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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 0.5 per cent per reduction in the trade balance, whereas changes in real foreign income do not appear to have any effect on 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, in a partial equilibrium framework, 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

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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:

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

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:

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

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 Equations (2) and (1) constitutes the trade balance TB_t:

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

This reduces to:

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

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 price of exports relative to 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 is expected to 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, and a 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 SPECIFICATIONS AND DATA

The basic model, from the preceding section, is:

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

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); Y_t and Y_t^* represent real domestic and foreign incomes, respectively; and ε_t represents a random error term. The effect of successive devaluations in Malawi may be underestimated if the partial 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:

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

where *PORT* is a dummy variable that takes the value of one from 1978 (the period in which the Mozambique ports were constantly under military siege and eventually closed) and is otherwise zero; *LIB* is a partial liberalization dummy variable that takes the value one from 1985 and is otherwise zero.

Almon Distributed-Lag (ADL) Model

Based on the hypothesis that the adjustment process in Malawi's trade balance follows a J-curve, an Almon distributed-lag model is also applied. Consider an finite distributed-lag model of the following form:

$$(7)\quad TB_t = b_0 + b_1 Y_t + b_2 Y_t^* + b_3 LIB + b_4 PORT + \beta_0 RER_t + \beta_1 RER_{t-1} + \beta_2 RER_{t-2} + ... + \beta_k RER_{t-k} + \varepsilon_t$$

This may be expressed more compactly as:

$$(8)\quad TB_t = b_0 + b_1 Y_t + b_2 Y_t^* + b_3 LIB + b_4 PORT + \sum_{i=0}^{k} \beta_i RER_{t-i} + \varepsilon_t$$

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

$$(9)\quad \beta_i = \alpha_0 + \alpha_1 i + \alpha_2 i^2 + ... + \alpha_m i^m$$

where m is the degree of the polynomial. Substituting Equation (9) into (8) gives:

$$(10)\quad TB_t = b_0 + b_1 Y_t + b_2 Y_t^* + b_3 LIB + b_4 PORT + \sum_{i=0}^{k} (\alpha_0 + \alpha_1 i + \alpha_2 i^2 + ... + \alpha_i^m) RER_{t-i} + \varepsilon_t$$

which is the same as:

$$(11)\quad TB_t = b_0 + b_1 Y_t + b_2 Y_t^* + b_3 LIB + b_4 PORT + \alpha_0 \sum_{i=0}^{k} RER_{t-1} + \alpha_1 \sum_{i=0}^{k} iRER_{t-i} + \alpha_2 \sum_{i=0}^{k} i^2 RER_{t-i} + ... + \alpha_m \sum_{i=0}^{k} i^m RER_{t-i} + \varepsilon_t$$

Defining

$$(12)\quad Z_{0t} = \sum_{i=0}^{k} RER_{t-i}$$

$$Z_{1t} = \sum_{i=0}^{k} iRER_{t-i}$$

$$Z_{2t} = \sum_{i=0}^{k} i^2 RER_{t-i}$$

....

$$Z_{mt} = \sum_{i=0}^{k} i^m RER_{t-i}$$

Equation (11) may be rewritten as:

$$(13)\quad TB_t = b_0 + b_1 Y_t + b_2 Y_t^* + b_3 LIB + b_4 PORT + \alpha_0 Z_{0t} + \alpha_1 Z_{1t} + \alpha_2 Z_{2t} + \alpha_3 Z_{3t} + ... + \alpha_m Z_{mt} + \varepsilon_t$$

The Almon scheme specified in Equation (11) can be estimated by regressing the dependent variable *TB* on the constructed *Z* variables. As long as the disturbance term ε_t satisfies the assumptions of the classical linear regression model, Equation (13) can be estimated using the ordinary least squares (OLS) procedure and the estimates of β_i derived from the estimates of α_i (Gujarati 1988).

The static and the Almon distributed-lag models of Equations (6) and (13) are tested on annual data from 1965 through 1988. To facilitate data transformation into logarithms, trade balance is expressed as a ratio of export and import values. Values 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, 1990; Internatioanl Monetary Fund, 1993).

EMPIRICAL ESTIMATION, RESULTS AND DISCUSSION

Estimation of the Almon distributed lag model requires testing of the length and order of the lag structure. Gujarati (1988) notes that the degree of the polynomial should be at least one more than the number of turning points in the curve relating to the coefficients to be estimated. A full expression of a 'classical' J-curve has two turning points, suggesting that a third degree polynomial may be appropriate (Bahman-Oskooee, 1984). However, a simpler representation of the J-curve embodying a single turning point suggests a second degree polynomial. The minimum polynomial order and lag length tested was 2. Following Laffer's study, a five year lag was chosen as the upper bound and restricted models with reduced lag lengths were sequentially tested against this unrestricted upper bound model. The Akaike information criterion and Schwartz criterion statistic were used, as discussed in Judge *et al.* (1988) to assess lag length. Test results, presented in Table 1, suggest a three-year lag as an appropriate polynomial length.

Table 1 *Determination of Lag Length*

Variable	Two lags	Three lags	Four lags	Five lags
AIC	−3.678	−3.772	−3.717	−3.517
SC	−3.282	−3.323	−3.219	−2.971

Notes: AIC = Akaike information criterion statistic; SC = Schwartz criterion statistic.

Sequential testing to discriminate between second and third order polynomials also used the Akaike information criterion, which suggests that a second order polynomial better fits the data, although a log-likelihood ratio test does not reject the hypothesis that estimates from second and third order polynomial models are not significantly different from each other. These results are in Table 2.

To test the J-curve phenomenon, second and third order polynomial models with three lags were estimated using ordinary least squares procedures. A static model as specified in Equation (6) was also estimated to provide a basis for comparison. Results are in Table 3. Economic theory, and the empirical results, favour the dynamic models, relative to the static model. However, application of a log-likelihood ratio test to compare the two dynamic models, does not reject the hypothesis that their estimates are not significantly different.

Table 2 *Determination of Order of Polynomial*

Variable	2nd degree	3rd degree
LLF	18.022	18.683
LRT	1.322	
AIC	–3.756	–3.772

Notes: LLF = value of the log-likelihood function; LRT = log-likelihood ratio test statistic; AIC = Akaike information criterion statistic.

Table 3 *The Effect of Currency Devaluation on Malawi's Trade Balance 1965–1989*

	Static model		Three lags and 2nd degree polynomial		Three lags and 3rd degree polynomial	
Variable	Estimate	S.E	Estimate	S.E	Estimate	S.E
Constant	–3.888**	0.452	–3.152**	0.736	–3.132**	0.740
RGN	–0.314	0.209	–0.479*	0.248	–0.492*	0.254
RWP	0.039	0.056	–0.0136	0.066	–0.012	0.066
RER	–0.590**	0.180	0.109	0.236	0.149	0.294
LRER1	-	-	–0.706**	0.175	–0.807*	0.469
LRER2	-	-	–0.422**	0.163	–0.312	0.496
LRER3	-	-	0.960**	0.282	0.906**	0.361
LIB	–0.490**	0.066	–0.532**	0.051	–0.531**	0.051
PORT	–0.260**	0.072	–0.353**	0.095	–0.350**	0.096
DW	2.231		2.536		2.542	
Adj-R^2	0.887		0.910		0.902	
LLF	16.046		18.656		18.683	
LRT			0.054			
AIC	–3.680		–3.864		–3.772	
SC	–3.385		–3.466		–3.324	

Notes: RGN = real domestic income (GNP); RWP = real world production index; LIB = dummy for market liberalization policy; and PORT = dummy for closure of trade route through Mozambique; RER = real effective exchange rate; Adj-R^2 = adjusted R^2; S.E = standard error; LLF = log likelihood function; LRT = log likelihood ratio test statistic.
** and * = significantly different from zero at the 95 per cent and 90 per cent confidence levels, respectively.

Effect of the Real Exchange Rate on Trade Balance and the J-Curve Effect

The tested hypothesis is that currency devaluation leads to an improvement in the trade balance through changes in relative prices or the real exchange rate. The results of this partial equilibrium analysis suggest that a one per cent increase in the real exchange rate in the static model results in 0.59 per cent rise in trade deficit in the current year. However, the results of the distributed lag models suggest that following successive deteriorations in the first two years after a devaluation, a one per cent increase in relative prices results in slightly more than 0.90 per cent improvement in trade balance in the third year. Even so, 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 full expression of the J-curve phenomenon.

The Real Income Effects

Both the static and the Almon distributed-lag models suggest that trade balance responds negatively to increases in domestic income, as expected. The responses are consistent with the aggregate import income elasticities reported for Malawi by Adu-Nyako *et al.* (1992). They fall within the ranges for a number of low income countries found in a 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. However, changes in foreign income do not appear to have a significant effect on the behavior of Malawi's trade balance. The apparent lack of responsiveness 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 Partial Market Liberalization Effect

The estimated effects of the partial liberalization of the domestic market, which included reduction in subsidies and partial price deregulation, imply a significant reduction in the trade balance. Interpreting the estimated coefficient on the dummy variable from the dynamic models as outlined by Gujarati (1988), implies a reduction of some 70 per cent in 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 significant negative impact on the trade balance, albeit less than that apparently associated with partial liberalization. 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. A reduction in trade balance of some 40 per cent, according to the results of the dynamic models, can be inferred, following Gujarati (1988).

CONCLUSIONS

This paper 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. The dynamic models indicate the existence of a lagged adjustment. The trade balance was adversely affected for two years after devaluation. A one percent change in the real exchange rate appears to be associated with a rise of about 0.90 per cent 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 expression of the hypothesized J-curve effect does not apply.

The analysis suggests that a one percent rise in real domestic income results in approximately 0.5 per cent reduction in the trade balance whereas changes in real foreign income do not appear to have any significant effect on 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.

REFERENCES

Adu-Nyako, Gottret, Weatherspoon and Seale, 1992, 'Macroeconomic Linkages Among Import Demand, Food Demand, and Foreign Debt', in Csaki, C., Dams, T.J., Metzger, D. and Van Zyl, J. (eds.), *Agricultural Restructuring in Southern Africa*, International Association of Agricultural Economists in association with the Association of Agricultural Economists of Namitsia, Windhoek, pp.163–76.

Bahman-Oskooee, M., 1984, 'Devaluation and the J-Curve: Some Evidence from LDC's', *Review of Economics and Statistics*, Vol. 67, No. 3, pp.500–504.

Carbaugh, R. J., 1980, *International Economics*, Winthrop Publishers, Inc., Cambridge, Massachusetts.

Gujarati, D., 1988, *Basic Econometrics*, 2nd Ed., McGraw Hill, New York.

Himarios, D., 1985, 'The Effects of Devaluation on the Trade Balance: A Critical View and Re-examination of Mile's "New Results", *Journal of International Money and Finance*, No. 4, pp.553–563.

International Monetary Fund, 1993, *International Financial Statistics Yearbook*, Washington, D.C.

Judge, G.R., Griffiths, H.W., Lutkepohl, H. and Lee, T.C., 1988, *Introduction to the Theory and Practice of Econometrics*, 2nd Ed., John Wiley and Sons, New York.

Koestler, U., 1993, 'Agricultural Trade Between Malawi, Zambia and Zimbabwe: Competitiveness and Potential', in Valdes, A. and Muir-Leresche, K. (eds.), *Agricultural Reforms and Regional Market Integration in Malawi, Zambia, and Zimbabwe*, International Food Policy Research Institute, Washington, D.C., pp.32–76.

Laffer, A. B., 1973, 'Exchange Rates, The Terms of Trade, and the Trade Balance', Mimeo, University of Chicago.

Miles, M. A., 1974, 'Re-Evaluating the Effects of Devaluation', Mimeographed, University of Chicago.

Mtawali, K.M., 1993, 'Malawi', in Valdes, A. and Muir-Leresche, K. (eds.), *Agricultural Policy Reforms and Regional Market Integration in Malawi, Zambia, and Zimbabwe*, International Food Policy Research Institute, Washington, D.C.

Reserve Bank of Malawi, 1990, *Financial and Economic Review*, Vol. 22, No. 4.

Sahn, D.E., Arulpragasam, J. and Merid, L., 1990, *Policy Reform and Poverty in Malawi: A Survey of Decade of Experience*, Cornell Food and Nutrition Policy Program Monograph 7, Ithaca, New York.

Salant, M., 1975, 'Devaluations Improve the Balance of Payments Even if Not the Trade Balance', Mimeo, US Treasury Department, Washington, D.C.

Valdes, A., 1993, 'The Macroeconomic and Overall Policy Environment Necessary to Complement Agricultural Trade and Price Policy Reforms', Valdes, A. and Muir-Leresche, K. (eds.), *Agricultural Policy Reforms and Regional Market Integration in Malawi, Zambia, and Zimbabwe*, International Food Policy Research Institute, Washington, D.C., pp.11–31.
Wolf, P.; 1992, 'A Double-Edged Sword: Liberalization May Lead to Instability', *Development and Cooperation*, German Foundation for International Development, Berlin.
World Bank, 1990, *World Tables*, Johns Hopkins Press, Baltimore.

DISCUSSION OPENING — Christopher Gerrard *(World Bank)*

This paper addresses an important topic, namely optimal domestic policy — more specifically, structural adjustment policy — in small, open economies in response to external economic shocks. I have three major comments, two concerning the specification of the model and the third on the econometric results.

First, the authors surely know that a nominal exchange rate devaluation is not the only variable influencing the real exchange rate, and probably not the most important. Changes in the external terms of trade, changes in world real interest rates, and changes in capital flows, (e.g. foreign borrowing or foreign assistance) all influence the real exchange rate. Over the time period in question, 1965 to 1989, such factors have almost certainly had a greater impact on the real exchange rate than have nominal devaluations. It is not even clear to what extent nominal devaluations do influence the real exchange rate in small open economies. It depends upon what happens to the domestic price of non-traded goods. If the nominal devaluation is accompanied by increased foreign borrowing or foreign assistance, which is often the case, the domestic price of non-traded goods may rise by as much as that of traded goods, and the devaluation will have no impact on the real exchange rate. Thus, while the authors are estimating the impact of changes in the real exchange rate on the trade balance, they are not necessarily estimating the impact of nominal devaluations on the trade balance. They are more likely estimating the impact of some other factors that are influencing the real exchange rate.

Second, given the other influences on the real exchange rate, given the uncertain impact of nominal devaluations on the real exchange rate, and given the repetitive nature of the nominal devaluations, should one regard nominal devaluations as an exogenous or an endogenous variable? I would suggest that in Malawi during this time period, it should more appropriately be regarded as an endogenous variable. Changes in the real exchange rate that result from external economic shocks ultimately require an adjustment in some nominal domestic variables. For example, a real exchange depreciation will ultimately require either; a nominal exchange rate depreciation, a domestic deflation relative to the rest of the world or an overvalued exchange rate, manifested either in the existence of a parallel market or in increased foreign borrowing to accommodate the excess demand for foreign exchange resulting from the real exchange rate depreciation. Devaluations may be the result of real exchange rate depreciations. They may also be the result of expanding domestic credit in order to finance central government deficits.

Third, while I doubt that the authors have actually estimated the impact of nominal devaluations on the trade balance, they have nonetheless provided some estimates of the impact of changes in the real exchange rate on the trade balance, whatever it is that is causing the changes in the real exchange rate. In this regard, I think that their results are impressive and, maybe, quite accurate. They may indeed have uncovered a J-curve in response to changes in the real exchange rate. In the long term, we normally expect a real exchange rate depreciation caused, for example, by a deterioration in the terms of trade, to lead to an improvement in the real trade balance — since real imports will decline relative to real output. But, in the short term, the nominal trade balance typically worsens since import prices (and import expenditures) are increasing relative to export prices (and export receipts). As far as I can tell, not knowing precisely what data they are using for the trade balance and for the real exchange rate, this appears to be what they have estimated. If you consider that factors other than nominal devaluations are influencing the real exchange rate, I find the results quite plausible.