# RURAL ECONOMY

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Staff Paper 93-03

# STAFF PAPER

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# Trade Balance and the J-Curve Phenomenon in Malawi

## Abstract

The effects of successive currency devaluations, since the 1980s, on Malawi's trade balance are analysed. The major hypothesis tested is that currency devaluation leads to an improvement in trade balance through changes in the real exchange rate. This hypothesis is not supported by the data for Malawi. Although there is evidence of a lagged adjustment yielding an improvement in the trade balance three years after devaluation, the magnitude of this improvement is insufficient to overcome the initial decline in the trade balance following devaluation. The extent of improvement is not consistent with that implied by the hypothesized J-curve effect. The analysis suggests that a one percent rise in real domestic income results in a 0.90 per reduction in the trade balance, whereas a one percent increase in real foreign income results in a 0.27 per rise in the trade balance. The lack of responsiveness of Malawi's trade balance to changes in foreign income may be associated with the unmanufactured nature of Malawi's export commodities and the relatively unfavorable market conditions for these exports in the major importing western countries. Other policy measures than those that have been relied on to date are evidently necessary for the desired improvements in trade balance to be achieved.

**Introduction**

Successive devaluations of the Malawi Kwacha do not appear to have led to an improvement in the trade balance, in contrast to expectations based on international trade theory. Such apparent failures of the trade balance to respond positively to devaluation-induced relative price changes have often been attributed to a temporary lag in the adjustment of exports and imports, a hypothesized phenomenon termed the J-Curve effect. Factors contributing to a possible J-Curve effect include low trade elasticities, economic rigidities, contractual obligations, or lags in production cycles. The J-curve describes an initial post-devaluation decline in the trade balance, attributable to increased expenditures on import transactions contracted before the devaluation, and a lagged response in production adjustments, prior to overall trade balance improvement. This study seeks to determine whether the J-Curve phenomenon has applied in the adjustment of Malawi's trade balance after the series of currency devaluations that occurred, as part of the structural adjustment process, since the early 1980s.

In general, empirical evidence on the effects of currency devaluation on trade balance appears inconclusive. The results of one of the earliest studies (Laffer, 1973) of the time pattern of the trade balance following devaluation in the 1960s, showed that this led to an improvement in trade balance one year later in only eight of the fifteen countries considered. This improvement does not seem to have lasted longer than two to three years. There was evidence of a J-curve in four countries. A study by Salant (1975) also indicates that the effect of currency devaluation on trade balance in both developing and developed countries is unclear. Miles (1974) observes that the results obtained in some earlier studies may have been influenced by the failure to incorporate the effects of time and domestic policy on trade flows and the use of annual data. Miles' use of quarterly data and residuals as indicators of trade flows does not support the hypothesis that devaluation improves trade balance, even after allowing for a time lag. However, the different approach applied by Himarios (1985) to Miles' data suggested that a devaluation generally improves the trade balance. The J-Curve phenomenon has not been tested for

Malawi or several other African countries. This study assesses whether the phenomenon may explain the apparent lack of response of the balance of Malawi's trade to successive devaluations.

**Conceptual Framework**

Analyses of currency devaluation and trade balance should consider the specification of domestic demand for imports and foreign demand for domestic exports or excess supply. Domestic demand for imports is derived from the postulates of utility maximization which assume that a consumer chooses a bundle of goods that maximizes satisfaction subject to a given budget constraint. Summation over consumers yields aggregate demand. The aggregate domestic demand for imports can be presented as:

$$M_t = M_t \left(\frac{eP_M^*}{P_N}, Y_t\right), \qquad (1)$$

where $M_t$ is the quantity of imports, $P_M^*$ and $P_N$ are prices for imports and non-tradable goods, respectively (with $P_M^*$ indicating the foreign currency denominated price of imports); $Y_t$ is real domestic income; and e is the nominal exchange rate, expressed in units of domestic currency per unit of foreign currency.

The supply of domestic exports, derived from the theory of profit maximization, yields output supply as a function of input and output prices, giving domestic export supply as:

$$X_t = X_t \left(\frac{P_X}{P_N}, Y_t^*\right), \qquad (2)$$

where $P_X$ and $P_N$ are prices of export and non-tradable goods respectively, expressed in Malawi Kwacha, and $Y_t^*$ denotes foreign real income (in US dollars) which is included to account for shifts in the supply function resulting from external influences. The difference between (2) and (1) constitutes the trade balance $TB_t$:

$$TB_t = X_t \left( \frac{P_X}{P_N}, Y_t^* \right) - M_t \left( \frac{eP_M^*}{P_N}, Y_t \right) . \tag{3}$$

This reduces to:

$$TB_t = TB_t \left( \frac{P_T}{P_N}, Y_t^* , Y_t \right) . \tag{4}$$

where $P_T$ is a weighted average of export and import prices.

Assuming the Marshall-Lerner condition is satisfied, it is expected that: $\partial TB_t / \partial (P_T / P_N)$, $\partial TB_t / \partial Y_t^* > 0$, and $\partial TB_t / \partial Y_t < 0$. That is, an increase in the relative price of exports and imports is expected to have a positive effect on the trade balance and this balance is expected to increase with increases in real foreign income, and to decrease with increases in real domestic income.

The immediate effect of a currency devaluation is to increase the price of imported goods relative to domestic goods. The quantity of imports demanded is expected to fall as the quantity of domestic currency required to purchase the same unit of foreign currency rises. Further, the volume of exports is expected to rise as domestic producers expect to receive a larger quantity of domestic currency for the same unit of foreign currency. However, the J-curve effect relates to a time lag in the adjustment of exports and imports. An initial deterioration in trade balance may arise from increased expenditure on import transactions that were contracted before the devaluation and a lagged response in production. Carbaugh (1980) observes that a lag in adjustment may be caused by failure to recognize a change in competitive conditions, uncertainty in forming new business connections and placing new orders, lag in delivery between the time new orders are placed and the time relative price changes have an impact on trade and payments flows, as well as replacement and production lags.

## Model Specification

The basic model, derived above, is:

$$TB_t = \alpha_0 + \alpha_1 RER_t + b_1 Y_t^* + b_2 Y_t + \varepsilon_t. \quad (5)$$

where $TB_t$ is the trade balance, $RER_t$ is the real exchange rate, measured as a ratio of the price of traded and non traded goods ($P_T/P_N$), and Y and $Y^*$ represent real domestic and foreign incomes, respectively. The effect of successive devaluations in Malawi may be underestimated if domestic market liberalization policy, part of the IMF-sponsored structural adjustment programme, and closure of the Mozambique trade route are not recognized in the analysis. The model is, therefore, modified as:

$$TB_t = \alpha_0 + \alpha_1 RER_t + b_1 Y_t + b_2 Y_t^* + b_3 LIB + b_4 PORT + \varepsilon_t. \quad (6)$$

where "PORT" is a dummy variable that takes the value of one from 1973 (the period in which the Mozambique ports were constantly under military siege and eventually closed) and is otherwise zero; LIB is a liberalization dummy variable that takes the value one from 1985 and is otherwise zero.

Based on the hypothesis of a partial adjustment process in the response of trade flows, a partial adjustment model is tested in the study. For purposes of comparison, and following Bahmani-Oskooee (1985), an Almon distributed-lag model is also applied.

**Almon Distributed-Lag (ADL) Model**

Consider an finite distributed-lag model of the following form:

$$Y_t = \alpha + \beta_0 X_{t-1} + \beta_2 X_{t-2} + .... \beta_k X_{t-k} + \mu_t. \quad (7)$$

From Weiestrass's theorem, Almon assumes that $\beta_i$ can be approximated by a suitable-degree polynomial in i, the length of the lag (Gujarati, 1988); i.e.,

$$\beta_i = \alpha_0 + \alpha_1 i + \alpha_2 i^2 + .... + a_m i^m, \quad (8)$$

where m is the degree of the polynomial. Substituting equation (8) into (7) gives:

$$\begin{aligned} Y_t &= \alpha + \sum_{i=0}^{k} (\alpha_0 + \alpha_1 i + \alpha_2 i^2 + \dots \alpha_m i^m) X_{t-i} + u_t \\ &= \alpha + \alpha_0 \sum_{i=0}^{k} X_{t-i} + \alpha_1 \sum_{i=0}^{k} i X_{t-i}\ \alpha_2 \sum_{i=0}^{k} i^2 X_{t-i} \dots \alpha_m \sum_{i=0}^{k} i^m X_{t-i} + \mu_t . \end{aligned} \tag{9}$$

Substitution of (9) into (5) gives the following estimating equation:

$$TB_t = \alpha_0 + \sum_{i=0}^{k} \beta_i\, RER_{t-1} + b_1 Y_t + b_2 Y_t^* + b_3 LIB + b_4 PORT + \varepsilon_t \tag{10}$$

**Partial Adjustment Distributed-Lag (PADL) Model**

This model provides an explicit framework to incorporate inertia and rigidities in trade balance adjustment. In the context of currency devaluation, it is hypothesized that the current value of the real exchange rate $RER_t$ determines the desired trade balance $TB_t^*$:

$$TB_t^* = \alpha_0 + \alpha_1 RER_t + \nu_t \tag{11}$$

However, the dependent variable adjusts only by some fraction ($\gamma$) of the desired adjustment in one period. Thus:

$$TB_t - TB_{t-1} = \gamma (TB^* - TB_{t-1}) \tag{12}$$

where $0 < \gamma < 1$ . Combining (11) and (12) yields:

$$TB_t = \alpha_0 \gamma + \alpha_1 \gamma RER_t + (1-\gamma) TB_{t-1} + \nu_t \tag{13}$$

which transforms to the following geometric lag model:

$$\begin{aligned} TB_t &= \alpha_0 + \alpha_1 \gamma RER_t + \alpha_2 \gamma (1-\gamma) \sum_{i=0}^{k} RER_{t-1} + \alpha_3 \gamma (1-\gamma)^2 \sum_{i=0}^{k} RER_{t-2} \\ &+ \dots + \alpha_m (1-\gamma)^{m-1} \sum_{i=0}^{k} RER_{t-i} + \nu_t \end{aligned} \tag{14}$$

Substituting (14) into (6) gives the estimating equation:

$$TB_t = \alpha_0 + \alpha_1\gamma RER_t + \alpha_2(1-\gamma)\sum_{i=0}^{k} RER_{t-1} + \alpha_3(1-\gamma)^2 \sum_{t}^{k} RER_{t-2} \qquad (15)$$

$$+ \dots + \alpha_m(1-\gamma)^{m-1}\sum_{i=0}^{k} RER_{t-i} + b_1\gamma Y_t + b_2\gamma Y^* + b_3\gamma LIB + b_4\gamma PORT + v_t$$

## Data

The static model and the two dynamic models outlined above are tested on annual data from 1964 through 1990. The measurement of trade balance as a ratio of export and import values facilitates transformation into logarithms. Value of exports and imports are from the Reserve Bank of Malawi. $P_N$ is measured as the GDP deflator of the Government of Malawi; real domestic income is represented by GNP; real foreign income is proxied by the world production index (World Bank; IMF).

## Empirical Estimation, Results, and Discussion

The length of the polynomial for the Almon distributed-lag model was determined by sequential testing of restricted models with reduced lag lengths against an unrestricted upper bound model. Based on Laffer's study, a five year lag was chosen as the upper bound. The likelihood ratio test and Schwartz-Criterion (SC) statistic as discussed in Judge et al. were used to choose lag length. Test results suggest a three-year lag as an appropriate polynomial length. A sequential testing procedure was used in discriminating between lower and higher order polynomials. The t-statistics and the Swartz Criterion for third order and second order polynomial regression equations suggest that a second order polynomial fits the data better.

Since initial diagnostic tests to check for the presence of serial correlation identified a second order autocorrelation structure, the modified Cochrane-Orcutt procedure, as discussed by White et al. was used to estimate both the static and Almon distributed-lag models. The dynamic partial adjustment model was estimated using the non-linear maximum likelihood procedure provided by Shazam (White et al., 1993). The estimated parameters are reported in Table 1.

With the exception of the real exchange rate and the liberalization dummy variable, the coefficient estimates generated by the three models have expected signs and are significantly different from zero. The error processes in each of the models constitute white noise. Although there is no evidence of misspecification for any of the three models, the Akaike Information Criteria suggests the partial adjustment model best fits the data.

**Effect of the Real Exchange Rate on Trade Balance**

The tested hypothesis that currency devaluation leads to an improvement in the trade balance through changes in relative prices or the real exchange rate is not supported. The partial adjustment model suggests that a one percent rise in the real exchange rate is associated with a 0.9 percent decline in the trade balance as measured by the export-import ratio. The deterioration in the trade balance immediately following a devaluation is expected to be due to a rise in the cost of imports associated with the devaluation.

**The J-Curve Effect**

The results of the partial adjustment model suggest that some 67 percent of the adjustment in the trade balance occurs in the year following a devaluation. The Almon model suggests that a one percent change in the real exchange rate is eventually associated with a 0.30 percent rise in the trade balance three years after a devaluation. However, the lagged improvement in the trade balance does not appear to be sufficient to offset the deterioration in the first two years after a devaluation as required for the full expression of the J-Curve phenomenon.

**Table 1. The Effect of Currency Devaluation on Malawi's Trade Balance 1965-1989**

| | Static | ADL | PADL |
|---|---|---|---|
| **C** | 2.45* (0.0039) | 2.25* (0.0042) | -0.072* (0.017) |
| **RGN** | -0.75* (0.00018) | -0.71* (0.00022) | -0.90* (0.00027) |
| **RWP** | 0.18* (0.00043) | 0.19* (0.00029) | 0.27* (0.00078) |
| **RER** | -0.77* (0.0053) | -0.24 (0.0049) | -0.90* (0.0065) |
| **LRER1** | - | -0.33* (0.0020) | - |
| **LRER2** | - | -0.16* (0.0023) | - |
| **LRER3** | | 0.30* (0.0039) | |
| **LIB** | -0.031* (0.0062) | -0.051* (0.00057) | -0.054* (0.0020) |
| **PORT** | -0.11* (0.0013) | -0.25* (0.0011) | -0.19* (0.0028) |
| **$\gamma$** | - | - | 0.67* (0.15) |
| **Adj-$R^2$** | 0.98 | 0.98 | |
| **AIC** | -10.11 | -10.30 | -10.34 |

Standard errors are given in brackets;
C = Intercept term;
RGN = Real domestic income (GNP);
RWP = Real world production index;
RER = Real effective exchange rate;
LRER1 = First lag of the real effective exchange rate;
LRER2 = Second lag of the real effective exchange rate;
LRER3 = Third lag of the real effective exchange rate;
LIB = Dummy for market liberalization policy;
PORT = Dummy for closure of trade route through Mozambique
$\gamma$ = Partial adjustment coefficient;
AIC = Akaike Information Criteria;
* = Significant at 95 percent confidence level; and
** = Significant at 90 percent confidence level.

**The Real Income Effects**

The results from the partial adjustment model indicate that a one percent increase in real domestic income results in a 0.90 percent decline in the trade balance, whereas a one percent rise in real foreign income is associated with a 0.27 percent rise in the trade balance. Both the static and the Almon distributed-lag models suggest slightly lower responses in trade balance in response to changes in domestic and foreign incomes than does the partial adjustment model. The income responses are consistent with the aggregate import income elasticities reported for Malawi by Adu-Nyako et al. (1992) and by Mataya (1994). The estimates fall within the ranges for a number of low income countries found in a similar study by Bahman-Oskooee. A relatively inelastic trade response to domestic income increase appears to reflect the dominance in imports of intermediate goods for infrastructural, industrial and agricultural development. The lower response of the trade balance to growth in world income highlights the problems Malawi faces from its dependence on raw material exports to western markets.

**The Market Liberalization Effect**

The estimated effects of the reduction in subsidy and partial liberalization of the domestic market from the three models are similar. Implementation of liberalization policies appear to have been associated with a small but significant decline in the trade balance. The negative effect could be attributed to a rise in the expenditure on imports with removal of subsidies or as commodities assume their true opportunity cost. It can be expected to wane with a more efficient allocation of domestic resources following the reduction of price and non-price distortions. However, Wolf (1992) observes that liberalization would achieve the desired results only if a devaluation results in a reduction in domestic demand. In interpreting the anomaly in the sign of the liberalization parameter, the relatively recent date since the policy was implemented should be noted. The incomplete nature of the liberalization policies may also be a feature (Sahn et al., 1990; Mtawali, 1993).

**The Trade Route Effect**

As expected, the closure of the Mozambique port had a negative impact on the trade balance. The partial adjustment and Almon models indicate estimates of -0.19 and -0.25, respectively. Rerouting of cargo following the closure of the traditional trade route led to increased haulage cost and thus increased the cost of imports and reduced net export earnings for Malawi.

## Conclusions

This study tests the hypothesis that currency devaluation leads to an improvement in trade balance through changes in the real exchange rate. The results do not appear to support this hypothesis. Dynamic models indicate the existence of a lagged adjustment. A one percent change in the real exchange rate appears to be associated with a 0.30 per rise in the trade balance three years after the devaluation. Since the lagged trade balance responsiveness to a change in the real exchange rate does not offset the decline in the first two years, the full effect of the hypothesized J-Curve effect does not apply.

The analysis suggests that a one percent rise in real domestic income would result in a 0.90 percent reduction in the trade balance whereas a one percent increase in real foreign income would result in a 0.27 percent rise in the trade balance. The unresponsiveness of the trade balance to changes in foreign income may be attributable in part to the unmanufactured nature of Malawi's export commodities and also to the development of unfavorable market conditions in the major importing western countries. Tobacco, in particular, is a major source of export earnings and this commodity faces market problems in the west since it is classified as a health hazard. Sugar, another export, faces limited and distorted world markets. The effectiveness of the exchange rate policy appears to have been partly limited by the disturbance and eventual closure of the Mozambique port, a feature that highlights the difficulty for domestic policy of dealing with external factors and disturbances.

Evidently, an extended mix of domestic and external policy changes may be necessary to achieve the desired improvements in trade balance. Proposals have included regional integration (Koester, 1993), further domestic market liberalization (Valdes, 1993) and the need for more open importing policies in developed country markets.

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