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Movement and Misalignment of Exchange Rate: Analysis of Its Impact on Tanzanian Economy

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Abstract

The study examines impact of exchange rate movement and misalignment on economic growth with evidence from Tanzania. The study uses annual data which covers a period of 47 years from 1967 to 2013. The paper employs multiple econometrics methods and models. The autoregressive Distributed lag model estimated by ordinary least square to determine anticipated and unanticipated exchange rate movements. Also, generalized method of moment (GMM) is applied to examine impact of exchange rate movement and misalignment on economic growth. Moreover, log-linear model used to determine growth trend of the variables pre and post economic reform. Based on findings exchange rate shock is persistent and significant determined by balance of trade. Results found no evidence of impact of unanticipated exchange rate movement on GDP, private sector spending, export and import growth. Besides, anticipated exchange rate depreciation found to have significant negative impact on GDP and import growth but positive impact on private spending. Moreover, study found exchange rate overvaluation significantly decrease export growth and GDP but found to have significant positive impact on import growth and private sector spending. Thus, insight to policy makers, depreciation policy may be effective if country will increase its production capacity without much dependence on imported capital and intermediate goods.

Keywords: Anticipated exchange rate shock, Economic growth, Exchange rate misalignment, Generalization method of moments, unanticipated exchange rate shock

1. Introduction

The relationship between exchange rate and macroeconomic variables received attention for long, however the linkage found to be complicated. This is due to the fact that the movement in exchange rate is related to many variations such as competitiveness of the economy, shocks in monetary policy and fiscal policy (Ozbilgin, 2015). Inconsistency macroeconomic policy may lead to misalignment of the exchange rate (Abida, 2011). The exchange rate misalignment refers to a gap between real exchange rate and its equilibrium level (Wong, 2013). Misalignment may either be overvaluation or undervaluation of the currency.

The interesting link between exchange rate misalignment and growth is notable from china where authorities have been frequently accused of keeping the value of Yuan very low against major currencies. Madej & Wyciszkiewicz (2010) states that undervaluation of Chinese currency against USD helped to boost up Chinese export and alleviated the impact of global economic crisis. Though Porter (1990) & Harris (2001) as cited from Ozbilgin (2015) states that undervaluation is also likely to impair growth. They argue that undervaluation may increase price of the importation of machines necessary for production hence this may reduce investment as result production drops or the produced goods become expensive and non competitive in the world market.

On the other hand, exchange may move down or up regardless of being misaligned or on equilibrium. For this case exchange rate movement involves depreciation (devaluation) or appreciation (revaluation) (Kandil & Dincer, 2008). Besides, more literature seems in favor of depreciation (devaluation) with argument of increasing price of imported goods which transforms spending from foreign goods to local goods. However, Kandil & Dincer (2008) argue that effectiveness of depreciation policy would depend to the capacity of the domestic economy to meet the increasing demand for local goods. On contrary, depreciation or devaluation of the domestic currency may lead to increase in price of domestically produced goods if the manufacturing sector depends on imported inputs that automatically rise cost of production (Kandil & Dincer, 2008). Therefore the effect of the exchange rate movement is mixed.

The brief introduction indicates mixed arguments and findings related to exchange rate impact on economic growth. This makes the debate far from an end. Hence, this paper intends to add evidence to the existing empirical literature related to exchange rate movement and misalignment and economic growth, more significant in Tanzanian context. We identified three studies related to exchange rate and macroeconomic variables for

Tanzania; the Rutasitara (2004); Nyamrunda & Mbogela (2014) and Kessy et al. (2015) yet none has fully covered the theme of the current study.

Evolution of exchange rate and economic environment in Tanzania

This section gives a brief background of exchange rate movement, volatility and misalignment in Tanzania in relation to gross domestic product (GDP), share of export on GDP and share of import on GDP in real term. The exchange rate discussion is limited to TZS against USD dollar rate; this is because USD has been a highly traded foreign currency in Tanzania. Moreover use of other foreign currencies apart from USD was limited by availability of data for the intended period of study (1967 to 2013). Hence, this led to a failure of constructing a real effective exchange rate which is relative better in establishing competitiveness of countries' produce in foreign market.

Exchange rate policy in Tanzania passed two regimes, the controlled regime from 1967 to 1985 and market determined regime from 1986 to present (Rutasitara, 2004). During control phase, the parallel market for foreign exchange was in existence (Rutasitara, 2004). Overvaluation of the currency throughout this period was eminent with exception of 1970, 1971 and 1978 as depict in Figure 1. Rutasitara, (2004) argue that overvalued currency was maintained in favor of import substitution industries but at the expense of agricultural sector. Though this argument is contrary to large number of literature advocating undervaluation for favorable growth than those advocating the opposite direction as cited from Schnabl, (2009). From this note, control policy came into pressure in the end of 1970s due to internal and external imbalances of the economy (Edwards, 2012). The need for reform was inevitable, in 1986 Tanzanian government and IMF signed agreement for Structural Adjustment program which involved devaluation of the currency by 57 percent among other measures (Edwards, 2012). Data indicate devaluation succeeded to decrease the increasing trend of trade deficit from 139 percent in 1984 /1985 to 119 percent in 1986/1987 and further decrease to 112 percent in 1989/1990. Yet still, currency overvaluation prevailed despite the reform measure. Figure 1 reveals that real exchange rate curve has been above the nominal exchange rate for pre and post reform with exception of 2009 due to high unusual deflation. Thus, this paper intends to find impact of overvaluation on Tanzanian economy.

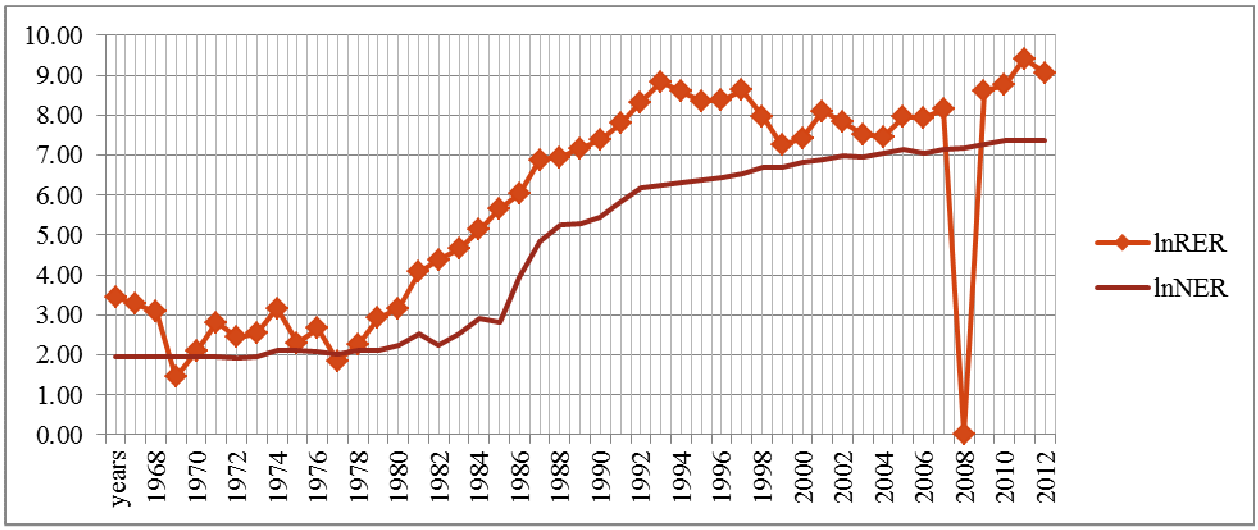

Figure 1: Evolution of Nominal (NER) and Real (RER) Exchange rate in Tanzania (TZS/USD)

Tanzania experienced trade deficit (import of goods>export of goods) for the whole period of the study (1967 to 2013) with exception of 1967 and 1969 only *(see figure 2).* From 1967 to 1972 the exchange rate was fixed and share exports on GDP had a decreasing trend while imports share had increasing trend. This widened the unfavorable trade balance as depicted in *figure 2*. From 1973 the nominal exchange rate started to fluctuate, perhaps due to a collapse of Breton Wood system. However, high fluctuation of exchange rate and wide exchange rate overvaluation was more prominent from 1979 to 1992. Facts extracted from National bureau of Statistic database analyzed based on ten years annual average indicate that from 1979 to 1988 annual average nominal exchange rate fluctuation was above 40 percent relative to 0.5 percent ten year prior (1969 to 1978). However liberalization of financial sector and perhaps enactment of Foreign Exchange Act of 1992 led to realization of relative stable exchange rate. This is evidenced by facts that fluctuation in nominal exchange rate decreased to 19.8 percent in average from 1989 to 1998 and further decrease to 6.8 percent during 1999 to 2008.

Apart from relative stabilized exchange rate, there other number of positive outcomes of economic reform including reduced inflation from 30 percent prior reform to a single digit after the reform, growing real GDP at an average above 6 percent (Bigsten & Danielsson, 1999).

Moreover, analysis shows growth of GDP was low during the period of high volatility and overvaluation of the exchange. That is annual average GDP growth rate for the period of 1979 to 1988 was 2.23 percent relative to 3.89 for ten years period prior to this. Besides, the trend after reform where exchange rate stability started to be realized the GDP rose to 3.04 percent (1989 to 1998) and 6.62 percent from 1999 to 2008. Therefore, we aim to see if there is a link between the slow GDP growth during large misalignment period as well as for the period during reverted growth versus relatively stabilized in exchange rate.

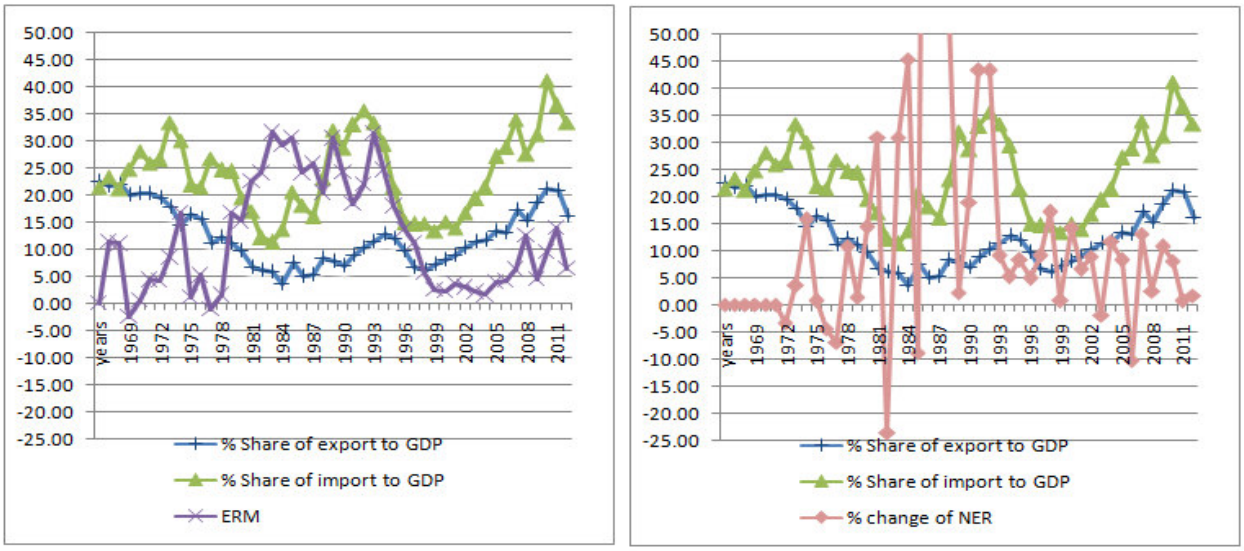

Figure 2: Export and Import as Share of GDP relative to Exchange rate Misalignment (ERM) and NER volatility.

This paper is organized in five sections. The first section above is introduction of topic in general and in Tanzanian context. Other sections are; literature review in section two, methodology in section 3, whereas section 4 presents empirical results and analysis. Finally, section 5 presenting conclusion, policy implication and recommendation for future research.

2. Review of Literature

The existing literature related to exchange rate is quite large but focus in this review is on exchange rate movement and misalignment and its effect on economic growth. Exchange rate, as any price, has effect on demand and supply not only of the currency but trade as well. Thus movement (depreciation or appreciation) in exchange rate may increase or decrease international competitiveness of domestic products in the world market (Kandil & Dincer, 2008).

Theoretical literature seems to offer both argument for and against depreciation of domestic currency to the country's economy (Ozbilgin, 2015). He state that depreciation may be favorable by reducing import due to the increase in the price of foreign goods relative to homemade and increase export. However the effectiveness of the devaluation policy depends on the capacity of the country to meet additional demand (Kandil & Dincer, 2008).

Moreover, exchange rate movement may be excessive over or below equilibrium level resulting into misalignment. That means gap between real exchange rate of the country and its equilibrium level is called misalignment (Wong, 2013). Misalignment may result from excess depreciation or appreciation with respect to equilibrium rate (Abida, 2011).This may bring either overvaluation or undervaluation of the currency from its equilibrium level. The assessment of exchange rate equilibrium has always been an issue on international macroeconomics (Abida, 2011). However, the concept of misalignment is still subjective as there is no consensus in literature (Razin and Collins, 1997) cited from Wong, (2013). It is noted that there are two main approach of measuring equilibrium exchange rate from which misalignment is deduced. According to Wong, (2013) purchasing power parity approach adjusted for Balassa and Samuelson effect is used. The currency is said to be misaligned if international prices differ given per capita income levels. The second major approach is based on fundamental exchange rate which seems much popular to among few empirical studies such as Sarkar &

Amor (2009); Abida (2011) and Wong (2013). They estimated real exchange rate based on fundamentals and use estimated equilibrium exchange rate to find misalignment (by a difference between actual exchange rate and equilibrium value). Equation 1 and 2 below applied by Abida, (2011) and Wong, (2013) respectively may shade light on how to estimate equilibrium real exchange rate using fundamental approach.

$$ERER_t = \alpha_0 + \alpha_1 prod_t + \alpha_2 govc_t + \alpha_3 invest_t + \alpha_4 open_t + \varepsilon_t \quad (1)$$

$$ERER_t = \alpha_0 + \alpha_1 trend + \alpha_2 DR_t + \alpha_3 prod_t + \alpha_4 O_t + \alpha_4 RD_t + \varepsilon_t \quad (2)$$

Whereas ERER present equilibrium real exchange rate, prod stand for relative productivity in traded good sectors, govc stands for government consumption as a share of GDP, invest stand for investment as a share of GDP and open stands as trade openness, whereas in equation 2, trend stands for time trend, DR represents real interest rate differential, RD stands for reserve differential, O is oil real price. All variables entered in a model in logarithmic form. Thus, from equation 1 & 2 authors calculated exchange rate misalignment using equation 3.

$$ERM = Actual\,RER - ERER \quad (3)$$

On contrary, this study adapted relative purchasing power parity theory to calculate exchange rate misalignment without incorporating Balassa and Samuelson effect as describe in Ozbilgin, (2015). Theory states that exchange rate adjustment is equal to the inflation rate differentials between the two countries (Ozbilgin, (2015). Meaning that difference between inflation rate differential and exchange rate adjustment should be equal to zero otherwise there is misalignment. Equation 4 is used to extract misalignment in exchange rate.

$$ERM_t = (\pi_d - \pi_f)_t - \left(\frac{\Delta ER_{d/f}}{ER_{d/f}}\right)_t \quad (4)$$

In addition, Kandil & Dincer, (2008) used modified version of equation 1&2 to establish anticipated exchange rate shock and none anticipated exchange rate shock. Thus, Kandil & Dincer used equation 5 below to estimate anticipated and non anticipated exchange rate shock

$$RER_t = \beta_0 + \beta_1 RER_{t-1} + \beta_1 BT_{t-1} + \beta_3 open_{t-1} + \beta_4 govc_{t-1} + \varepsilon_t \quad (5)$$

Whereas RERt represents anticipated exchange rate shock, ε_t is a residual which in this case stands as unanticipated exchange rate shock, BT stands for trade balance and other variables are defined similar to that of equation 1.

Furthermore, empirical literature on exchange rate and growth is immense worldwide, however findings seems mixed. Sarkar & Amor, (2009) seeking the effect of undervaluation and overvaluation in south and south East Asian countries found that exchange rate undervaluation has a significant positive impact on growth, whereas exchange rate overvaluation found to have negative impact on growth. This is consistent with Wong, (2013) study conducted in Malaysia which found an increase in real exchange rate misalignment has negative impact on economic growth, however Wong didn't distinguish whether the effect of undervaluation and overvaluation on growth. Moreover, other studies reviewed for Asian countries analyzed exchange rate movement effect rather than misalignment, For example Naseer, (2013) for Pakistan found there is long run relationship between exchange rate, trade, FDI and GDP growth where exchange rate found significantly affect trade. Similarly, Hua, (2012) found China's exchange rate appreciation negatively affect economic growth. These findings support argument by (Schnabl, 2009) that there is more literature which argues on the positive impact of undervaluation of real exchange rate on growth than those advocating the opposite direction

Other evidence includes Madej & Wyciszkiewicz (2010) stating that undervaluation of Chinese currency against used helped to boost up Chinese export and alleviated the impact of global economic crisis. China has been practicing fixed exchange rate in which china currency was page to USD at a fixed rates from 1994 to 2005. The nominal exchange rate of Yuan was always close to the real effect exchange till 2001, it appreciated against other currency alongside USD. Though from 2002, the sustainable productivity growth in China's export sector and depreciation of the USD dollar made the Yuan undervalued and hence boosted its export competitiveness and growth. Abida, (2011) argue that real exchange rate undervaluation can be attribute by competitive devaluation hence may derive exchange rate to a level that encourage export and growth. Whereas negative impact for overvaluation is the loss of competitiveness of exports in the world market (Schnabl, 2009). Abida states that overvaluation may lead to unstable current account balance and increasing external debt and possibility of speculative attack.

Despite positive argument for undervaluation, Ozbilgin, (2015) cited Porter (1990) & Harris (2001) with two hypothesis (factor cost hypothesis and Innovation Gap hypothesis) suggesting negative impact of undervaluation of real exchange rate on growth. Factor cost hypothesis with reference to Canada and USA, state that

undervaluation is likely to increase price of the importation of machines necessary for production hence this may reduce investment as result the production goes down or the produced goods become expensive and non competitive in the world market. Whereas Innovation Gap hypothesis state that technology recipient country if it weaken the value of its currency it makes inflow of technology to be expensive as well as it motivate brain drain because of reduced real wages for the expert

In addition, reviewed studies in African context indicate mixed results as well. For example Abida, (2011) examines exchange rate misalignment and economic growth across three countries (Tunisia, Algeria and Morocco) and found significant negative misalignment coefficient which means exchange rate undervaluation promote growth and overvaluation harm growth. In analyzing impact of exchange rate movement (Akinbobola, 2012) found that in long run exchange rate has inverse effect on inflationary pressure in Nigeria. On the other hand (Kandil & Dincer, 2008) found that anticipated exchange rate appreciation decreases export growth in Egypt whereas unanticipated exchange rate fluctuation decreases real output and increase export growth in Egypt. Besides (Kandil & Dincer, 2008) found that for Turkey anticipated exchange rate appreciation had significant adverse effect on growth of real output and demand for investment and rising prices.

Several methods of econometrics for estimation such as Ordinary least square, generalized method of moments, Generalized and two stage least square, Single equation and Vector Error correction model are used. Perhaps use of different methods of estimation contributed to the mixed results. For example studies with vector cointegration method of analysis found no evidence for long run relationship exchange rate, real income per capita and real export of goods and services i.e. Koccat, (2008) for Turkey and Suliman, (1996) for Sudan.

Literature of exchange rate in relation to economic growth in Tanzanian context seems limited. Three studies are identified (Rutasitara (2004); Nyamrunda & Mbogela, (2014) & Kessy et al. (2015)). Rutasitara focused on the effect of exchange rate regimes on inflation rate in Tanzania and he found parallel exchange rate push up inflation rate. He used ordinary least square (OLS) to estimate the autoregressive model to estimate data covered 1967 to 1995. Thus, study ignored the effect of overvaluation and undervaluation on economic growth and used OLS method which is prone to simultaneity bias due to the reversal link between exchange rate and inflation rate. Moreover, Nyamrunda & Mbogela analyzed impact of lower exchange on export, import and national output where found that lower value of annual official nominal exchange rate lead to increase in export over the long run but decrease in import. In addition, they found that devaluation of the currency is associated with the increase in national output. This study used vector autoregression model (VECM) which considers the reversal cause among variables. Whereas, Kessy et al. (2015) focused mainly on finding evidence of transaction dollarization Tanzania.

Based on literature evidence above, the study intends to test two hypotheses. *Hypothesis1*: Exchange rate movement has significant effect on economic growth in Tanzania. The aim is to test the direction of the effect of both devaluation and appreciation of exchange rate movement. *Hypothesis2*: Exchange rate misalignment has negative effect on economic growth. The aim is to test whether exchange rate overvaluation in Tanzania had a positive or negative impact in Tanzanian economy.

3. Methodology

This section describes data, variables, methods and models used for the analysis of the effect of exchange rate movement and misalignment on Tanzanian economy.

Description of Data

Time series data with a sample period of 47 years ranging from 1967 to 2013 is used, selected sample period is based on availability of data. Data used in the study sourced from Tanzania National Bureau of Statistic reports, Economic survey bulletin and World Bank database. Variables are measured in real terms using local currency after deflation based on 2001 prices; these variables includes gross domestic product (GDP), Export Growth (EXPG), Import Growth (IMPG) and Private Expenditure (PVE) as a dependent variables as a proxy of economic performance. Study used Government spending (GE), Money supply (MS), Trade openness (OP) and ratio of trade balance to GDP (SHTB) as controlling variables to explore impact of exchange rate on economic growth. The primary variables of interest in this study includes real exchange rate (RER), exchange rate misalignment (ERM), anticipated (ESHOC) and unanticipated (UNSHOC) exchange rate as described in next section. Due to a potential of non-linearity the natural logarithm is introduced to all our variables as suggested in many studies, to cite few Beck et al. (2000) & Dasgupta (2009). Therefore, all variables names are preceded by letters LN to indicate natural log. The summary statistics of the variables is not presented given the fact that inference does not depend on nature of distribution due to a use of GMM on estimation.

Description of variables

Exchange rate misalignment (ERM)

This variable is calculated based on relative purchasing power parity theory. That is exchange rate adjustment is equal to the inflation rate differentials between the two countries (Ozbilgin, 2015). Hence, difference between inflation rate differential and exchange rate adjustment should be equal to zero otherwise there is misalignment. To extract misalignment variable equation 6 is used.

$$ERM_t = (\pi_d - \pi_f)_t - \left(\frac{\Delta ER_{d/f}}{ER_{d/f}}\right)_t \quad (6)$$

Whereas ERM represents exchange rate misalignment which appears when the value is not equal to zero, when the value of ERM is positive means overvaluation and if negative means undervaluation of the exchange rate, π_d *and* π_f represents domestic and foreign country's inflation rate respectively, $ER_{d/f}$ represents nominal exchange rate expressed in terms of number of units of domestic currency against a single unit of foreign currency. Δ represent operator for change in a particular variable.

Real Exchange rate (RER)

Real exchange rate refers to the measure of the prices of goods and services of one country relative to the other (Ozbilgin, 2015). It measures the effect of exchange rate on competitiveness of home country on international trade. This is calculated as product of nominal exchange rate and relative price of each country (Wong, 2013; Ozbilgin, 2015). Relative prices involve the use of consumer price index of each particular country. Equation 7 below represents formula used for calculating the real exchange rate

$$RER = ER_{d/f} x \frac{P_f}{P_h} \quad (7)$$

Whereas RER represents real exchange rate, P_f and P_h represents price level in the foreign and home country respectively. $ER_{d/f}$ represents nominal exchange rate expressed in terms of number of units of domestic currency per unit of foreign currency. The rise in RER indicates depreciation of home currency against the foreign currency.

Anticipated (ESHOC) and Unanticipated (UNSHOC) exchange rate shock

These two variables aim to measure the effect of exchange rate movement on growth. However the movement is separate in two ways; the anticipated movement and unanticipated movement. As adapted from Kandil & Dincer, (2008), the anticipated and unanticipated components of exchange rate is identification through regressing the change in real effective exchange rate against its own lags and the lags of all variables that are relevant in determining exchange rate movements. As per Kandil & Dincer, (2008), ratio of trade balance to GDP, ratio of sum of export and import to GDP as measure of openness, and dummy variable used as determinants of exchange rate movement. Equation 8 below represents the model used to estimate the anticipated and unanticipated exchange rate shock

$$\widehat{RER}_t = \beta_0 + \beta_1 RER_{t-1} + \beta_1 TB_{t-1} + \beta_3 OPN_{t-1} + \beta_4 GE_{t-1} + \beta_5 D + \varepsilon_t \quad (8)$$

$\widehat{RER}_t$ stands for estimated exchange rate in this case referred as anticipated exchange rate shock (ESHOC), Whereas BT represents ratio of trade balance to GDP, OPN is a ratio of sum of export and import to GDP as measure of openness, GE is a government spending and D is a policy dummy which represents adoption of economic reform 1986. Whereas ε_t refers to a residual which in this case represents unanticipated exchange rate shock (UNSHOC) given by $RER - \widehat{RER}$. The lags were determined based on lag length determination criterion. Table 1 presents result for lag selection criteria which indicates that all criteria; sequential modified likelihood ratio (LR), Final prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion (SC), Hannan-Quinn information criterion (HQ) agreed that one lag length is optimal.

Table 1: Lag Order Selection Criteria results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-142.2060	NA	0.017577	7.310298	7.479186	7.371362
1	-5.000784	240.1090*	4.12e-05*	1.250039*	2.094479*	1.555362*
2	1.367878	9.871425	6.85e-05	1.731606	3.251598	2.281187
3	11.31909	13.43414	9.91e-05	2.034046	4.229589	2.827885
* indicates lag order selected by the criterion						

The equation 8 is a simple autoregressive distributed lag model (ARDL) estimated using ordinary least square (OLS). The use OLS is appropriate because all independent variables are predetermined hence estimates cannot be bias. According to (Dritsaki & Dritsaki, 2013) the use of ARDL allows the estimation of the relationship between variables irrespective of whether the regressors are purely I(0), I(1) or cointegrated. The main aim of this estimate was to establish anticipated and unanticipated exchange rate shocks that are used in equation 10 to determine its impact on exchange rate growth. Result of equation 8 is presented in table 2, where residual representing unanticipated exchange rate movement or shock satisfies all rationality condition. The residual diagnostic tests presented on third row of table 2, show that it is free from heteroskedasticity problem and serial correlation using Breusch-Godfrey tests. Also Ramsey test indicates the model is free from misspecification. Coefficients of the lagged real exchange rate found to be significant providing evidence of the persistence of the shock on exchange rate. Also lagged share of trade balance on GDP (LNSHTB) found to be significant determinants of real exchange rate movement in Tanzania. The negative sign of LNSHTB coefficient indicates that improved trade balance lead to appreciation of Tanzanian currency. This results is consistent with that of Kandil & Dincer, (2008) a case study of Egypt.

Table 2: Result for establishing Real exchange rate shocks (Anticipated and Unanticipated)

Model
LNRER = - 0.149+ 0.837*LNRER(-1) - 0.326*LNSHTB(-1) + 0.085*LNGE(-1) - 0.277*LNOP(-1) + 0.506*DUMMY (0.069) (10.09)*** (-2.848)*** (0.459) (-1.179) (1.212) R2 = 0.971, R2 = 0.967, S.E = 0.46, Log Likelihood=-25.51, DW =2.26, Mean dependent var = 5.86, SD dependent var = 2.56, Akaike info criterion = 1.432, Schwarz criterion = 1.676, F. Statistic 254.65***
Diagnostic Test: *Breusch*-Godfrey Serial Correlation LM Test: F=1.359; Prob. F(2,36) = 0.2698 Heteroskedasticity Test: Breusch-Pagan-Godfrey: F=1.234, Prob. F(5,38) = 0.3122 *Ramsey Reset Test:* F=0.091 Prob. F(1, 37) = 0.765
*** and * denote statistically significant at the 1% and 5% significance level, respectively.* *Note: (1) The numbers in parentheses below the estimated coefficients in a model are t-statistics. (2)E-view 8 used for estimate.*

Unit Root Analysis

It is usually a normal practice to conduct a unit root test for each individual time series variable to avoid pseudo regression results. Despite existence of numerous unit root tests such as Kwiatkowski, Phillips, Schmidt, and Shin (KPSS), Ng and Perron (NP) etc. This study employed only two tests Augmented Dickey Fuller and Phillip-Perron unit root tests because they work well in large sample though Phillip-Perron perform much better(Dasgupta, 2009). Therefore, use of two tests aims to provide alternative evidence for authentication of the result. The test results are presented on table 3. Result indicates that LNERM, LNMS, LNGE, LNOP, LNGDP and LNPVE have unit root problem at level but stationary at first difference. LNRER, LNSHTB, LNEXPG and LNIMPG found stationary at level. However, differencing of non stationary variables in our models could not be considered because Augmented Engle–Granger (AEG) indicated in long run variables in the model were moving together. This follows Gujarati, (2004pp822) stating that regression of non stationary individual variables may cancel out their stochastic trends if cointegrated and becomes meaningful (not pseudo). The Engle–Granger test results are presented on table 6 in each particular model under residual diagnostic analysis.

Table 3: Unit Root Test Results

VARIABLE	AUGMENTED DICKEY FULLER			PHILLIPS–PERRON (PP)			REMARK
	Level		First difference	Level		First diff	
	Drift	Drift & Trend	Drift	Drift	Drift & Trend	Drift	
LNERM	-2.9604	-2.9383	-8.0179*	-3.0179	-3.0039	-8.1680*	I (1)
LNRER	-4.6235*	-5.7826	N/A	-4.6997	-5.8036	N/A	I (0)
LNMS	-1.0273	-1.9014	-4.7725*	-0.6337	-1.5943	-4.7993*	I (1)
LNGE	-0.6861	-1.9534	-5.3491*	-0.4257	-2.1174	-5.8083*	I (1)
LNOP	-1.5318	-1.4724	-5.3178*	-1.8785	-1.7761	-5.2840*	I (1)
LNSHTB	-3.6921*	-3.5207	-6.0963*	-3.7324*	-3.4906	-7.0348*	I(0)
LNGDP	4.1616	1.6515	-3.2664**	2.6363	0.6020	-3.1991**	I(1)
LNPVE	0.4190	-2.3099	-6.6832*	1.1450	-2.3342	-6.6692*	I(1)
LNEXPG	-5.1336*	-5.5487*	N/A	-5.2094*	-5.5427*	N/A	I(0)
LNIMPG	-5.6532*	-5.7096*	N/A	5.6728*	5.7096*	N/A	I(0)

* indicates rejection of null hypothesis at 1% significant level, **=0.05

Note

1. All variables with exception of RER and ERM are derived and treated to reflect 2001 Constant Prices hence this analysis is on real terms
2. These variables were measured in natural logarithmic form to account for non-linearity
3. I (0) & I(1) indicates variable is stationary at level & first difference respectively
4. E-view 8 used for estimates

Specification of Models

Log-linear model

The log-linear model involves estimation of the growth curve. The aim is to establish growth trend of variables involved in the study for pre and post economic reform. The estimation is given in three categories i.e. estimation for (1967 to 2013), the estimation before reform (1967 to 1985) and the estimation after reform (1986 to 2013). The aim is determine whether the reform has impact on macroeconomic variables involved in this study.

Hence, Log-Lin Model with and without Dummy variable is used for the growth analysis. The analysis model is presented in *equation 9* adapted from Gujarati, (2004pp178)

$$lnY_t = \beta_0 + \beta_1 t + \beta_2 D + \varepsilon_t \quad (9)$$

Where Yt stand for the variable intended to find growth rate. The t stands for time which takes a value of 1, 2, 3…etc. The D represents policy dummy variable. βs represents coefficients for the variables. The interpretation of β1 is that it represent instantaneously growth rate while taking the antilog of β1 and subtract by 1 we get the compounding growth rate. Normally compounding growth rate is little higher than instantaneously growth rate because of compounding effect. β2 is a dummy variable coefficient which is also known as differential intercept coefficient because it reflect the difference between the category that receive the value of 1 and the intercept herewith referred as a benchmark value (β0). In this case Yt may stand as share of export and import on GDP, Money supply, Government spending excluding investment spending, Private spending, Nominal exchange rate, real exchange rate and Share of trade balance on GDP. Result for this analysis is presented on Table 4.

Generalized Method of Moments

The study employs generalized method of moment (GMM) for estimation which is useful for controlling endogeneity bias. Usually existence of reversal causality between explanatory variable and dependent variable may cause endogeneity bias. (Beck et al. 2000; Kandil & Dincer 2008; Fowewe 2011). Endogeneity in explanatory variables may result into correlation of explanatory variable with error term, which makes use of

ordinary least square inappropriate due to biased estimates. Thus, it is noted that GMM is usefully in determining impact of exchange rate on economic growth. Literature review indicates reversal causal relation between exchange rate and economic growth. For example Balassa Samuelson theorem indicates the causal effect is running from productivity to real exchange rate (Ozbilgin, 2015). On the other hand (Kandil & Dincer, 2008) observed reversal where exchange rate appreciation decreases output. Not only that but government spending and exchange rate found to be correlated by Kandil & Dincer, (2008), thus because they both appear in the model as explanatory variables (X) the use for instrument variables as per GMM is advisable. Literature indicates GMM has been used by number of studies in the related topic such as Schnabl, (2007 & 2009); Abida, (2011) and Hua, (2012).

Therefore to control simultaneity bias we device instrumental variables (z). which are correlated with explanatory variables (real exchange rate, exchange rate shock, exchange misalignment, money supply, government consumption trade and openness) i.e. $E(Z'X) \neq 0$. Moreover, z is chosen to ensure exogeneity with dependent variables that means they are not correlated with the error term i.e. ($E(Z'U) = 0$). The following are the instrument variables used; GE, MS, OP, ESHOC, EXPG, IMPG, ERM, DUMMY and UNSHOC together with their lagged values. However, not all instrument variables utilized in each equation rather inclusion is determined by the over identification test. Hence, GDP model used 11 instruments, PVE model used 12 instruments, whereas EXPG model used only 9 instruments and IMG model used 10 instruments. Hence, J-statistics and its probability are reported on table 6 to indicate validity of the instruments used. It can be noted that explanatory variables features as instrument variables, this is because the predicted or estimated values of the endogenous variables may inter the original equation as true exogenous variable. The predicted or estimated variable solve reversal causality problem.

Equation 10 below represent a model utilized in this study to analysis link between exchange rate economic growth as adapted from (Kandil & Dincer, 2008)

$$Y_t = c + \sum_{j=1}^{k} \alpha_j X_t + \sum_{j=1}^{k} \beta_j Z_t + \mu_t \qquad (10)$$

Where Y stands for dependent variable i.e. LNGDP, LNPVE, LNEXPG and LNIMPG each represent a separate equation. Moreover, X represents a vector of different forms exchange rate variables i.e. exchange rate misalignment and exchange movement (anticipated and unanticipated). Z stands for vector of conditioning information which control other factors associated with economic growth i.e. LNMS, LNGE and Dummy. The study used standard GMM to estimate the model and Hansen test of whether the instrument are correlated with error term is used under the null hypothesis that instruments are not correlated with error term, the test follow χ^2 distribution with (J-K) degree of freedom, whereas J is number of instruments and K is number of regressors.

4. Empirical Results and Analysis

Growth trend

Table 4 present results of the growth trend for seven macroeconomic variables involved in this study. This includes export, import, money supply, government spending, private spending and gross domestic product in real term and nominal exchange rate. Result indicates data fit well the model as evidenced by significant coefficient of determination. Using probability of F-statistic presented in a column P* shows that all models estimates are significant at 1% significant level. The growth estimates for each variable is conducted with and without policy dummy variable.

The growth curves without inclusion of dummy variable indicate that all variables i.e. EXP, IMP, MS, GE, PVE, GDP and NER have significant positive compound annual growth rate (CAGR). The significance is referred from t-statistic of the t coefficient. The positive coefficient indicates increasing trend which accelerate year by year. The nominal exchange rate displays the highest compounding annual growth rate of 16.9 percent followed by import which is 4.1 percent. The lowest growth rate is 3.3 displayed by export variable.

On the other hand inclusion of dummy variable on the model fitted well data on all variables relative to that of no dummy. This is reflected through the improved coefficient of determination in all cases. The introduction of the policy dummy aims to capture the economic reform effect in our variables. Results indicate that dummy variable is significant to all variables except import, which means reform policy brought significant effect on growth rate of GDP, export, money supply, government and private spending. Besides, there is decreasing growth trend as depicted by negative sign on dummy coefficient.

Therefore, this analysis reveals that reform policy has substantial impact in the Tanzanian economy overtime. However, responses of variables differ in terms desirable magnitude and direction. For example nominal exchange rate trend show depreciation of the value of the currency but at decreasing trend. This is perhaps desirable for the economy. Though, we also see increasing GDP but at decreasing trend which is not desirable in the economy. Next section analyzes the link between exchange rate and GDP, export growth, import growth and private spending.

Table 4: Growth Trend Results

Variable	Intercept	t coefficient	Dummy	R^2	F	P*	CAGR (%)
LNEXP	12.781 (12.781)	0.032 (5.467)	N/A	0.399	29.88	1.92E-06	3.29
LNIMP	13.287 (110.54)	0.040 (9.133)	N/A	0.650	83.416	8.22E-12	4.06
LNNER	0.892 (4.296)	0.156 (20.735)	N/A	0.905	429.97	1.16E-24	16.9
LNMS	13.536 (138.90)	0.036 (10.132)	N/A	0.695	102.648	3.45E-13	3.7
LNGDP	14.835 (442.10)	0.037 (30.532)	N/A	0.953	932.18	1.01E-31	3.8
LNGE	12.874 (124.70)	0.039 (10.335)	N/A	0.704	106.81	1.83E-13	3.9
LNPVE	14.487 (409.36)	0.038 (29.753)	N/A	0.951	885.21	3.07E-31	3.9
LNEXP	12.685 (78.105)	0.053 (4.919)	-0.672 (-2.251)	0.461	18.825	1.24E-06	5.46
LNIMP	13.259 (106.103)	0.046 (5.502)	-0.192 (-0.834)	0.655	41.776	6.78E-11	4.7
LNNER	1.162 (7.640)	0.098 (9.673)	1.897 (6.784)	0.954	453.113	4.40E-30	10.3
LNMS	13.408 (189.34)	0.063 (13.464)	-0.897 (-6.891)	0.853	128.09	4.51E-19	6.6
LNGDP	14.799 (519.15)	0.045 (23.677)	-0.251 (-4.790)	0.970	704.81	3.82E-34	4.6
LNGE	12.779 (137.12)	0.059 (9.570)	-0.670 (-3.910)	0.780	78.01	3.41E-15	6.1
LNPVE	14.459 (434.06)	0.044 (20.002)	-0.199 (-3.245)	0.961	541.62	1.03E-31	4.5

Note: (1) The results is base on 47 observation that is from year 1967 to 2013
( ) t-statistics, CAGR refers to compounding annual growth rate (2) Microsoft Excel used for estimates

Exchange rate and Economic growth

The effect of exchange rate movement and misalignment on gross domestic product, private spending, export growth and import growth is estimated in four separate models using generalized method of moments. Results are presented on Table 6 where each column of the dependent variable represents one model based on equation 10. The results indicate there is a significant negative effect of exchange rate misalignment on gross domestic product and growth of export but insignificant effect on private spending and import growth. Coefficient of determination for each of the model found to be significant using probability of F-statistic. Also each model is diagnosed against presence of residual autocorrelation using Durbin Watson statistics and we found all estimations are free from autocorrelation as reported on Table 6. Also the heteroskedasticity Test indicates homogeneity. Moreover, the use of more instrument variables than estimated parameters in each model necessitate a test for over identification restriction, in which we found the orthogonality condition satisfied (see probability of J-statistic on table 6). Thus, all these tests conducted indicate the appropriateness of our estimates as none of them failed.

Misalignment effect seems consistent with Wong, (2013) study in Malaysia which found an increase in real exchange rate misalignment has negative impact on economic growth. Our result also indicates significant negative coefficient of exchange rate misalignment on GDP and export growth. This consistent with (Abida, 2011) findings showing a negative coefficient for misalignment variable, which means that a more depreciated

RER helps growth while more appreciated harms long-run growth. The results confirm second hypothesis that exchange rate misalignment harm economic growth. As highlighted in the introduction section, Tanzania has been experiencing overvaluation with exception of year 1970, 1971 and 1978 indicating undervaluation. This means there is more harm than help on economic growth. The estimation result might be evidence for the slow GDP growth during 1979 to 1988. This is because from 1979 to 1988 there has been wide overvaluation as depicted in Figure 1. Though, trend shows decreasing gap between equilibrium rate and nominal exchange rate after the reform, thus much stability on growth might be achieved as indicated by the increase of GDP growth to 3.04 percent (for 1989 to 1998 average) and 6.62 percent (for 1999 to 2008 average). This study add more evidence to the empirical literature arguing that there is negative impact of overvaluation of real exchange rate on growth.

On the other hand, exchange rate movement impact is separated into two categories; the unanticipated exchange rate movement (unanticipated shock) and anticipated exchange rate movement (anticipated shock). Table 6 results indicates that unanticipated has no effects on all dependent variables i.e. gross domestic product, private spending, export growth and import growth. On contrary anticipated shock appear to have significant effect on GDP, PVE and IMPG but insignificant on export growth. The anticipated exchange rate shock found to have negative coefficient on GDP and IMPG. This means depreciation of the currency lead to decrease in GDP and decrease in import growth. This finding is consistent with large number of literature associating depreciation of currency to the decrease on import. Kandil & Dincer, (2008) states depreciation lead to the increasing the international competitiveness of domestic industries which transform spending from foreign goods to local one. However, we also see depreciation is related to a decrease in GDP which is contrary to many literature to cite few (Kandil & Dincer, 2008; Hua, 2012). The negative effect of depreciation on GDP may be explained through the argument that; depreciation of the domestic currency may lead to increase in price of domestically produced goods if the manufacturing sector depends on imported inputs which would automatically rise cost of production (Kandil & Dincer, 2008). Consistent with factor cost hypothesis which argue the same as stated by Porter (1990) & Harris (2001) cited from Ozbilgin, (2015). The reason behind negative impact of anticipated depreciation on GDP is likely true in Tanzanian case; Table 5 reveals that much of the Tanzania imports are for production support i.e. capital and intermediate goods seems to take more than 70 percent of the total imports.

Table 5: Imports Composition in Tanzania

Period	Consumer goods as a percentage of Total import (5 years average) %	Capital plus intermediate goods as a percentage of Total import (5 years average) %
1986-1990	17.2	82.8
1991-1995	29.7	70.3
1996-2000	40.5	59.5
2001-2005	29.6	70.4
2006-2010	22.6	77.4

Source: Calculated by Author from Tanzania Economic Survey Report of 2011

Moreover, anticipated exchange rate depreciation lead an increase private expenditure. This means depreciation boost up demand. Following the famous Keynesian general theory, deficiency spending or deficiency in aggregate demand is a major economic problem. Therefore, despite a decrease in GDP, depreciation boosts up demand and export growth. Moreover, analysis includes controlling variables such as government spending, money supply and dummy variable. Findings indicate that government spending (GE) which excludes investment spending is found to have significant positive effect on import growth but insignificant on gross domestic product, private spending and export growth. Whereas the increase in money supply (MS) significantly result to the increase in gross domestic product (GDP) and private spending (PVE) but a negative significant impact on import growth. Moreover, dummy variable aiming to capture the effect of economic reform found to be insignificant on GDP and PVE but have a significant positive effect on import growth and export growth. Perhaps the reform policy is yet to attain its full potential. As revealed by growth curve analysis, most of the variables are increasing but at decreasing trend. Though decreasing trend government spending is not unexpected impact, perhaps is the desirable direction as explained by many literatures in favor of liberalization.

Table 6: Generalized Method of Moment Results

	DEPENDENT VARIABLES			
	LNGDP	LNPVE	LNEXPG	LNIMPG
LNERM	-0.1439***	-0.0564	-0.8426***	-0.0015
UNSHOC	-0.0337	-	0.9353	-0.1405
ESHOC	-0.1117***	0.1366***	-0.7814	-1.2162**
NEGSHOC	-	-0.1766	-	-
POSSHOC	-	0.4859	-	-
LNGE	-0.1300	0.0874	0.0726	4.3458***
LNMS	0.6551***	0.4526***	-	-2.7804*
DUMMY	0.0250	-0.0573	6.5404***	5.3199**
C	7.7087***	6.9321***	1.9251	-15.402
DIAGNOSTIC TEST				
R^2	0.92	0.92	0.34	0.32
S.E. of regression	0.1427	0.1554	2.25	2.31
F-Statistic	77.12***	47.54***	4.22***	2.96**
DW (in parenthesis is critical values)	1.727 (1.026-1.648)	1.827 (0.977 – 1.715)	1.9120 (1.099-1.584)	2.1242 (1.0528-1.6442)
Instrument rank	11	12	9	10
J-statistic	4.2727	1.9072	3.1755	3.7917
Prob(J-statistic)	0.3704	0.7528	0.3654	0.2849
Obs after adjustment	42	42	44	44
RESIDUAL TESTS				
Augmented Engle–Granger (AEG)- (test statistic)	-5.6323***	-6.0195***	-6.0482***	-6.1071***
Heteroskedasticity Test Prob. Chi-Square(15)	0.4539	0.2091	0.1347	0.8525
Normality test: Jarque-Bera Prob	0.3945	0.9175	0.4547	0.7291

*** Indicates rejection of the hypothesis at the 0.01 level
** Indicates rejection of the hypothesis at the 0.05 level
* Indicates rejection of the hypothesis at the 0.10 level
Note: (1) Heteroskedasticity Test is Breusch-Pagan-Godfrey established from Two Stage least Square (2SLS) estimates. The F-statistic is as well established from 2SLS because offers close estimates to that of GMM (2) E-view version 8 econometric tool is used for all estimates in this table.

5. Conclusion and Remark

This study examined the impact of exchange rate movement and misalignment on Tanzanian economy. Multiple econometric methods of estimation utilized i.e. ordinary least square and generalized method of moment. The sample period covers 47 years from 1967 to 2013. Findings support our two hypotheses that exchange rate movement has significant effect in Tanzanian economy and exchange rate misalignment has a negative effect on Tanzanian economy.

Moreover, results indicate exchange rate misalignment in particular the overvaluation has negative impact on Tanzanian economy. It shows that overvaluation lead to a decrease in export growth and GDP. Furthermore, result shows that exchange rate movement has significant effect on the economy. That is because anticipated depreciation lead to a decrease in GDP. Though, on the other hand it leads to increase in export growth. The log-linear analysis highlight that reform measures have not attained its full potential. Thus, this study may give insight to policy makers that depreciation policy and overvaluation harm economic growth. Though, depreciation policy may be effective if country will increase its production capacity without dependence on imported capital and intermediate goods. Moreover, if at all the production increases on given condition the much benefit might be archived because depreciation support export growth. Besides, exchange rate should be kept close to the equilibrium level, perhaps by ensuring exchange rate timely adjust to relative inflation changes. Despite insightful findings more researches are required in related topic and future research may consider real effective exchange rate.

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