The Exchange Rate Sensitivity of Foreign Trade: Evidence from Malawi

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Abstract

This study examined the effects of the exchange rate on foreign trade in Malawi. Separate export value and import value models were estimated using the single equation error correction modelling framework proposed by Pesaran et al. (2001). Apart from the real effective exchange rate, the aggregate GDP of Malawi's key trading partners was included in the export value function, while Malawi's own GDP was allowed to explain the value of imports. The findings documented in this paper show that foreign trade in Malawi was not responsive to the real effective exchange rate, both in the long-run and in the short-run. Thus, there was no compelling support for either the Marshall-Lerner condition or the J-curve effect. These results suggest that exchange rate policy should focus more on other national considerations (such as influencing imported inflation) than the trade balance. They particularly imply that welfare maximisation may be attained through exchange rate policy at no opportunity cost of deterioration in the trade balance. They also suggest that Malawi's persistently precarious foreign reserve position is a result more of the unavailability of adequate reserves than the effect of currency overvaluation on trade.

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1. Introduction

This study examined the effects of the real effective exchange rate on the aggregate foreign trade flows in Malawi, in order to inform the formulation of exchange rate policy. Exchange rate policy continues to attract significant interest among economists, because the exchange rate has key theoretical bearings on many macroeconomic variables including the balance of payments, domestic prices and international reserves. Within the context of Malawi, the combination of a low export base and high dependence on imports paused a challenge in terms of preserving the domestic and external values of the local currency (the Malawi kwacha). While the established economic theory posits that an overvalued domestic currency relative to foreign exchange worsens the country's trade balance and foreign reserve position (Marshall, 1923; Lerner, 1944), it is also the case that domestic currency depreciation can be inflationary, especially in highly import-based economies. The latter effect can be described through yet another entrenched theory, the purchasing power parity (PPP) hypothesis seminally popularised by Cassel (1918). As such authorities typically face a crucial dilemma in the exchange rate policy objective function, especially when their capacity to defend the domestic currency is compromised by foreign reserve limitations.

Intuition, observation and analytical work strongly suggested that the exchange rate was a key determinant of domestic prices in Malawi. Immediately upon currency flotation in 1994, the 62.0 percent resultant devaluation of the Malawi kwacha accounted for the most inflationary period in Malawi: annual inflation reached the pick of 60.6 percent in 1995. Mangani (2011) documents evidence that the exchange rate was the single most importance variable in explaining price dynamics in Malawi, and that its effects were transmitted directly rather than through the exchange rate channel of the monetary policy transmission mechanism. Additional evidence in this regard is provided by Ngalawa (2009). On the other hand, although some commentators posit that the welfare implications of currency devaluation outweigh its benefits in Malawi, credible quantitative evidence on the effects of the exchange rate on the country's balance of payments in general - and the trade balance in particular – remained wanting. This paper contributes to this debate by establishing that the exchange rate has no significant effects on Malawi's trade flows.

The paper proceeds as follows. Section 2 discusses Malawi's exchange rate policy developments in order to locate the ensuing analysis in the national context. The methodologies adopted in the study are presented in Section 3, while Section 4 presents the findings. A conclusion in made in Section 5.

2. Exchange rate policy in Malawi[1]

Malawi is a heavily import-dependent economy and exchange rate policy is as crucial as conventional monetary policy. Thus, in addition to the control of demand-pull inflation resulting from swelling money supply, the central bank has to deal with cost-push inflation largely arising from domestic currency devaluation and exogenous shocks. Malawi's foreign reserve position is quite precarious due to excessive dependence on two key but wobbly sources: tobacco exports and development assistance. Failures in rain-fed agriculture and donor inflows induce sometimes unsustainable interventionist activities from the authorities, or directly impact on domestic prices when authorities succumb to the resultant foreign exchange shortages by invoking currency devaluation to address external imbalances. Moreover, the country's land-lockedness and heavy reliance on imported oil for energy have great potential to induce imported inflation and to undermine monetary policy. The exchange rate clearly emerges as the nominal anchor of stabilisation in Malawi.

Various exchange rate regimes have been pursued in Malawi during its history. The Malawi kwacha (MK) was pegged to the British pound sterling (GBP) at one-to-one from 1964 to 1967, and at MK2.00 per GBP between 1967 and 1973. Following the collapse of the Bretton Woods' fixed exchange rate system, the kwacha was pegged to a trade-weighted average of the pound sterling and the United States dollar (US$) from November 1973 to June 1975, and to the Special Drawing Rights (SDR) at almost one-to-one between July 1975 and January 1984. In response to an expansion in Malawi's trade volume and trading partners, the kwacha was subsequently pegged to a trade-weighted basket of seven currencies (US$, GBP, German deutschemark, South African rand, French franc, Japanese yen, and Dutch guilder) between 1984 and 1994. This period was characterised by frequent devaluations implemented in the context of the structural adjustment programmes supported by the International Monetary Fund (IMF), in an attempt to improve the country's export competitiveness and balance of payments position. Five devaluations in the magnitudes of 7 percent to 22 percent against the US$ were effected between February 1986, and August 1992. In February 1994, the kwacha was purportedly floated, and an interbank foreign exchange market was introduced to determine the exchange rate. The current account was liberalised consequently, although the capital account was not liberalised and some exchange controls (such as limitations on foreign exchange allowances for travel, remittances, repatriations and importation of consumer goods) remained in place. The immediate effect of the flotation was a 62.0 percent depreciation of the domestic currency between February and December 1994, from MK5.92 to MK15.58 per US$.

[1] Most of this account is derived from Mangani (2011).

Given the limited number of players on the market which constrained the foreign exchange bidding process, the government adopted a managed floating system in 1995. This system permitted the authorities to intervene in order to artificially influence the exchange rate through sales and purchases of foreign currency, hence managing it within a narrow band. However, the band was removed later in 1998 in favour of a free float, only to be reinstated with a very narrow flexibility range in mid 2006.

Although maintaining stability of the exchange rate is a prime objective of the Government, it is clear that the attainment of this objective is quite a challenge. Due to a multiplicity of factors (such as excessive dependence on imported raw materials, intermediate inputs and final consumer goods; currency over-valuation; a narrow export base), Malawi's trade balance and balance of payments positions are almost perpetually negative, and have been worsening over time (Tables 1 and 2). Thus, the authorities' concerted yearning to prevent adverse fluctuations in the exchange rate exerts a lot of pressure on foreign reserves and the external value of the kwacha, because it reflects a subsidisation of imports.

Table 1 – External trade position (US$ million)

	2002	2003	2004	2005	2006	2007*	2008*	2009	2010*
Total imports	699.6	787.0	932.2	1183.7	1268.5	1436.4	1654.5	1574.674	2325.807
Total Exports	409.6	530.5	483.1	503.7	709.1	920.4	1036.6	1118.117	1062.909
Trade balance	-290.0	-256.5	-449.1	-680.1	-559.4	-516.0	-617.9	-456.556	-1262.9

Source: Government of Malawi, Annual Economic Report, various. *Estimates

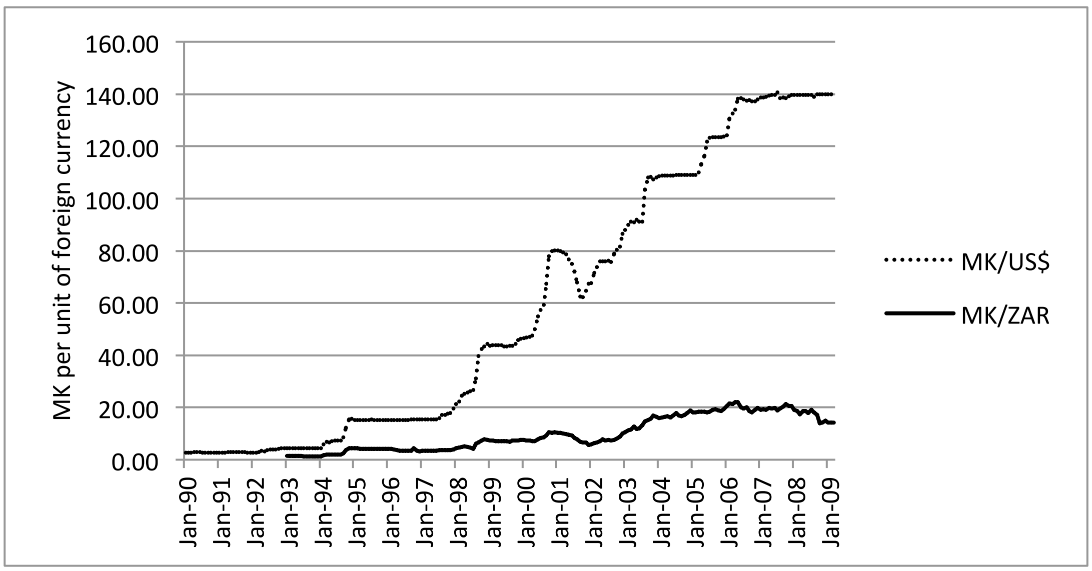
Table 2 – Malawi's balance of payments summary (K million)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Trade balance	-3226	-13895	-24400	-33889	-59369	-67499	-76298	-67316	-74514	-64959
Current account balance	-12831	-28678	-41581	-55232	-83136	-95348	-100592	-92614	-108177	-106105
Capital account balance	20241	15151	14012	29442	35677	28949	64020	68111	101808	141636
Balance before debt relief	559	-5904	-6224	-6774	-12483	-17100	-4535	9061	-7278	-14046
Debt relief	820	2244	4634	5125	7079	14925	155	-	-	-

Source: Reserve Bank of Malawi, Financial and Economic Review, various issues.

Figure 1 shows trends in the nominal exchange rates between the Malawi kwacha and two key currencies, the United States dollar (MK/US$) and the South African rand (MK/ZAR). The figure reveals that pressure on the Malawi kwacha remained steady ever since its flotation in February 1994, leading to a persistent downward trend in the value of the domestic currency. This trend continued until around mid 2006 when authorities unequivocally opted to allow very limited variability in relation to the US$. Thus, the Malawi kwacha depreciated from about MK118 per US$ in 2005 to about MK139 per US$ by May 2006, although it remained pegged around this level (plus/minus MK2.00 per US$) until around November 2009. This was reflective of reversion to the managed floating regime already discussed, and was costly on the limited foreign reserves available to the country. The fact that the rate on the parallel market was usually significantly above the official rate during this period was a telling sign of domestic currency overvaluation[2]. Thus, at US$209.5 million in July 2009, total gross official reserves[3] were only equivalent to 1.6 months of imports (Reserve Bank of Malawi, 2009). This represented a marginal improvement to the level of 1.1 months of imports experienced in January 2009, and 1.3 months in September 2008, all of which were significantly lower than the 2.5 months recorded in December 2005. Gross official reserves were estimated at US$302 million or 2.33 months of imports in November 2010,but increased to the equivalent of 3.11 months in January 2011 on account of increased donor inflows. This increase followed a positive review of the Extended Credit Facility by the IMF in December 2010 (Malawi Savings Bank, 2011).

Figure 1 – Trends in Malawi kwacha exchange rates



Data source: Reserve Bank of Malawi Database

As at 13 May 2011, gross foreign exchange reserves were at $350 million or the equivalent of 2.71 months of imports. This compared favorably with the situation on the same date in 2010, when the reserves stood at $327 million or 2.54 months of imports[4]. However, compared with 2010 when foreign exchange earnings from tobacco stood at $150.6 million by end May, the 2011 tobacco earnings had declined by 78.8 percent to only $31.9 million as at May 2011. Low tobacco proceeds, high import

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[2] The CABS Group, March 2009 CABS Review: Aide Memoir.
[3] Estimate for the entire Banking System, which includes Gross Official Reserves, Foreign Currency Denominated Accounts (FCDAs) and authorized dealer bank's (ADB's) own foreign exchange positions.
[4] Malawi Savings Bank Financial and Economic Report, various.

costs for petroleum products and fertilizers posed challenges on the foreign reserve position. It was officially reported that only about one half of the foreign exchange requirements of importers were backed by export proceeds in 2010 (Government of Malawi, 2011). Since 2009, foreign exchange shortages remained a major factor in stifling industrial growth through fuel shortages and inability to import inputs, and the IMF[5] projected that Malawi's economic growth would continue to slow down as a result of this, from 8.9 percent in 2009 and 6.7 percent in 2010 to 6.1 percent and 5.9 percent in 2011 and 2012, respectively. Responding to this persistent pressure on foreign exchange reserves, the Malawi kwacha weakened and was selling at K147.4 against the United States dollar at the close of December 2009. By end January 2010, the kwacha was trading at around K151.5 per U.S. dollar, and remained around that level throughout 2010 and the first half of 2011. A devaluation of 10 percent was implemented in August 2011 in reaction to the external imbalances.

Given the country's narrow and vulnerable export base, it is difficult to imagine that, in the short- to medium-term, a stable market-determined exchange rate regime could be operated without balance of payments support and other forms of assistance from donors. Yet at the same time, limited flexibility in the exchange rate tended to create persistent external imbalances. Although there was a strong narrative regarding the adverse effects of the country's foreign exchange policies on the trade balance, these effects had not yet been quantified.

3. Theoretical Framework and the Literature

The conventional wisdom that domestic currency devaluation improves the trade balance is rooted in a static and partial equilibrium approach to the balance of payments, called the elasticity approach. This approach is evolutionally formalised in the so-called BRM model due to Bickerdike (1920), Robinson (1947) and Metzeler (1948), which provides a sufficient condition (the BRM condition) for trade balance improvement. In particular, domestic currency devaluation makes domestic goods attractive on the foreign market (hence boosting exports) and foreign goods expensive on the domestic market (hence restricting imports), both of which effects lead to an improvement in the domestic country's trade balance. A particularly stylised form of the BRM condition, popularly called the Marshall-Lerner condition (Marshall, 1923; Lerner, 1944; hereafter the ML condition), states that for a positive effect of devaluation on the trade balance to occur, the sum of the exchange rate elasticities of exports and imports must exceed unity in absolute value terms. When the ML condition holds, the exchange market is implicitly stable since there will be excess foreign exchange when the exchange rate is above the

[5] IMF, World Economic Outlook Report 2011.

equilibrium, and vice versa. As such, the ML condition is a long-run (equilibrium) condition empirically investigated through the exchange rate sensitivity of the imports and exports in level variables.

It is now increasingly recognised that the effects of devaluation on the trade balance occur with a time lag. As first observed by Magee (1973) as well as Junz and Rhomberg (1973), imports and exports adjust to changes with time lags which may take such forms as decision lag, recognition lag, production lag, replacement lag and delivery lag. Importantly, it is argued by some researchers that the trade balance actually deteriorates in the short-run in response to devaluation, but improves over time towards the ML condition. Hsing (1999) argues that the degree of foreign and domestic producer's price pass-through to consumers and the scale of supply and demand elasticities of exports and imports determine the value of the exchange rate effect, and these tend to improve with time. This suggests that there is a short-run discrepancy which is corrected through an adjustment process in each period as the economy progresses to equilibrium (Bahmani-Oskooee and Ratha, 2004). The time path of the effects of devaluation on the trade balance, therefore, traces the so-called J-curve. Empirically, most work on the J-curve effect has benefitted from the application of cointegration and error correction techniques, building on the work of Bahmani-Oskooee (1985).

Models explaining both the ML condition and the J-curve effects typically express the trade balance as a function of domestic income, foreign income and the exchange rate, where the income variables are control variables while interest is on calibrating the exchange rate effects. Exports and imports may also be individually modelled in a similar manner. Mixed empirical evidence exists on the exchange rate sensitivity of the trade balance. A sample of the mixed evidence on the ML condition is in Summary (1989), Nadenichek (2000), Narayana and Narayana (2005), Bahmani-Oskooee and Goswami (2004), and Arize (2001). Equally mixed evidence on J-curve effects has also been documented for many countries, including Japan (Gupta-Kapoor and Ramakrishnan, 1999), Croatia (Tihomir, 2004), the USA (Bahmani-Oskooee and Ratha, 2008; Koch and Rosensweig, 1990;), Taiwan (Hsing, 2003), some ASEAN countries (Onafowora, 2003), as well as a selection of 13 developing countries from Asia, Latin America and Europe (Bahmani-Oskooee, 1991). Kamoto (2006) documents evidence of J-curve effects for South Africa.

Using a vector error correction modeling framework, Kamoto (2006) was unable to find a statistically significant J-curve effect in Malawi, although he was able to detect evidence of the long-run effect. Very little else has been documented on this subject using data from Malawi where debate on the macroeconomic effects of exchange rate policy is rife. The present study applies a recently proposed error correction modeling framework to add to the very limited evidence from Malawi.

4. Methodology

4.1 The models

Building on Bahmani-Oskooee and Goswami (2004) and following Bahmani-Oskooee and Ratha (2008), the following log-linear export value and import value models can be specified:

$$\ln X_t = \alpha_0 + \alpha_1 \ln Y_t^* + \alpha_2 \ln E_t + \mu_{1t} \tag{1}$$

$$\ln M_t = \beta_0 + \beta_1 \ln Y_t + \beta_2 \ln E_t + \mu_{2t} \tag{2}$$

where t denotes time, X_t and M_t are the values of Malawi's exports and imports, while μ_1 and μ_2 are white noise error terms. In addition to the real effective exchange rate (E_t), exports could also depend on the income level of Malawi's trading partners (Y_t^*), while imports could depend on the level of Malawi's income (Y_t). All the variables are expressed in natural logarithmic levels, while α_i and β_j ($i, j = 0,1,2$) are parameters to be estimated. It is expected that both α_1 and β_1 should be positive, indicating that the value of exports increases with Y_t^* while that of imports increases with Y_t, *ceteris paribus*. Since an increase in the real effective exchange rate as reported in the International Financial Statistics (IFS) of the IMF represents an appreciation of the domestic currency relative to foreign currency, it is expected that $\alpha_2 < 0$ and that $\beta_2 > 0$. This is premised on the theoretical proposition that a higher external value of the kwacha makes foreign goods price-attractive to Malawians, and makes Malawian products unattractive to foreigners.

Advances in time series econometrics suggest that in the estimation of long-run relationships such as equations (1) and (2), the short-run dynamics must be incorporated in order to account for the adjustment path towards the long-run. Therefore, the study estimated the following error correction models which do not require explicit unit roots testing, in the spirit of Pesaran et al. (2001):

$$\Delta \ln X_t = a_i Q_{it} + \sum_{i=1}^{m} \rho_i \Delta \ln X_{t-i} + \sum_{i=1}^{m} \delta_i \ln Y_{t-i}^* + \sum_{i=1}^{m} \pi_i \ln E_{t-i} + \phi_1 \ln X_{t-1} + \phi_2 \ln Y_{t-1}^* + \phi_3 \ln E_{t-1} + \varepsilon_{1t} \tag{3}$$

$$\Delta \ln M_t = b_i Q_{it} + \sum_{k=1}^{n} \gamma_k \Delta \ln M_{t-k} + \sum_{k=1}^{n} \lambda_k \ln Y_{t-k} + \sum_{k=1}^{n} \eta_k \ln E_{t-k} + \varphi_1 \ln M_{t-1} + \varphi_2 \ln Y_{t-1} + \varphi_3 \ln E_{t-1} + \varepsilon_{2t} \tag{4}$$

where Δ is the first difference operator and Q_{it} has been added to capture the inclusion of intercept terms, trend terms, dummy variables, and such other deterministic terms that may be suggested by the data generating processes. ε_{1t} and ε_{2t} are white noise error terms. All other variables are as defined for equations (1) and (2), and parameters to be estimated have obvious notation. In these error correction specifications, cointegration is confirmed in the export value function if the ϕ_i coefficients are jointly significant. Similarly, the import value function is cointegrated if the φ_k coefficients are jointly significant. Thus, the cointegartion tests were based on the null hypotheses of $\phi_1 = \phi_2 = \phi_3 = 0$ and $\varphi_1 = \varphi_2 = \varphi_3 = 0$ in the environment of standard Wald tests for linear restrictions. Pesaran et al. (2001) provide the upper and lower bound critical values for resolving this hypothesis, based on the standard *F*-statistics. Cointegration may not be rejected if the *F*-statistic is greater than the upper bound critical value, but may be rejected if the statistic is smaller than the lower bound critical value. A major attractiveness of this procedure is that it can be applied regardless of whether the variables in the system are I(0) or (1) processes, or even a mixture of the two. As such, there is no need to conduct unit root tests on the variables. As its drawback, however, the test becomes inconclusive if the computed test statistic lies between these critical value bounds.

The foregoing procedure provides joint estimates of the short-run and long-run effects of the regressors on exports and imports. For instance, the short-run effect of the exchange rate on export values is jointly measured by π_i coefficients, while its long-run effect is measured by ϕ_3 normalised by ϕ_1 (hence by $-\phi_3/\phi_1$). Similarly, the η_k coefficients jointly measure the short-run exchange rate effect on import values, while $-\varphi_3/\varphi_1$ measures the long-run effect. As such, the tasting framework permits a joint investigation of the long-run ML condition, as well as the short-run J-curve dynamics.

In order to determine the appropriate orders of lagged terms (that is, the values of m and n), initial guidance was based on the minimisation of standard model selection criteria (namely the Akaike information criterion (AIC), the Schwarz Bayesian criterion (SBC) and the Hannan-Quinn criterion (HQC)). However, due attention was put on ensuring that the resulting models could account for serial correlation of at least the forth order using the Breusch-Godfrey Lagrange multiplier (B-G LM) test, and extra lags were accordingly included if thus necessary. Further diagnostic checks conducted to establish model adequacy were Ramsey's regression specification error test (RESET) for the inclusion of quadratic and cubic terms, and Engel's autoregressive conditional heteroscedasticity (ARCH) test of up the forth order. Remedial measures for any evident diagnostic lapses were evoked as described in Section 5.1.

4.2 Variables and data

The values of Malawi's exports and imports (in f.o.b and c.i.f terms, respectively) as well as Malawi's nominal GDP and real effective exchange rate were used in the study. Values in local currency were converted to US dollar equivalents at the officially supplied exchange rates. Appendix 1 shows Malawi's nineteen most important trading partners which accounted for about 71 percent of Malawi's total trade in 2010. Of these, adequate data were not available for Mozambique, Swaziland and Zimbabwe, such that the income level of Malawi's trading partners (Y_t^*), expressed in US$ terms, was computed as the sum of the nominal GDPs of the remaining sixteen trading partners.

The study used quarterly data for the period 1980Q1 – 2010Q2. Most of the data used were obtained from the IMF's International Financial Statistics (IFS) online database, but data gaps were filled through recourse to various issues of the Financial and Economic Review of the Reserve Bank of Malawi and other online data sources, and through interpolation. Importantly, since GDP data did not exist at the quarterly frequency for many countries including Malawi, or only existed for part of the sampling period for other countries, they were interpolated with the use of individual countries' export values as follows:

$$Y_{tTi} = \frac{X_{tTi}}{X_{Ti}} Y_{Ti} \tag{5}$$

where Y_{tTi} and X_{tTi} are the GDP and export values in quarter *t* of year *T* for country *i*, while Y_{Ti} and X_{Ti} are the GDP and export values for country *i* in year *T*. Although this interpolation process is not error-free (and none is!), the data thus generated alongside cases where actual quarterly GDP series were available had much smaller discrepancies compared with using the alternative index of industrial production (IIP) in place of export values. In addition, this process was preferred since the sum of quarterly export values is a meaningful statistic as opposed to the sum of quarterly IIP observations.

The foregoing discussion indicates that the data were compiled on five variables, namely the value of Malawi's exports (X), the value of Malawi's imports (M), the GDP in Malawi (Y), the total GDP of Malawi's trading partners ($Y*$) as well as Malawi's real effective exchange rate (E). Time plots of the natural logarithms of the five variables are presented in Appendix 2. It is reasonable to suspect that seasonality was prevalent in some of the series. To address this, the following regression was fitted on each of the five variables:

$$V_t = \psi_1 + \psi_2 d_{2t} + \psi_3 d_{3t} + \psi_4 d_{4t} + \upsilon_t \tag{6}$$

where V_t is the series being tested for seasonality, d_{jt} assumes a value of unity in the *j*th quarter of the year and zero otherwise, and ψ_j are parameters to be estimated. Seasonal effects were said to be prevalent if at least one of the ψ_j coefficients was significant at 5 percent significance level. The results of this procedure revealed that seasonal effects were in fact present in the X_t and the Y_t series, but not in the rest. The evident seasonality was eliminated by noting that the corresponding $\hat{\upsilon}_t$ series represented the deseasonalised V_t series in such instances.

Further to the above, all the variables except the real effective exchange rate also showed an upward trend which could potentially be deterministic. A downward deterministic trend in the exchange rate (consistent with persistent depreciation of the Malawi kwacha in real terms) could also be suspected. The effect of currency floatation was also noticeable through a downward spike which reached its floor during the last quarter of 1994, but this effect clearly died off within 1994. Based on these observations, and since currency flotation occurred in the 1994Q1, the study attempted to include the trend and intercept terms, and a dummy variable which assumed a value of unity for all 1994 observations and zero otherwise. However, the estimated coefficients of the trend term and the currency floatation dummy variable were persistently insignificant at 5 percent. Therefore only the intercept terms were included in the final models in order to avoid undue loss of degrees of freedom. In the ensuing analysis, the intercepts for the two models are denoted a and b, respectively. All the estimations and tests were conducted using the EViews 7 package.

5. Results and Discussion

5.1 Model specifications and diagnostics

The results of the lag order selection process for differenced terms as well as the B-G LM tests are presented in Table 3 for both the export value model (Panel A) and the import value model (Panel B). While both the SBC and HQC suggested a lag of 1 for the export value model, the resulting regression was unable to account for serial correlation. Similarly, some evidence of first order serial correlation was apparent (although only at 10 percent significance level) in the 2-lag model suggested by the AIC. A lag order of three was acceptable in terms of accounting for serial correlation, despite that it was not preferred by any of the three criteria. Similarly, the parsimonious one-lag import value model suggested by the SBC and HQC showed signs of serial correlation that was effectively corrected through the inclusion of three lags instead of one, but adding a forth lag appeared rather unrewarding in terms of the serial correlation structure. Therefore, three lags in differenced terms were included in both models.

Table 3: Model selection statistics

Panel A: Export value model					
Lag	Selection Criteria Statistics			B-G LM Test	
	AIC	SBC	HQC	χ_1^2 (p)	χ_4^2 (p)
1	0.241	0.412*	0.315*	0.306 (0.083)	12.400 (0.015)
2	0.233*	0.466	0.328	3.611 (0.057)	5.693 (0.223)

3	0.251	0.556	0.375	1.976 (0.160)	4.912 (0.296)
4	0.287	0.665	0.440	1.589 (0.207)	10.925 (0.027)
Panel B: Import value model					
Lag	Selection Criteria Statistics			B-G LM Test	
	AIC	SBC	HQC	χ_1^2 *(p)*	χ_4^2 *(p)*
1	-0.181	-0.018*	-0.115*	1.236 (0.266)	16.862 (0.002)
2	-0.186	0.047	-0.090	6.907 (0.009)	9.888 (0.042)
3	-0.215	0.091	-0.091	0.268 (0.605)	4.294 (0.368)
4	-0.219*	0.159	-0.065	2.448 (0.118)	2.950 (0.566)

Notes: χ_1^2 and χ_4^2 are the B-G LM test statistics under the null hypotheses of no 1st order and 4rd order serial correlation respectively, and *(p)* denotes the corresponding probabilities of accepting such null hypotheses. * identifies the suggested model under each criterion.

Table 4 shows that Ramsey's RESET yielded insignificant statistics at the 5 percent significance level for the two regression models investigated, suggesting that there were no gulling signs of incorrect functional form. On the other hand, the ARCH test suggested the presence of conditional heteroscedasticity in the import value model but not the export value model. Therefore, the export value regression was estimated using the ordinary least squares (OLS) method, while the import value regression was estimated as a first order generalised ARCH processes (that is, a GARCH (1,1) process) to account for the observed ARCH effects. Maximum likelihood estimation was accomplished in estimating the latter model by employing the Marquadt optimisation algorithm. The estimated GARCH model showed that the resultant error terms were conditionally normally distributed – the Jarcque-Bera test statistic yielded a probability value of 0.727 – implying that there was no necessity for invoking quasi-maximum likelihood assumptions and generating robust standard errors and covariances, as would be required if conditional normality did not hold. Moreover, setting a smoothing parameter of 0.8 in backcasting the pre-sample variance for GARCH seemed conservatively reasonable: the conclusions reported in this paper were sturdily strengthened as this value approached unity (that is, as the assumed pre-sample variance approached the unconditional variance).

Table 4: Diagnostic tests for selected models

Model	Ramsey's RESET Test		Engel's ARCH Test	
	F_2 *(p)*	F_3 *(p)*	χ_1^2 (p)	χ_4^2 (p)
Export value	0.682 (0.411)	0.514 (0.599)	0.030 (0.864)	1.844 (0.764)
Import value	0.659 (0.419)	0.547 (0.581)	1.504 (0.220)	14.903 (0.005)*

Notes: F_2 and F_3 are the test statistics for investigating the appropriateness of quadratic and cubic models, respectively. Similarly χ_1^2 and χ_4^2 are the test statistics for ARCH(1) and ARCH(4) effects, respectively. In each case, (p) denotes the corresponding probability value under the respective null hypotheses of correct specification or no conditional heteroscedasticity. * indicates that the appropriate null hypothesis may be rejected at 5% significance level.

Full estimation results are presented in Table 5, in which Panel A shows the results of estimating the export value regression model, while Panel B shows similar results for the import value model. The models only explained 26 percent and 17 percent of the variability in the values of exports and imports, providing *prima facie* evidence against the validity of the underlying theories. The sturdily significant GARCH term coefficient buttressed the observation of ARCH effects in the import value model. Results for formal tests of the long-run and short-run exchange rates effects on trade are analysed in the sequel.

Table 5: Estimation Results

Panel A: Export value model				Panel B: Import value model			
Variable	Coefficient	t-Statistic	Prob.	Variable	Coefficient	t-Statistic	Prob.
a	0.303	0.168	0.867	b	2.571	2.338	0.019
ΔLnX_{t-1}	-0.237	-1.961	0.053	ΔLnM_{t-1}	-0.190	-1.048	0.295
ΔLnX_{t-2}	-0.309	-2.874	0.005*	ΔLnM_{t-2}	-0.347	-2.399	0.016
ΔLnX_{t-3}	-0.170	-1.662	0.100	ΔLnM_{t-3}	-0.190	-1.678	0.093
ΔLnY^*_{t-1}	-1.413	-1.376	0.172	ΔLnY_{t-1}	-0.010	-0.076	0.940
ΔLnY^*_{t-2}	-1.526	-1.774	0.079	ΔLnY_{t-2}	0.069	0.765	0.444
ΔLnY^*_{t-3}	-0.591	-0.699	0.486	ΔLnY_{t-3}	-0.077	-1.032	0.302
ΔlnE_{t-1}	0.402	1.761	0.081	ΔlnE_{t-1}	-0.111	-0.353	0.724
ΔlnE_{t-2}	-0.138	-0.527	0.599	ΔlnE_{t-2}	0.577	1.746	0.081
ΔlnE_{t-3}	0.154	0.501	0.617	ΔlnE_{t-3}	0.331	1.111	0.267
LnX_{t-1}	-0.334	-2.863	0.005*	LnX_{t-1}	-0.117	-1.003	0.316
LnY^*_{t-1}	0.117	1.0516	0.295	LnY_{t-1}	-0.044	-0.367	0.714
LnE_{t-1}	-0.267	-1.463	0.146	LnE_{t-1}	-0.395	-2.965	0.003
				Variance equation			
$\bar{R}^2$ = 0.259				*Intercept*	0.002	1.095	0.274
F = 4.409				*ARCH(1)*	0.170	1.473	0.141
Prob (F) = 0.000				*GARCH(1)*	0.790	5.829	0.000
				$\bar{R}^2$ = 0.171			

Note: * denotes statistical significance before any normalisation procedures, at 5% significance level or lower.

5.3 Long-run effects

Cointegration test results under the aforesaid null hypotheses are summarised in Table 6. The critical values used were from Pesaran et al. (2001), as presented in their Table C1.iii. In both models, the test statistics fell in the region between the lower bound and upper bound critical values at the 5 percent significance level, suggesting that the test was inconclusive. While this did not suggest a rejection of the cointegration hypothesis *per se*, it did not suggest evidence of the same either. However, at the 10 percent significance level, some weak evidence of cointegration was prevalent in the export value model, and the test statistic for the import value model was notably much closer to the upper bound critical value than it was to the lower bound critical value. The inconclusive test result, therefore, seemed to tilt more towards not rejecting cointegration rather than rejecting it.

Table 6: Cointegration Test Results

Model	Null Hypothesis	F-Statistic	5% Critical Values		10% Critical Values	
			CV_L	CV_U	CV_L	CV_U
Export value	$\phi_1 = \phi_2 = \phi_3 = 0$	3.866	3.23	4.35	2.72	3.77
Import value	$\varphi_1 = \varphi_2 = \varphi_3 = 0$	3.230	3.23	4.35	2.72	3.77

Note: CV_L and CV_U are the lower bound and upper bound critical values provided by Pesaran et al. (2001).

Subject to the admissibility of this vacillating evidence of cointegration, the long-run sensitivities of export and import values to the real effective exchange rate were established through normalisation, as follows:

Export value model: -0.798

Import value model: -3.379

These normalised effects appeared large, but should obviously be interpreted within the context of statistical significance. The χ_1^2 Wald test statistics computed under the null hypotheses that $-\phi_3/\phi_1 = 0$ and $-\varphi_3/\varphi_1 = 0$ were respectively equal to 1.585 and 1.360, with probability values of 0.208 and 0.244. This suggested that there were no significant long-run effects of the real effective exchange rate on either export values or import values, which was consistent with the observation that cointegration could not be unequivocally established in the first place. Although the lnE_{t-1} coefficient was significant in the import value model, it follows that this result was more spurious than credible.

5.3 Short-run effects

Table 5 above shows that all the first differences of the real effective exchange rate were insignificant at the 5 percent significance level in both the export value model and the import value model (although there were traces of statistical significance at 10 percent), and that a key source of the scanty explanatory power in the models was autoregressive terms and non-normalised (spurious) long-run effects.

In the spirit of Granger-causality testing, the joint significance of each exogenous variable's lagged difference terms was evaluated as reported in Table 7. Clearly, the real effective exchange rate terms were completely unimportant (as were the income variable terms) in explaining both export values and import values.

Table 7: Joint short-run effects

Panel A: Export value model		
Effect	Null Hypothesis	F-Statistic *(p)*
Own	$\rho_1 = \rho_2 = \rho_3 = 0$	2.830 (0.042

Trade partners' GDP	$\delta_1 = \delta_2 = \delta_3 = 0$	1.599 (0.194)
Exchange rate	$\pi_1 = \pi_2 = \pi_3 = 0$	1.210 (0.310)
Panel B: Import value model		
Effect	Null Hypothesis	*F*-Statistic *(p)*
Own	$\gamma_1 = \gamma_2 = \gamma_3 = 0$	1.995 (0.119)
Malawi's GDP	$\lambda_1 = \lambda_2 = \lambda_3 = 0$	1.449 (0.233)
Exchange rate	$\eta_1 = \eta_2 = \eta_3 = 0$	1.461 (0.230)

Note: *(p)* denoted the probability of accepting the corresponding null hypothesis of joint insignificance. * denotes statistical significance at 5% or lower.

6. Conclusion

This study jointly examined the effects of the exchange rate on the aggregate trade balance in Malawi. Both the long-run effects postulated in the Marshall-Lerner condition, as well as the short-run effects proposed by the J-curve theory were simultaneously explored. Separate export value and import value models were estimated using the single equation error correction modelling framework proposed by Pesaran et al. (2001). Apart from the real effective exchange rate, the aggregate GDP of Malawi's key trading partners was included in the export value function, while Malawi's own GDP was allowed to explain the value of imports. The inclusion of a dummy variable to account for foreign exchange liberalisation in 1994 was unrewarding in both models. Similarly, the inclusion of a trend term was found to be gratuitous, even though this was suggested in a graphical display of the series.

The findings documented in the paper show that the trade balance in Malawi was not sensitive to the real effective exchange rate, both in the long-run and in the short-run. Evidence of a long-run (equilibrium) relationship could not be forcefully established in either the export value or the import value models. Even when this was optimistically assumed, the normalised exchange rate elasticities of export values and import values were not significantly different from zero. Similarly, the exchange rate variable did not have any short-run effects on export values or import values, both of which were scantily explained by their own lagged values in the short run.

That the trade balance in Malawi was not sensitive to movements in the real effective exchange rate is explainable from an examination of the constituents of exports and imports. Tobacco was Malawi's dominant export, accounting for 59.5 percent of the value of Malawi's total exports in 2010 according to the Government of Malawi's National Statistical Office (see http://www.nso.malawi.net). Uranium had recently become a distant second at 11.6 percent of export value in 2010, followed by tea at 8 percent. Tobacco production was entrenched in the economy of Malawi to the point that it could not respond to changes in world prices, let alone exchange rates which were generally fixed in nominal terms. The so-called cobweb phenomenon in agricultural production suggested that the time lag with which even the most rational farmers could react to changing market conditions was generally long, and a significant proportion of tobacco production in Malawi was by smallholder farmers with limited options and constrained flexibility in decision-making. Similar arguments could be made regarding the rest of Malawi's key exports. On the other hand, the country's imports tended to be dominated by necessities. Fertilizers were most dominant, and accounted for 14.4 percent of the total import bill in 2010, followed by petroleum products (14.0 percent) and medicines (7.1 percent). Significant amounts of the import bill were also attributable to machinery plant and laboratory equipment. It is overly presumptuous to expect that such imports should be responsive exchange rate changes.

The findings of this study suggest that exchange rate policy should focus more on other national considerations (such as influencing imported inflation) than the trade balance. They particularly support a contentious proposition that exchange rate policy can be applied to achieve welfare maximisation at hardly any opportunity cost of deterioration in the trade balance. The results also suggest that the country's persistently precarious foreign reserve position is a result more of the unavailability of adequate reserves than the effect of currency overvaluation on trade.

It is possible that the results reported in this paper are a construct of aggregation bias, implying that a study of bilateral trade flows between Malawi and its individual trading partners might yield different results. Potentially different results could also obtain if the responsiveness of key individual imports and exports (as opposed to aggregates) were explored. Such reasoning could inform the direction of subsequent research.

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Appendix 1: Malawi's Major Trading Partners (2010)

Country	% of Total Exports	% of Total Imports	% of Total Trade
Belgium	-	16.73	5.16
China	5.93	3.28	5.11
Denmark	1.08	-	0.75
Egypt	0.34	8.31	2.80
France	1.78	-	1.23
Germany	0.88	4.16	1.89
India	5.42	2.05	4.38
Japan	1.71	-	1.19
Kenya	2.09	1.08	1.78
Mozambique	6.14	3.57	5.35
Netherlands	1.55	4.74	2.53
RSA	29.54	7.60	22.78
Russia	-	2.60	0.80
Swaziland	0.43	1.21	0.67
Tanzania	1.75	0.31	1.31
UK	3.73	4.93	4.10
USA	2.22	4.32	2.87
Zambia	3.95	3.97	3.95
Zimbabwe	1.41	4.65	2.41
Total	69.94	73.51	71.04

GoM, National Statistical Office (2010)

Appendix 2 – Time Plots of the Variables (in Natural Logarithmic Form)