a country's currency relative to an index or basket of other major currencies adjusted for the effects of inflation.

Bilateral exchange rate involves a currency pair, while an effective exchange rate is a weighted average of a basket of foreign currencies, and it can be viewed as an overall measure of a country's external competitiveness. A nominal effective exchange rate (NEER) is weighted with the inverse of the asymptotic trade weights. A real effective exchange rate (REER) adjusts NEER by appropriate foreign price level and deflates by the home country price level.

It is computed using the logic of the law of one price as follows:

The domestic price of imported good is given as

$$P_t = E_t P_t^* \quad \dots\dots\dots\dots\dots\dots\dots(6)$$

Where P_t, E_t and P_t^* are domestic price, nominal exchange rate and foreign price respectively. The nominal exchange rate is defined as the quantity of domestic currency needed to purchase a unit of foreign currency. If E_t is a weighted average of nominal exchange rates of a country's major trading partners, then we have an effective exchange rate. Dividing the right hand side of equation (6) by P_t^* gives us the real effective exchange rate provided E_t is a weighted average of nominal exchange rates of a country.

$$Real\ effective\ exchange\ rate\ (REER) = \frac{E_t P_t^*}{P_t}$$

Ordinary Least Squares OLS) is applied to the data to obtain the parameters of equations (1) and (2).Robust Least Squares is used to estimate the variances of the parameters. Robust Least squares estimation of the variances of the parameters is superior to Ordinary Least Squares method because the former produces robust results that are free of heteroscedasticity.

6. Results and Discussions

By applying both OLS androbust least squares to equation (1), we obtained the following results as shown in Table 1.

Variable	Coefficient	Robust	Standard Error	Robust t-ratio
Constant	6.2903e+009	1.24e+09		5.0788**
REER	-2.6504e+006	8.9707e+005		-2.9544*
$DW = 0.128539$; $\bar{R}^2 = 0.065$				

Table 1: Regression of Imports on Real Effective Exchange Rate (REER)
*** significant at 1% ;   * significant at 5%*
Source: From the study

Expressing the result in terms of equation (1), we have

$$M_t = (6.2903e + 009) - (2.6504e + 006)REER_t \dots\dots\dots\dots\dots(7)$$

This result suggests that a unit increase in real effective exchange rate causes imports of goods and services to fall by approximately US\$ 2.7 million. This is consistent with economic theory since a rise in real effective exchange rate implies real depreciation of the Cedi which makes imports more expensive and hence reduce its demand.

Again, by applying OLS androbust least squares to equation (2), we obtained the following results as shown in Table 2.

Variable	Coefficient	Robust	Standard Error	Robust t-ratio
Constant	4.7960e+009	1.0984e+009		4.3663**
REER $_{t-1}$	-1.9757e+006	7.3101e+005		-2.7027*
$DW = 0.148648$; $\bar{R}^2 = 0.0429395$				

Table 2: Regression of Export on lagged Real Effective Exchange Rate $(REER_{t-1})$
*** significant at 1%;   * significant at 5%*
Source: From the study

Substituting the results into equation (2), we have

$$X_t = (4.7960e + 009) - (1.9757e + 006)(REER)_{t-1} \dots\dots\dots\dots(8)$$

From equation (8), it can be observed that a one unit increase in real effective exchange rate last period reduces export of goods and services in the current period by approximately US\$ 2.0 million. This result is inconsistent with economic theory because real effective exchange rate increase implies real depreciation of the Cedi which should make locally produced goods competitive in both home and international markets. The relation is however significant at 1% level. We are, however, cautious in our interpretation of the regression coefficients in the light of spurious regression phenomenon pointed out by Granger and Newbold (1974).

Despite the fact that the two models have low *Durbin-Watson* (DW) statistic, implying that there is serious positive serial correlation of the residuals, we can still use the estimated coefficients for further analysis. This is because, even in the presence of serial correlation, ordinary least square estimator is still linear, consistent and unbiased.

Recalling the general solution of the difference equation (4),

$$(REER)_t = (\eta_1)^t (REER)_0 + \frac{\eta_0}{1-\eta_1} \quad \dots\dots\dots\dots\dots(9)$$

Where $\eta_0 = \frac{\beta_0 - \alpha_0}{\alpha_1}$; $\eta_1 = \frac{\beta_1}{\alpha_1}$ and

$\alpha_0 = 6.2903e + 009$; $\alpha_1 = -2.6504e + 006$; $\beta_0 = 4.7960e + 009$;
$\beta_1 = -1.9757e + 006$

Now,

$$\eta_0 = \frac{\beta_0 - \alpha_0}{\alpha_1} = \frac{4.7960e+009 - 6.2903e+009}{-2.6504e+006} = 563.8017 \text{ and}$$

$$\eta_1 = \frac{\beta_1}{\alpha_1} = \frac{-1.9757e+006}{-2.6504e+006} = 0.7454$$

Substituting $\eta_0 = 563.8017$ and $\eta_1 = 0.7454$ into equation (5), we have

$$(REER)_t = (0.7454)^t (REER)_0 + 563.8017 \quad \dots\dots\dots\dots\dots(10)$$

Taking limits of equation (10), we have

$$\lim_{t\to\infty}(REER_t) = \lim_{t\to\infty}\{(0.7454)^t REER_0 + 563.8017\}$$

Expanding,

$$\lim_{t\to\infty}(REER_t) = \lim_{t\to\infty}\{(0.7454)^t (REER)_0\} + \lim_{t\to\infty}(563.8017)$$

Implying,

$$\lim_{t\to\infty}(REER_t) = 563.8017$$

The term

$$\lim_{t\to\infty}\{(0.7454)^t REER_0\} = 0 \text{ since } 0 < 0.7454 < 1.$$

The term $(0.7454)^t$ will decrease geometrically to zero (0) with the passage of time, t.

In summary, we expect the real effective exchange rate (REER) of Ghana to decline over time. The implication is that the real exchange rate will appreciate in real terms making Ghanaian goods and services uncompetitive in home and overseas markets.

7. Conclusion and Recommendations

The fall in the real effective exchange rate in the case of Ghana means Ghanaian economy will be uncompetitive in the global market. This suggests that locally produced goods will be more expensive relative to goods produced abroad. This state of affairs will encourage imports and discourage exports thereby creating balance of payments deficit. This balance of payments deficit will put an upward pressure on the Ghanaian Cedi to depreciate.

It is recommended that government initiate a study to establish the factors that are responsible for the inability of locally produced Ghanaian goods to compete favourably with goods produced in other parts of the world. It is also suggested that local producers adopt cost cutting measures and invest more into research and development so as to position themselves to produce goods that are competitive.

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