Global Macroeconomic Models and African Trade and Finance: A Survey of the Literature

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I. Introduction

The trade and finance problems of Africa have been extensively examined from both theoretical and empirical angles. In this survey, an attempt is made to locate these problems within a global economy context. This is important for two main reasons. Firstly, it helps one to identify the position of Africa within the world economy. Secondly, it allows one to assess the extent to which Africa’s entry into the world economy represents an obstacle to development efforts being undertaken in that continent. This exercise will be formally undertaken using the increasingly popular methodology of modeling North-South economic interaction or global modelling. Notwithstanding the proliferation of such models, the modeling of the South remains, at best, rudimentary. Indeed, almost no examples of North-South models focusing specifically on Africa have been developed, to date.¹ Macroeconomic models are actually becoming more important. In the developing countries, macro models are currently being seen as important tools for forecasting and policy analysis. In this perspective the global models are becoming important due to the rapid rise in globalisation. The purpose of the contribution of this paper is to review the literature on global modelling. An attempt will be made to examine both the theoretical and practical efforts at modeling the South within a North-South framework. The main conclusion is that the North receives a lot of interest and the developing countries are poorly modeled despite the recent efforts.

The study is organized as follows. Section 1.2 sketches the broader theoretical framework within which most current North-South models fall. In section 1.3 some of the more important of the existing North-South models are examined. Based on this review, section 1.4 attempts to draw out a number of lessons for improving the modeling of the South. These lessons form the basis for the development of an alternative North-South model focusing specifically on Africa. This model is fully developed in section 1.5. Section 1.5 will have for main components: A compressed model of African trading partners (the North), a compressed model of OPEC, and a compressed model of ‘International Banking, and a prototype African (the South) Macro Model. The details of the latter are fully developed in the subsequent publications of the TRID of the ECA that follows this study (see TRID Working Paper No. 2).

¹. The theoretical model developed by Rattso (1992b), along the lines of Taylor (1981) and the non-formal analysis of Kiss (1984) may be the only exceptions to this generalisation.
II. Basic Theoretical Models

2.1 The Mundell-Fleming Model

In open economy macroeconomics, modelling the interaction of finance and trade between countries, and the analysis of related policy issues, are formulated around what is termed the Mundell-Fleming model, or, following Vos (1994), the Meade-Mundel-Fleming model. As Vos (1994) notes, the model’s foundation was laid by Robert Mundell (1960, 1963, 1968) and J. Marcus Fleming (1962), who extended the pioneering work of Mead (1951), focusing on the Keynesian internal-external-balance-adjustment analysis (see Vos, 1994: 65-66). Following Vos (1994) and Hallwood and MacDonald (1994), among others, the basic structure of the model may be described as follows.

Assuming two countries, North (N) and South (S), their output supply and demand (Eq. 1 and 2) and similar demand and supply equation for credit (Eq. 3) may be given by,

\[ Y_N = D_N(Y_N, r) + M_S(Y_S, \phi) - M_N(Y_N, \phi^{-1}) \]  
\[ Y_S = D_S(Y_S, r) + M_S(Y_S, \phi) - M_S(Y_S, \phi^{-1}) \]  
\[ B_N + B_S + H = L_N(Y_N, r) + L_S(Y_S, r) \]  

Where: Di is aggregate domestic demand consisting of private consumption, investment and public expenditure that varies positively with income (Y) and negatively with the real interest rate (r); \( f = PS/PN \) which is the terms of trade; Bi the supply of domestic credit; Li the demand for credit; H the world stock of reserves treated as an outside asset; Mi import demand.

Based on the model’s further assumption, that a perfect capital market exists, interest rates tend to equalise across countries. Import demand (Mi) and, implicitly, export supply, will depend on income and terms of trade. The model’s solution also depends on the exchange rate regime, which is in operation. With a fixed exchange rate the money supply may be taken as endogenous, while it is best considered as exogenous under a flexible exchange rate regime. Based on these assumptions, Diagram 1.1 summarises the equilibrium condition for the world economy.
Diagram 1.1: The Meade-Mundel-Fleming Model

In Diagram 1.1 equilibrium for the world economy is attained at point E, where both the money (LM) and the product (IS) markets are in equilibrium within the two countries. This ensures a unique level of interest rate. Once such a framework is developed, it is quite straightforward to analyze the impact of different policies relating, say, to the impact of financial flows from North to South (See Vos, 1994: 68-70 for such an analysis). Indeed, this basic formulation has been expanded upon and modified by a number of authors with the aim of overcoming some of the limitations of this basic formulation. Thus, according to Vos’ survey, the basic model has been extended to include private and public sector demand in Frenkel and Razin (1987) while imperfect substitution between domestic and foreign assets is treated in Kouri and Porter (1974) and Dornbusch (1980) (See Vos, 1994: 68-69).

2.2 The Theoretical Basis of Recent North-South Models

Notwithstanding the importance of the Meade-Mundel-Fleming model, the relevance of such an IS/LM approach, in analyzing North-South interaction remains limited. This is because the behavior of agents and the structure of the economy, which is assumed to be the same in the
two countries, could, in fact, vary significantly between them. A good example of this relates
to differential access to capital markets (see Vos, 1994: 70). This suggests the desirability of
using different models for the economies of the North and South, which, in turn, implies that
the interaction between the two economies may depend on the underlying theory about the
structure of these economies. This also represents an important theoretical justification for
the proliferation of North-South models, in general. Thus, following the works of Ocampo
(1986), Vos (1989b) and Dutt (1990), the following discussion will outline the major theoretical
classification of North-South models. This will help to locate the model, which we develop in
section 1.3, within the relevant literature.

Most existing North-South models may be classified under three theoretical strands, which may
be formulated by assuming a common Lewis type economy in the South and combining this
with either a neoclassical, Kaleckian or Neo-Marxian North. Following the approach of Dutt
(1990), we will first outline the incomplete general framework he has developed. The different
theoretical approaches will then be defined according to their assumption of ‘model closure’
for the general framework. This thematic classification is also helpful in understanding the
theoretical underpinnings of the recent North-South models, which are examined in section 1.3
and which will inform the version of the model developed in this study.

2.2.1 The General Framework

In the general framework, the two economies, North (n) and South (s), are assumed to produce
a single good N and S, respectively. Both use a Leontief technology, incorporating labour (L)
and capital (K) as factors of production. The S good is assumed only to be consumption good,
while the N good is both a consumption and investment good, which can be used in both
regions. These assumptions imply the following two quantity and price equations, given as:

\[
X_n = c_n^n L_n + c_s^n L_s + g_s^n K_s + g_s^n K_n
\]

\[
X_s = c_s^n L_n + c_s^n L_s
\]

\[
P_n = W_n a^n_0 + r_n P_n \left( \frac{K_n}{X_n} \right)
\]

2. Unless otherwise stated, the discussion in section 4.2.2 is based primarily on Dutt (1990) (particularly
Chapters 2 and 8) and to a lesser extent, on Ocampo (1986). In the discussion, which follows, in order
to avoid unnecessary repetition, frequent citation of these studies will not be made.
\[ P_n = W_n a_0^s + r_s P_n \left( \frac{K_n}{X_n} \right) \]  

\[ \frac{K_n}{X_n} \geq a_1^i, \ i = n, s \]  

Where: \( a_1 \) is the technologically fixed capital-output ratio, \( c_{ij} \) denotes the consumption of good \( j \) in region \( i \) per worker employed in region \( i \), \( a_0 \) is the employment-output ratio, \( g \) is the rate of growth of capital, \( r \) the rate of profit, \( W \) is the money wage (rate) and \( P \) prices (measured in terms of a common currency with exchange rate fixed at 1).

It is further assumed that only profit earners save a constant fraction, \( s_n \), of their profit. The total consumption expenditure of wage and profit earners is also assumed to be split between \( N \) and \( S \) goods, with a constant fraction, \( a \), being spent on \( N \) goods. Workers in the South are assumed not to save and to consume only Southern goods, while Southern profit earners are assumed to save a constant fraction, \( s_s \), and spend a constant fraction, \( b \), of their consumption expenditure on \( N \) good, the rest being spent on the \( S \) good. Labour and capital are assumed to be internationally immobile. These assumptions imply,

\[ c_n^s L_n P_n = a [W_n L_n + (1 - s_n) r_n P_n K_n] \]  

\[ c_s^s L_s P_s = (1 - a) [W_n L_n + (1 - s_n) r_n P_n K_n] \]  

\[ c_s^s L_s P_s = W_s L_s + (1 - s_s)(1 - b) r_s P_s K_s \]  

Substitution of Eqs. 6 to 9 into Eqs. 1 to 4 yields,

\[ 1 = a \left[ \left( \frac{W_n}{P_n} \right) a_0^s + (1 - s_n) r_n \left( \frac{K_n}{X_n} \right) \right] + [(1 - s_s) b r_s + g^s] \left( \frac{K_n}{X_n} \right) k^{-1} + g^n \left( \frac{K_n}{X_n} \right) \]  

\[ 1 = (1 - a) \left[ \left( \frac{W_n}{P_n} \right) a_0^s \left( \frac{X_n}{K_n} \right) \left( \frac{K_n}{X_n} \right) k\pi^{-1} + (1 - s_n) r_n \left( \frac{K_s}{X_s} \right) k\pi^{-1} \right] + \left( \frac{W_s}{P_s} \right) a_0^s + (1 - s_s)(1 - b) r_s \left( \frac{K_s}{X_s} \right) \]
1 = (\frac{W_n}{P_n})a_o^n + r_n (\frac{K_n}{X_n}) \quad \text{[12]}

1 = (\frac{W_s}{P_s})a_o^s + r_s (\frac{K_s}{X_s}) \pi^{-1} \quad \text{[13]}

Assuming away capital flows, balance of payment requires balance of trade, which implies

Where \ k = \frac{K_n}{K_s} \quad \text{and} \ \pi = \frac{P_s}{P_n} \quad \text{[14]}

which, in turn, implies,

\[ (1 - a)[(\frac{W_n}{P_n})a_o^n k + (1 - s_n)r_n (\frac{K_n}{K_s})] = g^n + (1 - s_n)br_s \] \quad \text{[15]}

Substitution of Eqs. 15 and 3 into Eq. 2 implies,\(^3\)

\[ s_n r_n = g^n \] \quad \text{[16]}

\[ s_s r_s = g^s \] \quad \text{[17]}

Eqs. 16 and 17 show that, with balanced trade, total income equals total expenditure, in each region, so that saving equals investment. The above framework can be represented by five independent equations, numbered 10, 12, 13, 16 and 17, comprising ten variables, Wn/Pn, Ws/Ps, rn, rs, gn, gs Kn/Xn, Ks/Xs, k and p and is clearly indeterminate. (In other words, the number of equations does not equal the number of variables). Focusing on the long-run issues we may assume a given stock of capital in the short run and hence k is assumed fixed. The condition for the long run, steady state, equilibrium, where we will treat k as a variable to be determined, entails that Kn and Ks must grow at the same rate. Hence

\[ g^n = g^s \] \quad \text{[18]}

\(^3\) Solving Eq. 15 for gn, inserting the result into Eq. 2 solving it again for gn, and multiplying the result by (Pn/Pn) (with interpretation of the result) will, in a fairly straightforward fashion, yield Eq. 16. Similar steps may be taken in order to arrive at Eq. 17.
Having substituted Eq. 18, which implies Eqns. 12, 16 and 17 into 10, we arrive at Eq 19. However, four more equations are required, in order to close the model. Sections 2.2.2 to 2.2.4. give us alternative closure rules, which allow us to arrive at a solution to the following general model

$$k = \left[ (1 - s_s) \left( \frac{b}{s_s} + 1 \right) \right] \left( 1 - a \left[ \frac{1}{g} \left( \frac{K_n}{X_n} \right) - 1 \right] \right)^{-1}$$  \[19\]

where g is the common growth rate of capital stock.

### 2.2.2 The Solow-Lewis Model

In this model the North is assumed to be a neoclassical economy, with perfect competition prevailing within the goods market. Full employment of labour and capital is assumed at all times, with growth determined by the natural rate, n. The production of the Southern good is constrained by the extent of capital accumulation. Assuming flexible and unlimited labour supply, at a given real wage, a la Lewis (1954), investment from profits will increase output in the long run. The fixed wage, however, may also be explained by a standard neo-Marxian argument. Thus, the biologically required socially necessary labour time, taken in conjunction with Marx’s description of moral and historical considerations implies a certain wage level, below which workers will not work. At this wage level, these workers will join the reserve labour force (See Dutt, 1990: 18). These assumptions imply,

$$\frac{K_n}{X_n} = a^n_i$$  \[20\]

$$\frac{K_s}{X_s} = a^s_i$$  \[21\]

$$g^n = n$$  \[22\]

$$\frac{W_i}{P_s} = V_s$$  \[23\]
Where $V_s$ is the fixed real wage. Substitution of Eqs. 21 and 23 into 13 implies,

$$\pi = V_s a^s_0 + r_s a^s_1$$ \[24\]

which yields a relation between $r_s$ and the terms of trade, $p$, shown by OT in panel (b) of Diagram 1.2. Eq. 17 yields another relation between $g_s$ and $r_s$, shown by OS in panel (d) while Eq. 16 gives the relation between $g_n$ and $r_n$ shown by ON in (c). Substitution of Eq. 20 into 12 yields,

$$1 = \frac{W_n}{P_n} a^n_0 + r_n a^n_1$$ \[25\]

which gives the Northern wage-profit frontier shown as AB in panel (a). From Eq. 22 the level of $g_n$ is fixed at rate $n$, and panel (c) determines (* indicates equilibrium values) $g_n*$ and $r_n*$, and $r_s*$, $g_s*$ $p*$ and $(W_n/P_n)*$ are determined by Diagram 1.2. $K*$ may be determined by substituting Eqs. 20 and 22 into Eq. 10, in order to arrive at,

$$k* = [(1 - s_s) \left( b \right) \left( 1 - a \right) \left( \frac{1}{a^*_i n} - 1 \right) ]^{-1}$$ \[26\]

$V_n*$ (real wage in North) which equals $(W_n/P_n)(P_n/P_s)1-a$, where the (weight) $0 < a < 1$, is also determined since $(W_n/P_n)*$ and $p*$ are determined. This will complete the model solution.

This model may be used to explore the effects of changes in the parameters of the model on economic interaction between the two regions. One notes, for instance, that technological change (understood as lower $a_0$s and $a_1$s) in the South results in a deterioration in terms of trade of the South. Conversely, within this model, Northern growth is found to improve the terms of trade of the South. Other similar parameter changes, and their impact, are discussed in detail in Dutt (See Dutt, 1990: 163).

Models developed by Findlay (1980, 1981) and Algoskoufis and Varangis (1992), may broadly be classified under this category. The World Bank’s Global Economic model, Bank-GEM, (Peterson et al 1991, and Pedersen 1994) may also be taken as falling under this category. This is because the model is based on the NIESR (National Institute of Economic and Social Research) and the London Business School global economic model, both of which incorporate similar features to the Solow-Lewis model, in the long run. However, the London Business School model uses
2.2.3 The Kalecki-Lewis Model

As with the Solow-Lewis model, within this framework the South is assumed to have a Lewis type economy. Hence Eq. 21 is assumed. Along Kaleckian, or, following Dutt, Kalecki-Steindl lines, the North is assumed as characterized by excess capacity. This implies that Eq. 20 should not be assumed. Instead, a strict inequality, given in Eq. 5, is applied for $i = n$. Thus, three equations are required, in order to close the model. The first comes from the Lewisian assumption, which may be expressed by Eq. 24. The second is the Kalecki-Steindl desired accumulation function given by,

$$g^n = g^n \left( r_n \frac{X_n}{K_n} \right)$$

4. In the latest version of this model, the South is taken as comprising Latin America, the newly industrialized countries and Africa. However, the author was not able to obtain access to this (unpublished) African model.
with both partials being positive. The third is a Kaleckian mark-up pricing equation, given as,

\[ P_n = W_n a^n_0 (1 + z) \]  \[ \text{[28]} \]

where \( z \) is the fixed mark-up rate.

Substitution of Eq. 27 in Eq. 12 and solving for \( r_n \) gives,

\[ r_n = \left[ \frac{z}{(1 + z)} \right] \frac{X_n}{K_n} \]  \[ \text{[29]} \]

which, when substituted into Eq. 27 implies \( g_n \) is a rising function of \( r_n \), which we assumed to be concave and given by GG in panel (b) of Diagram 1.3. Its intersection with ON, given by Eq. 16, determines \( g_n^* \) and \( r_n^* \). As before, in panel (d), AB is the wage-profit frontier. However, because of excess capacity, the economy must lie inside this frontier, such as at point C, where \( (W_n/P_n)^* \) is obtained using Eq. 28. Note also that, at point C the inequality of Eq. 5 (for \( i=n \)) is satisfied. OS in panel (a) shows Eq. 17 and solves for \( r_s^* \) and \( g_s^* \). OT in panel (c) represents Eq. 24 and solves for \( p^* \). Substituting \( r_n^* \) into Eq. 29 solves for \( (X_n/K_n)^* \). Substituting this and the common rate of growth into Eq. 19 solves for \( k^* \).

Analysis of parameter changes, using this model, reveals a number of interesting results. For instance a rise in mark-up rate, which pushes the GG curve downward, is associated with deterioration in terms of trade of the South. A similar deterioration in terms of trade may result from productivity growth, associated with technological change, in the South, while growth in the North may improve the terms of trade of the South. (See also Dutt, 1990: 169, for a similar analysis, in relation to other parameter changes).

Among the existing North-South models, some of which are examined in section 1.3, below, Taylor (1981, 1983 1991), Darity and FitzGerald (1982), IMF’s MULTIMOD (Masson et al, 1990), Vos (1994), Sarkar (1994, 1996) may all be considered as falling under this broad category.
2.3 The Neo-Marxian North and a Lewis South Model

Problems exist with the labeling of this type of model. The widely cited model developed by Vines (1984), as well as the published version, developed by Molana and Vines (1989), have both wrongly been termed ‘... along Kaldorian lines’. Molana and Vines’ model essentially assumes a Lewis type economy within the South. The North is also assumed to have surplus labour with an exogenous real wage and the level of output taken as supply-determined rather than Keynesian (Molana and Vines, 1989: 444). Following Dutt, (1990) the economy of such a North might better be termed Neo-Marxian than Lewisian. Certainly, it is wrong to label such models as Kaldorian, since Kaldor explicitly assumed that, in the North, ‘prices are administered’ using mark-up, that there is excess capacity and, hence, that output is demand determined through ‘a stock adjustment mechanism’ (Kaldor, 1976: 705). After correcting for this oversight, Sarkar (1994, 1996) developed various North-South models. However, Sarkar’s models are best understood as broadly falling under a Kalecki-Lewis classification, as described in section 1.2.2.3, above.

5. This section of the model is rightly specified along Kaldorian line (See Kaldor, 1976: 705).
In terms of our equations, full capacity utilization in both North and South is assumed. This implies that Eqs. 20 and 21 hold. The South is assumed to have a given real wage so that Eq. 23 also holds. Similar assumptions for the North implies,

\[ \frac{W^n}{P^n} = V^n \left( \frac{P^n}{P^n} \right)^{1-a} \]  \[30\]

for a given \( V^n \), which is fixed, say, for Neo-Marxian reasons.

Inserting Eq. 21 into Eq. 13 implies 24, as in the first model. This gives the OT line in Panel (b) of Diagram 1.4. From Eqs. 16 through 18 we get,

\[ r^n = \left( \frac{S^n}{S^n} \right) r^s \]  \[31\]

which gives OR in panel (d). Substitution of 20 into 12 yields Eq. 25, which gives line AB in panel (c). In panel (a) ON shows Eq. 30 for a given \( V^n \). Curve CD in panel (b) is derived from OR, AB and ON in the diagram and plots the locus of \( r^s \) and \( p \), which satisfy Eqs. 25, 30 and 31. The intersection of OT and CD in panel (b) determines \( r^n* \) and \( p* \). \( r^s* \) and \( (W^n/P^n)^* \) can be read from the rest of the Diagram. Substitution of the rates of profit into Eqs. 16 or 17 determines \( g^* \), and substitution of this and Eq. 20 into 19 implies,

\[ k^* = \left[ (1 - s) \left( \frac{b}{s} \right) \left( 1 - a \left( \frac{1}{g^* a^*_i} - 1 \right) \right) \right]^{-1} \]

Analysis of various parameter changes using this model is undertaken in Dutt (See Dutt, 1990: 165). It is interesting to note that, within this model, technical progress in the South (represented by lower \( a^*_0s \) and \( a^*_1s \)) implies a deterioration in its terms of trade, while a similar improvement in the North improves the terms of trade of the South. As noted above, the Vines (1984) and Molana and Vines (1989) models may broadly be taken as falling under this general category.
2.4 Some Points about Capital Flows

The literature on capital flows as drivers of economic growth gained prominence in the beginning of the 1980s, as the process of globalization picked a rapid pace. The differences in the rates of economic growth within and between global regions have been attributed in some of this literature to the share and distribution of the capital flows received in the regions. Thus, the East Asian miracle was arguably driven by the positive net capital flows into the region. This means one of the plausible links between the East Asian region with other regions such as the North in a global economic model would be through the capital flows linkage. Yet, besides the capital flows, the other linkages between the North and other regions are dominated by trade.

It is intuitively justifiable for global models that emphasize on the linkage between African region and other regions in the world, to emphasize the dominance of the trade linkages. These linkages to the global economy through trade have been central to understanding Africa’s macroeconomic performance. Some authors have even argued that capital flows did not alter the pattern of asymmetric adjustment in countries where export of primary commodities dominated the determinants of macroeconomic performance (see Vos 1994). There is however, as indicated below, a need for a distinction between public and private capital flows. The former constitute the official capital flows and are determined by different factors than those that determine the private capital flows (see Alemayehu 2002).
Vos (1989b) and Dutt (1990), in their analysis of capital flows to the South from the North, envisage it to be partly driven by the profit differential. They further assumed that part of the capital stock in the South is owned by the North and that the North earns and remits profit from that stock. Implicitly, the capital stock resulting from the capital flows to the South is owned by the North resulting in a profits repatriation system within the model. The capital flows in question in this case are the private capital flows originating from the international banking system. In models such as Vos (1989b) and Dutt (1990) where private capital flows are determined by the profit differential, the implication is that it is possible for the capital owned by the South within their own region to be completely crowded-out by the capital owned by the North. Extending this argument further, where the profit differential is zero or negative, it means that there will be no capital flows from the North to the South. This framework is buttressed further by the low income elasticity of primary commodities (and hence terms of trade deterioration) and by the expectation that the savings elasticity is higher in the North compared to the South holds. The low income elasticity of primary commodities imply that the South is not able to finance strong capital stock build up, owned by the South in this case. Coupled with the low savings elasticity in the South, the North will always have higher accumulation of savings, which serve to facilitate the capital flows to the South. (Vos, 1989b: 138).

Whereas this framework is intuitively appealing and there is empirical evidence to support it, it ignores the possibility that North owned capital flows might also crowd-in capital stock accumulation owned by the South. Viewed as complementary to South’s capital accumulation process, the capital flows from the North could be determined by factors other than just the profit differential too. The framework also assumes that the returns to foreign owned capital is taxed at the same rate as that from domestically owned capital. Where the tax rates differs in favour of domestic owned capital returns, the framework of Vos (1989b) and Dutt (1990) would predict a weaker impact of capital flows from the North. Moreover, the profit differential needs also to include risk premiums that are sectoral dependent. In other words, it has been common to observe capital flows to economies in the South that are conflict prone where such flows are aimed at building capital stock for oil extraction. Conversely, we also observe limited capital flows in non-oil rich South countries even though risk premiums in some of these countries have been lower.

In short, models such as that of Vos (1989b) and Dutt (1990) could be criticized for their failure to take account of possible crowding-in of South’s capital; differential tax regimes for North and South owned capital in the South; and differential impacts of risk premiums on profit differentials in the South. Moreover, today, official capital flows in the form of aid, driven mainly
by political and geopolitical considerations are emerging as strong linkages between majorities of African countries with the North. In sub-Saharan Africa in particular, private capital flows originating from international banks are becoming more and scarcer (see Bhinda et al, 1999, however). Given the declining terms of trade of these commodities-dependent economies, they are left with no option than to rely on official capital flows. Thus, modeling capital flows in global macroeconomic models that focus on Africa could best be undertaken by emphasizing on the official capital flows rather than access to (private) international banks credit. While the latter proposition seems plausible, if a model recognizes the different sub-regions, then it is reasonable for those sub-regions where there is the oil-factor, to be modeled taking on board the importance of private capital flows syndicated by North players in the oil industry.

How different models have dealt with the issue of capital flows is demonstrated in the section that follows where standard North-South linkages are explored further under financial and trade linkages. For any new models linking Africa through capital flows, it might also help to revisit the recent literature on global financial architecture (see FitzGerald 2004). It is also important to note that most of these models were constructed before the full effect of the Washington Consensus led reforms which resulted in liberalization of capital controls in the South was well understood. As a result, it is upon new models to ask whether with open capital accounts in the South, even in Africa, emerging capital markets, whether hypothesis geared on taking account of the financial deepening element might not be better ways rather than focusing on credit rationing theories and imports compression arguments which could have been intuitively appealing before the full effects of the trade and financial liberalization episodes. These are what will be attempted in this study.

To sum up, this section has clearly demonstrated that the view of the economy, or the stylized facts, adopted by the researchers, implies different closure mechanisms and, hence, more often than not, different results. Such a thematic classification helps to understand the existing global models, which are examined in section 1.3, below. Thus, the following section will examine the practice of global modeling, focusing primarily on how the South is modeled, with the aim of arriving at lessons relevant to the modeling exercise undertaken in this study.

6. Ricardian type trade arguments favour specialisation through trade and as such lead to the expectation that terms of trade may not deteriorate for as long as there are comparative advantages held by the commodities exporting South. However, given the higher savings rate in the North the capital exports from the North to South could be counter-productive in as far as they end up leading to higher production of the commodities that tend to have lower income elasticity - what is called the ‘adding-up problem’.
III. Standard North-South Linkages

From modelling the Afican interaction with the rest of the world points of view, we may broadly classify global models of economic inter-linkages into two. The first class of model refers to those North-South (trade) models which focus on trade linkages and to a limited degree on financial linkages. These models usually focus on analyzing the effects of North on the South. The Second class of global models refers to those large global macroeconomic models that usually ignore or undermine the South and focus on the North. In this survey we discuss both types of global models and look at the standard linkages in North-South models which may broadly be classified as financial and trade. These linkages serve as propagating mechanisms for the impact of macro policy changes across the two regions, and usually run from North to South. The discussion of these linkages will proceed at two levels. Thus, Section 2 will examine financial linkages, while trade linkages will be discussed in Section 3.

3.1 Financial Linkages

Most North-South models take account of financial flows that links the Northern model with that of the South. However, the emphasis that is placed on finance, relative to trade linkages, varies from model to model. For instance the models of, inter alia, Muscatelli and Vines (1991), Murshed (1990) and Vos (1994) place more emphasis on financial linkages compared to other North-South models such as MSG2 (McKibbin and Sachs, 1991), G-Cubed (McKibbin and Wilcoxen, 1992; 1998) the IMF’s MULTIMOD (Masson et al, 1990), COMPASS and GINFORS (Meyer et al, 2004) and Project LINK (Ball 1973). Hence, in this section we will examine how these financial linkages are established within a number of existing models and draw lesson for Modelling African in the global Modelling context.

In the UNCTAD model (See Ball 1973), which is also used by Project-LINK as the model of the South, net factor payments are related to external deficits and export revenue. Important financial variables such as exchange rate and net foreign capital inflows are assumed to be determined exogenously. This exogenously given external finance is specified as affecting the level of reserves, which, in turn, affects the level of imports, and hence, investment. This specification allows for the possibility of depicting the phenomenon of ‘import compression.’ This is important, since import compression is reported to be widespread, not only in the relatively more advanced developing countries, such as Brazil (Fritsch 1988), but also throughout the less developed countries of Africa (Ndulu 1986, 1991 and Rattso 1992b, Alemayehu 2002).
Within the MSG2\(^7\) model (McKibbin and Sachs 1991), all new loans to the least developed countries (LDCs) are assumed to remain in historical proportions. All other capital inflows are derived from the consistency that requires world balance of payments to sum to zero. For the US, Japan, Germany, the rest of the OECD and OPEC the current account is determined under the assumption that domestic agents have free, unrestricted access to international borrowing and lending at international rates. For LDCs the scale of borrowing is set exogenously, by consideration of country specific risk. In modeling commercial flows to LDCs, the MSG2 model emphasizes the supply-determined nature of such flows, and hence the importance of credit-rationing to the South.

Another model closely related to the MSG2 is G-Cubed global model which was developed by McKibbin and Wilcoxen (1992), updated and revised by McKibbin and Wilcoxen (1995, Revised 1998), and which is a dynamic inter-temporal general equilibrium model combining the approach taken by MSG2 model with that of disaggregated econometrically estimated, inter-temporal general equilibrium models (McKibbin, 1998: 11-12). This global model assumes perfect capital mobility. Trade imbalances are assumed to be financed by flows of assets between countries (McKibbin and Wilcoxen, 1998). Further more, the model assumes fully endogenous international capital flows; inter-temporal optimization is used to model saving, investment, and international financial market arbitrage; where appropriate, the existence of liquidity-constrained agents is taken into account. Behavioral parameters of the model are estimated from time-series data wherever possible; and all budget constraints are satisfied at all times.

In Beenstock’s (1988) North-South econometric model, the financial linkage is established following the ‘loanable-fund’ doctrine. The supply of such funds from OPEC and North is equated to the stock of LDC debt, as well as the North’s public debt and capital requirement. This stock equilibrium, coupled with capital market specification for the North, determines the interest rate. Interest rates, in turn, affect the debt service of the South, which is included in the balance of payment equation for the South. The other financial linkage is aid, which is included in the balance of payment equation of the South, as being exogenously determined by the

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7. The MSG2 multi-country model was developed by McKibbin and Sachs in two stages. The first stage involving the development of MSG which was a modern Keynesian style macroeconomic model of the world economy with the unique advance of including rational expectations in the foreign exchange market. The parameters of the model are also essentially reduced form parameters calibrated to the estimates of existing macroeconomic models (McKibbin, 1998:10). Influenced by developments in modern inter temporal macroeconomic theory and modeling techniques used by CGE modelers which focus on individual optimization by economic agents, the authors reconstructed the MSG into MSG2 which is documented in McKibbin and Sachs (1991).
North. Indebtedness of the South is approached as follows. LDCs have a desired debt position in stock terms. In the short run the desired may differ from the actual, reflecting adjustment costs. Reserve movements are determined residually through the balance of payment identity. In the long run, the South could have a desired reserve that might be attained by controlling imports, stimulating exports or altering the exchange rate. Although the total supply of funds, and its effect on interest rate, is based on the classical ‘loanable-fund doctrine’, the modeling of capital flows to South does not follow a specific financial theory. Rather, it is derived from a consistency rule, which, in the case of aid, is exogenously given. The Beenstock model also adheres to the assumption that capital flows to the South are largely demand driven. Hence, the model neglects supply conditions in the North, which are emphasized in other models.

In the OECD model INTERLINK, (OECD 1988), financial linkages are established through the use of capital flows. The capital flow to each country is a function of short-term interest rate differentials, expected rates of currency depreciation/appreciation and domestic and foreign current balances. Foreign interest and exchange rates are taken as exogenous within the single country model. In the linked model, changes in interest rate, exchange rate and money supply of a country are specified as affecting macro variables in other countries, through their influence on capital flows. Hence, the effects of these variables may be felt throughout the whole system. These equations are subject to strong cross-country parameter restrictions, which, together with appropriate weighting matrices, ensure global consistency of net capital flows. Basically, the financial linkages specified in the INTERLINK model are based on portfolio choice theory. Indeed, the model’s particular strength lies in the use of appropriately valued asset and liability stocks in the determination of capital flows.

The World Bank’s Global Economic model, Bank-GEM, (Peterson et al 1991, and Pedersen 1994) focuses on three types of external capital flows. These are FDI, debt creating flows and foreign asset holdings of the private sector. FDI is set as being determined by the same factors as domestic investment. Namely, foreign real rate of interest as an indicator of portfolio choice, domestic GDP as an indicator of market size or policy success and the real exchange rate, which affects profitability. In modeling debt-creating flows, individual LDCs are assumed to receive a fixed share of official concessional funds, the exact size of which will depend on growth of income within OECD countries. Disbursement of official non-concessional loans will depend on GDP growth of the borrower (as a proxy for credit worthiness), the current account balance (representing financing requirements), and the previous period’s net disbursements (as an indicator of borrower behavior). Public commercial borrowing is projected by imposing the growth rate of official non-concessional borrowing, assuming that this falls within the general
borrowing strategy of the LDC in question.

Finally, commercial borrowing of the private sector constitutes the residual component of the balance of payments. Portfolio returns and risks associated with portfolio holding, as well as risk differential by domestic and foreign investor, and hence two-way flow, approaches may be used to define the foreign assets of the private sector. Hence, these assets, sometimes referred to as ‘capital flight’, may be defined as a function of: 1) domestic income growth (which may be associated with lack of opportunities at home or policy credibility); 2) domestic and foreign inflation; and, 3) the lagged ratio of foreign asset holdings to total wealth of the private sector within a ‘normal’ portfolio. The short term capital flows of the private sector are set as a function of price and volume of imports (in order to show trade credits, which might finance imports), while those of the public sector are defined as the official foreign reserve flows of the balance of payment. The change in reserves is modeled as an adjustment to a desired stock level, which will depend on the dollar value of the exchange rate, as well as the price and volume of imports. Finally, the percentage change in nominal exchange rate is related to the percentage change in domestic and foreign inflation differentials. In general, the Bank-GEM financial modeling is informed by a Mundel-Fleming framework, since financial markets are assumed to clear for world interest rates in an integrated world capital market. Within this framework, private capital inflows are seen as being determined along the lines of a portfolio theory of finance (See Alemayehu 1994, for details about Bank-GEM)

Muscatelli and Vines’ (1991) study also focuses on financial linkages. They begin their North-South model by outlining a number of possible causes of the debt crisis. Firstly, domestic policies pursued by the South are cited as a possible cause. Secondly global macroeconomic shocks, which result from changes in interest rates, the fiscal and monetary policy adopted by the North, as well as fluctuations in commodity and oil prices. Thirdly, creditors’ failure to assess risks. And, fourthly, trade restrictions applied in the South. The debt crisis has resulted in a variety of expenditure switching and reducing effects. Of these, the former effect was found to have led to inflation, while the latter to import compression and fiscal adjustment, characterized by reduced public spending and high interest rates, in the short run. The expenditure reducing effect was also found to have had supply side effects on long-run growth and developmental potential, with implied demand side impacts.

In order to locate the above problems in the context of North-South interaction, Muscatelli and Vines (1991) identify the macroeconomic linkages between the two regions. Hence, in the modeling approach adopted, the South is assumed to depend on North for its exports, import
of capital goods and finance. Conversely, the North is assumed to depend on the South in order to meet its demand for raw materials. Further, it is assumed, through the operation of international capital markets, that the economic behaviour of the South can influence that of the North, and vice versa. Thus, the perceived probability of default is likely to adversely affect capital inflows to the South, with a rise in interest rates also having the effect of depressing investment in the South. This, in turn, will affect the short-run demand for northern goods, and may also have long-run supply effects, as the supply of commodities declines. Moreover, a rise in interest rate will have a negative effect on the debt service costs of the South. Recognition of these linkages has led various authors to focus their attention on three specific areas, in seeking a solution to the debt crisis. Firstly, domestic policies of the South. Secondly, macroeconomic policies pursued by OECD countries. And, thirdly, measures specifically aimed at reducing the level of outstanding debt.

Murshed (1990) also seeks to explain the debt crisis of the 1980s as representing a recent manifestation of ongoing North-South macroeconomic interactions. For him, the crisis as a whole, its emergence and possible solutions are all rooted in this interaction. Murshed notes a number of stylized features of North-South interaction in the 1980s. Two such features are a contractionary monetary policy in the North and the intensification of a protectionist tendency toward Southern goods. Such policies have resulted in the collapse of commodity prices and the evolution of indebtedness into a fully blown debt crisis. Adjustment programs designed to tackle debt problems have resulted in entitlement losses and low growth rates. In his model the North is depicted as functioning in a Keynesian fashion, with income assumed as being demand determined. In the goods market, the financial linkage is established by making Northern absorption partly a function of interest payments on Southern debt. Within this model, disposable income of the North is also set as being boosted by commercial tariffs levied on Southern exports. Capital flows from North to South are set to be a function of interest rates (as in a Mundellian or MacDougal approach) while the South’s debt is related to balance of payments. Finally, the balance of payments, itself, is assumed to depend on macroeconomic conditions in the North. Having analyzed the overall model, Murshed concludes that ‘the debt crisis as a whole is best viewed as a painful spillover of Northern macroeconomic policy onto

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8. For example, through the effects of monetary policy on interest rates, as well as terms of trade between North and South.
In general, Murshed’s model focuses quite sharply on financial interactions relating to macro policy and macroeconomic conditions in the North and their repercussions on the South.

MULTIMOD (‘offspring’ of MINIMOD) is a model developed and maintained by the IMF. It is a dynamic multi-country macro model of the world economy that has been designed to study the transmission of shocks across countries as well as the short-run and medium-run consequences of alternative monetary and fiscal policies (Laxton et al, 1998). The model, especially the latest Mark III version, could be classified as one of the new generation of macroeconometric models which are more firmly based on optimization theory (McKibbin and Wang, 1998: 8; Laxton et al, 1998). It was initially designed to analyze the macroeconomic effects of industrial country policies on the world economy but has been extended in a number of directions primarily for the purpose of increasing its usefulness in assisting with the IMF’s multilateral surveillance over policies of its members (McKibbin and Wang, 1998) and also the IMF’s periodic publication of ‘World Economic Outlook’. Another notable feature of the model is that exchange rates and interest rates are related by an adjusted interest parity condition that can allow for persistent risk premiums.

In MULTIMOD (Masson et al, 1990, Laxton et al 1998), the financial linkages of the finance-constrained developing country are formulated based on its capacity to service external debt. This capacity is measured by comparing the interest on debt as proportion of the exports of a developing country in question (LDC), to an expected or targeted value of a similar ratio, which is exogenously given. In this specification, exchange rate is allowed to have an influence on capital flows to the South. Economic activities in the North will also affect the numerator and denominator, and hence, the overall value of this ratio. A sort of ‘import compression’ mechanism is predicted when the South’s ratio passes the targeted threshold level. The theoretical basis of this approach is a rudimentary credit rationing mechanism based on solvency criteria. Finally, since exports are used in the computation of the relevant ratios, it is reasonable to conclude that MULTIMOD’s approach may be used, not only to indicate insolvency, but also short-term liquidity problems.

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9. Murshed specified his North-South model at both comparative static and dynamic levels. It seems that the two versions provide different conclusions about the impact of the North’s macro policy. Thus, while the former underscores its negative impact on the South’s debt, the latter does not. Murshed did not comment on this apparently contradictory result (See Murshed, 1990:87).
Laxton et al (1998) describe the Mark III version of the MULTIMOD in details. Accordingly, the version differs from its predecessors in that it includes new features such as a core steady state analogue model, a new model of the inflation-unemployment nexus, an extended non-Ricardian specification of consumption-saving behavior, and improved specification and estimates of investment behavior and international trade equations (see Laxton et al 1998). In the Mark III version, it is assumed that behavior of agents is completely forward looking in financial markets and partially forward looking in goods markets while consumption-saving behavior is based on an extended Blanchard-Weil-Buiter paradigm in which agents are assumed to have finite planning horizons. Similarly, the change in the investment equations means in the new version MULTIMOD investment behavior is based on Tobin’s q theory, according to which the desired rate of investment exceeds the steady-state rate as long as the expected marginal product of capital is greater than its replacement cost.

In Vos’ (1994) model, which is termed STAC, financial linkage is established by letting North have unrestricted access to capital markets, while the access of the South is rationed, on the basis of an imperfect credit worthiness assessment. This assessment is based on perceived payment capacity, which is calculated by relating interest payment to exports, in a similar fashion to that undertaken in MULTIMOD. Moreover, financial flows from the North are linked to public and private investment by way of the deficit. Imports are determined as residual, thus capturing the ‘import compression’ phenomenon. Other official flows are taken as being exogenously determined. In Vos (1989b, 1994), as well as Darity and FitzGerald (1982), the theory of credit rationing by oligopolistically functioning international banks is applied in modeling the linkages between the regions. The basic argument of these approaches is that the behavior of the suppliers, who are basically the international and commercial banks of the North, needs to be taken account of in the determination of such flows. Hence, in relation to lending to the South, the focus is mainly on credit rationing. In Taylor (1981), and Marquez and Pauly (1987), the South’s dependence on capital inflows from the North is recognized and understood to result from technological or capital input dependency. The extent of this dependency, which is equal to the regions trade deficit, is assumed to be determined by political factors. Indeed, following Vos (1989b), Taylor (1991) has attempted to model these financial linkages.

QUEST is another global model which can be characterized as Neoclassical-Keynesian Synthesis model. As described in Roeger (1997), financial linkages between national economics are explicitly modeled. The model assumes that financial assets denominated in different currencies are perfect substitutes up to an exogenous risk premium (Roger, 1997: 2). In other words, the model assumes that financial markets are fully integrated across all industrialized regions which are the
sole focus of the model. Thus, the model assumes perfect capital mobility across countries. In addition, the model assumes fully flexible exchange rates that are endogenously determined (Roger, 1997). Similarly, in the National Institute for Economic and Social Research’s model, NIGEM (NIESC Website), the financial linkages between countries, which come via linkages in their financial markets in the form of structure and composition of wealth, emphasis is given to the role and origin of foreign financial assets and liabilities. In other words, the economies are financially interlinked through exchange rates effects and the patterns of asset holding and associated income flows where interest rates and exchange rates are determined in the financial markets. This is tantamount to assuming that the financial markets are well functioning and closely integrated.

Even though Walley’s (1984) general equilibrium model is a North-South model that is meant primarily to model trade linkages, it also incorporates financial flows in the form of investment, interest and dividend and aid. Interest, dividends and aid flows are treated as income transfers while investment is treated as if it is a purchase of capital goods by agents located in the country of source of capital funds. The model differentiates between investment flows and merchandise trade by considering capital goods (since FDI is treated in the model as purchase of capital goods) not as something that flows to the country of location of the purchaser (like in the case of foreign goods) but as something that remains in the source country to generate incomes in future (Walley, 1984: 225). COMPASS (Comprehensive Model of Policy Assessment) and its improved offspring GINFORS (Global Inter-industry Forecasting System), a recent model that relates to the EU’s project MOSUS (Modelling Opportunities and Limits for Restructuring Europe towards Sustainability, are reported to interlink individual country macro models via bilateral multisector / multicountry trade model. (see Meyer et al, 2004). Finally, the models of Findlay (1980, 1981), Molana and Vines (1989), Sarkar (1997), Chui et al (2002) and Schiff and Wang (2006) do not consider capital flows at all.

To sum up, recent global models have attempted to incorporate different aspects of financial flows. However, the emphasis, the selection of variables and the specification adopted will vary depending on the theoretical approach chosen or the accounting framework adopted. Most existing models, which focus on the North emphasise the Mundel-Fleming and Portfolio theories of capital movements in modelling financial linkages. However, there are also a growing

10. Chui et al (2002) term Findlay’s (1980, 1982) models as “old growth- old trade” model because they essentially add some special characteristics of a Southern (Lewis, 1969, type) economy to a neoclassical (a Solow one sector economy) growth model for the North where trade between the regions follows HOS pattern and long-term growth is exogenous. (See Ibid: 126-133 for an extensive treatment of the Findlay North-South Model.)
number of North-South models, which are based on theories of credit rationing and oligopolistic banking behaviour. Indeed, the latter approach is quite plausible in explaining private bank flows to African countries, which are usually considered to be the worst risk. Thus, in modelling these flows to Africa a theoretical framework based on oligopolistic banking behaviour will be very important. Hence, this approach, together with some other specific features of African macroeconomics, not considered in existing North-South models, will be taken into account in building the model.

Table 3.1: Summary of Financial Linkages

<table>
<thead>
<tr>
<th>North-South (N-S) models</th>
<th>Uses Interest rate from integrated capital market</th>
<th>Uses disaggregated capital flows</th>
<th>Focus on debt, default and North’s macro policy effect on South</th>
<th>Focus on Import compression</th>
<th>Comprise credit rationing behavior in North</th>
<th>Focus on supply side determination of flows (liquidity, risk..)</th>
<th>Focus on the demand side determination of flows</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walley’s (1984)</td>
<td>Yes</td>
<td>Limited</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Limited</td>
<td>No</td>
</tr>
<tr>
<td>QUEST (Roger, 1997)</td>
<td>Yes</td>
<td>Limited</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Limited</td>
<td>No</td>
</tr>
<tr>
<td>NIGEM (NIESC Website),</td>
<td>Yes</td>
<td>Limited</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>COMPASS, GINFORS MOSUS</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>(see Meyer et al, 2004).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Beenstock (1988)</td>
<td>Yes</td>
<td>Limited</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Darity &amp; FitzGerald (1982)</td>
<td>No</td>
<td>Limited</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>INTERLINK, OECD, 1988</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Limited</td>
<td>Limited</td>
</tr>
<tr>
<td>MULTIMOD (IMF) (Masson et al, 1990) and MULTIMOD, Mark III (Laxton 1998)</td>
<td>No</td>
<td>No</td>
<td>Limited</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Study/Model</td>
<td>Endogenous</td>
<td>Consistency</td>
<td>Rule</td>
<td>Through Deficit Financing</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>-------------</td>
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<td>-------------</td>
<td>------</td>
<td>--------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Murshed (1990)</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Muscatelli and Vines (1991)</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>MSG2 (McKibbin and Sachs, 1991)</td>
<td>No, but Yes across N</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes, through consistency rule</td>
</tr>
<tr>
<td>STAC (Vos, 1994)</td>
<td>No</td>
<td>Limited</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes, through deficit financing</td>
</tr>
<tr>
<td>Taylor (1981); and Marquez &amp; Pauly (1987)</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes, through deficit financing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Findlay (1980, 1981); and Molana and Vines (1989)</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>UNCTAD, Project LINK (1973)</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Bank-GEM (Peterson et al 1991, Pedersen 1994)</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes, but limited</td>
<td>Yes</td>
</tr>
<tr>
<td>MSG2 (McKibbin and Sachs, 1991)</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

### 3.2 Trade Linkages

At least two basic approaches have been used in modeling trade linkages between North and South. Firstly, one which ensures endogenous determination of the relevant trade variables
(i.e. exports, imports and their prices). And secondly, an approach based on trade or market share matrices. In relation to the first of these approaches, three important aspects may be outlined. The first of these relates to the nature of the market, with the North usually assumed to specialize in industrial goods production and the South in primary goods. The market for industrial goods clears for quantity, or, in some models, for price, while that of primary goods clears only for price. Secondly, it is noteworthy that some models move beyond this simple, but illuminating, classification and disaggregate commodities into at least four to five commodity groups. Finally, a number of models focus explicitly on the impact of financial variables on the primary commodity market. The second approach, using trade share metrics, also has a number of variants. Thus, bilateral trade may be estimated, either directly, from a linearized Armington formulation (Hickman and Lau 1973), by using an estimation of total exports, by allowing variation in the share matrices (Klein and van Peterson 1973) or by emphasizing measures of competitiveness (Samuelson and Kurihara 1980).

A very common approach, used in most recent global economic models, is to establish the link, between North and South, through the specification of the supply of exports from one region, with the demand for imports in the other. This approach has been adopted, among others, by Krugman (1979a), Taylor (1981, 1983, 1991), Marquez and Pauly (1987), Masson et al (1990), Vos (1994), Muscatelli and Vines (1991), Moutos and Vines (1988). In none of these models, with the exception of MULTIMOD, NiGEM and Walley (1984), are commodities disaggregated. Rather, usually an aggregate manufactured good is specified for the North, and an aggregate primary commodity, for the South. However, as described below, the models differ as to how they specify their trade linkages, as well as the assumptions made about the nature of the goods market.

In the UNCTAD model, project-LINK, an attempt is made to model the South. However, the specification of the import/export equation, or trade linkage, for the South is carried in a very simple manner. Thus, exports are simply related to an index of world trade and a ratio of exports to world price, while imports are related to GDP, lagged real foreign inflows, deflated by import price, and the real exchange rate. The major trade linkage is established through market shares. The initial LINK exercise was to estimate the import function of each country, for a given level of world trade. Subsequently, world level consistency is achieved by making the total world level of trade an adjusting variable. This is termed the Mini-Link. This approach assumes that the level of world trade is the only adjusting variable. An alternative approach, termed the Maxi-Link, is employed in the final version of the project LINK model. The Maxi-Link is a modified Armington formulation, and is estimated by relating actual to estimated exports.
The latter are estimated, based on share matrices, estimated imports, a partial adjustment specification of such estimates in the preceding period and a trend term (See Klein and van Peterson, 1973). When constructing models of the size of project LINK and Bank-GEM, the use of a simplified structure is understandable. However, it should be pointed out that this simplicity might come at the expense of ensuring the use of theoretically and empirically sound adjustment mechanisms.

The Bank-GEM model followed two approaches in dealing with trade linkages. The first was to use a modified Armington type specification. The modification relates to the inclusion of price pass-through effects, a time trend and the use of an error correction method within the estimation. This approach is then used in the specification of trade in manufactures (SITC 5-9). For trade in food and beverage (SITC 0+1), raw materials (SITC 2+4) and energy (SITC 3), a similar approach to that used in project LINK is proposed. However, it is not clear which version of the LINK’s linkage mechanism is to be used. Neither does the Bank-GEM model clearly explain the market structure used in its commodity market. For manufactured goods it seems that a middle path, between monopoly and perfect competition, is chosen. However, there is no guarantee that the price specification used will yield the intended results. (See Peterson et al, 1991: 18). Indeed, within such a set-up, price is more likely to be flexible than fixed.

A global trade model, very much in the tradition of the export share matrix, is that of Taplin’s (1973) model of world trade. Taplin’s model, discussed, is based on the ‘Expanded World Trade Model (EWTM)’, developed by the Research Department of the IMF for the short term forecasting of trade flows and analysis of economic policies. The version discussed here treats the world as divided into 27 countries and regions comprising each of the 25 developed countries, the CEMA (the former ‘socialist’ countries) and the rest of the world (RW). The RW encompasses the developing countries in total. The level of imports for each developed country is determined by an import function. Economic activity (measured as autonomous spending) and relative prices are both represented as explanatory factors within the import function. However, due to a shortage of relevant information, economic activity and exports are used to determine the imports from the CEMA region. The imports of the rest of the world are set as a function of current and past foreign exchange receipts. The level of exports of

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11. This is included, in order to approximate convergence of consumers’ test or preference, especially between developed countries and the newly industrialized countries.

12. Ideally, the Maxi-LINK should be used, since this is relatively the stronger linkage mechanism.

13. This model, which was discussed in detail in Chapter 2, serves as a useful illustration of how market share models are formally modelled.
each country and region are obtained by distributing the forecasted imports by an export share matrix. In common with project LINK, export share matrices lie at the heart of the system. Thus, using Armington’s approach, the share matrices are estimated by regressing the change in market shares onto a proportionate change in price ratio.

Another widely cited global model is MSG2. In this model, the linkage between North and South is set in a vertically integrated fashion. The North produces consumption and investment goods, while the South supplies primary inputs, including oil, for use in the North’s production process. Thus, the demand for goods from the South is a derived demand for Northern goods. Output of the North is specified, in a Cobb-Douglas form, as a function of value added and primary inputs. Value added is further specified, also in Cobb-Douglas form, using capital and labour as inputs, while primary inputs are defined as a Cobb-Douglas function of oil and non-oil primary inputs. Oil is then specified as a Cobb-Douglas function of domestic production and imports from OPEC. For goods from OPEC and the LDCs a single world uniform price is assumed. Prices of commodities from the South and OPEC are defined by a mark-up over a basket of OECD goods. By making this mark-up a positive function of the demand for OPEC and LDC exports, in effect, the price of OPEC and the South’s commodities are assumed to be demand determined. However, the downside of this assumption is that it overlooks the important distinction that the oil market clears for output and the primary commodity market for price, which is taken as a stylized fact in most recent North-South models. However, a useful development, incorporated into the MSG2 model, is the use of an integrated or nested production structure. Although the MSG2 specified such relations at an aggregate level, the method may also be applied in relating sectoral supply to sectoral demand, within the two regions or countries. The specification of such sectoral linkages would allow for the examination of the sectoral implications of macro linkages, in general, and of trade linkages in particular.

As was observed earlier, the G-Cubed model closely related to the MSG2 model. However, compared to the MSG2 model, G-Cubed model is a world model with substantial regional desegregation with considerable sectoral detail. It is also designed to be a bridge the gap between CGE models that traditionally ignore the adjustment path between equilibrium and macroeconomic models that ignore individual behavior and the sectoral composition of economies (McKibbin and Wilcoxen, 1998: 12). More specifically, the model is meant to bridge the gaps between three areas of research: econometric general equilibrium modeling, international trade theory, and recent developments in macroeconomics by incorporating the best features of each (but at the cost of being fairly large) (McKibbin and Wilcoxen, 1998: 1). From the trade literature it borrows the approach of modeling the world economy as a set of
autonomous regions interacting through bilateral trade flows. It follows the Armington approach of considering goods produced in different regions as imperfect substitutes and distinguishes between financial and physical capital (McKibbin and Wilcoxen, 1998). The G-Cubed model imposes an intertemporal budget constraint on each region, i.e., all trade deficits must be eventually repaid by future trade surpluses. From the general equilibrium literature, the model adopts the representation of each region by its own multi-sector econometric general equilibrium model while drawing on macroeconomics theory by representing saving and investment as the results of forward looking inter-temporal optimizer economic agents (McKibbin and Wilcoxen, 1998). In the model, international trade is modeled at bilateral level and trade imbalances are financed by flows of assets between countries. Labor is assumed to be perfectly mobile across sectors within each region but immobile between regions; long-run labor supply is assumed to be completely inelastic and is determined by the exogenous population growth rate while in the short run nominal wages adjust slowly according to an overlapping contracts model where wages are set based on current and expected inflation and on labor demand relative to supply (see McKibbin and Wilcoxen, 1998).

Based on Vernon’s (1966) theory of ‘product cycle’, Krugman (1979a) has formulated trade patterns that emerge from technological change within a North-South framework. He assumes a world of two countries, consisting of an innovating North and a non-innovating South. Innovation takes the form of developing new products, which could, after a lag, be produced in the South. The lag in the adoption of new technology by the South, gives rise to trade. Interestingly, Krugman concludes that the ‘North always exports new products and imports old products… Each good is at first produced in and exported by the North; then when technology becomes available to South, the industry moves to lower wage country. Case studies in such a world reveal a Vernon-type product cycle’ (Krugman, 1979a :260). Although his theory cannot usefully be applied to the South, in general, Krugman’s general point remains valid for particular countries, particularly in East Asia. However, its relevance to low income, institutionally weak, African countries remains very limited. As cited in Chui et al (2002), Dollar (1986) extends the Krugman (1979) model to incorporate two factors of production - capital and labor. It also endogenized the North-South technology transfer taking a process of international capital mobility on board. (See Chui et al, 2002: 135-139 for details of this and other models which they identify as “old growth- new trade” models.)

One of the trade linkages used in the North-South model developed by Algoskoufis and

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14. One feature that distinguishes it from other typical macro models is that its parameters are determined by estimation rather than calibration.
Varangis (1992) relates to an attempt to link the fiscal condition of the North with the primary commodity price of the South. This is a very small model, which is analytically similar in structure to that of the Mundel-Fleming model. In the section of the model dealing with the North, for a given set of supply and demand parameters, macro equilibrium depends on the relative price of commodities to manufactures, and on the real interest rate. A similar equilibrium structure is also maintained in the section dealing with the South. Finally, the two models are combined and solved for the equilibrium values of real interest rate and relative prices. The model conveys an important point, that the relationship between world interest rate and primary commodity prices could be negative or positive, depending on the origin of shocks. Thus, if demand and supply shocks originate, say, from North, the relationship between real interest rate and relative prices is negative. This result indicates the presence of a strong linkage between the fiscal deficit in the North and price of primary commodities. The model developed by Beenstock (1988) also emphasizes such commodity and financial market linkages.

The new version of The IMF’s MULTIMOD Mark III has a standard specification of import and export behavior that embodies the notion that countries trade in diversified products where import volumes are a function of the main components of aggregate demand, with import contents of the different components calibrated on the basis of information from input output tables. Exports are modeled to approximately represent the mirror image of the foreign import demand functions (Laxton et al, 1998). In the model, (Masson et al 1990, Laxton et al, 1998), trade in goods is disaggregated into three basic commodity groups. These are, oil, primary commodities and manufactures. Trade in oil is assumed to take place at a unique world price, which is determined exogenously. For the industrialized countries a domestic demand equation determines oil consumption, with oil imports determined as residual, once domestic sources have been tapped. For the two groups of LDCs specified in the model, namely capital importing and capital exporting, exports of oil are taken as endogenous and world demand is equated with world supply. Any increase in demand is shared between the two regions, in fixed proportions, with production passively responding to demand, at a given price. Primary commodities, produced by the South, are assumed to have perfectly flexible prices, which will ensure market clearing. Relative price changes in favor of primary products, or profitability, are assumed to induce a shift of resources into this sector, with associated positive repercussions. Manufactured products are assumed to be produced by all countries and are mark-up priced. With the exception of high-income oil earners, the import and export of manufactures is taken as endogenous to the model.

The trade linkage is established with the North’s export of manufactures, through an export
equation that comprises foreign absorption and real effective exchange rate as explanatory factors. Another trade linkage is established with the commodity imports from the South using an import function, which contains the variables for Northern GDP and real exchange rate as arguments. Owing to the endogenous determination of the main linkages, the model is characterized as a dynamic version of the Mundell-Fleming model. An important feature of MULTIMOD is its market structure. Specifically, manufactured goods are (fix-price) quantity clearing, while primary commodities are (flexi-price) price clearing.

The North-South Models of Taylor (1981, 1983, 1991), Darity and FitzGerald (1982), Marquez and Pauly (1987), Vos (1994) Sarkar (1994, 1996), among others, are also based on a similar market structure, with Northern goods’ market clearing for output and commodity markets for price. These models fall under the same theoretical grouping as the Kalecki-Lewis models. In contrast, the trade linkages within the models of Findlay (1980, 1981) as well as Molana and Vines (1989), describe a perfectly competitive market within both regions. These markets accommodate goods produced using a neoclassical production function. Thus, in these models, the demand for imports within each region will depend on relative price and real income.

Walley (1984) built a numerical general equilibrium model of world trade, where prices are endogenous, to analyze terms of trade issues and welfare impacts of protection in the North and the South. The model uses the ‘Armington’ assumption of product heterogeneity by region to accommodate cross hauling (intra-industry trade). His model separately specifies preferences and production function parameters in order to model trade determination in terms of technology and preference differences, besides factor endowments. Seven trading regions and six product categories (five traded and one nontraded goods) are specified in the model. The model used explicit demand functions derived from CES/LES preference functions and production functions are assumed to be of CES form and product markets are assumed to be perfect.

Sarkar (1997) develops a North-South macroeconomic framework of the world economy on the Keynes-Kalecki-Kaldorian lines to study the role played by factors such as income and price elasticities and the rising monopoly power of the Northern producers in determining the long-term behavior of the North-South terms of trade. The paper develops three different

15. These are, price and volume of goods traded, exchange rate and interest rate.
16. However, Molana and Vines (1989) assumed production technology of a fixed coefficient type, within the North, since labour is assumed to be in surplus. For the South their Cobb-Douglas function has three arguments: land, labour and capital.
models under three different assumptions: (1) consumer goods are traded under fixed mark-up pricing in the North; (2) consumer goods are traded under flexible mark-up pricing; and (3) the South imports the whole of its machine requirements from the North. The North is demand constrained while the South is supply constrained; (prices adjust to balance demand and supply in the South while output adjusts in the North). Sarkar (1997) finds that, if the South does not require Northern machines, it can grow at an independent rate. Furthermore, in a product cycle scenario, (where the income elasticity of Northern demand for Southern export good is less than that for the Northern good in the South), the terms of trade of the South will deteriorate if its growth rate is not less than that of the North. However, Sarkar (1997) does not find any role for the growth of monopoly power of the Northern producers in explaining the terms of trade of the South, nor any role for price elasticity of demand for Southern exports.

The OECD’s INTERLINK is a macroeconomic model that combines short term “Keynesian” features with long-term neo-classical properties with a country-specific models for OECD countries and a crude block-specific models for non-OECD countries. Each country or block is linked through the channels of trade, financial flows and exchange rate (Dalsgaard et al, 2001:5). The core of each country model in INTERLINK consists of (a) a production function determining output in the long term, (b) a wage-price block, which in combination with factor demand equations (for capital and labor), essentially determines the speed of adjustment following a shock and (c) behavioral equations for private consumption as well as for prices and volumes of imports and exports (Dalsgaard et al, 2001).

In the OECD’s INTERLINK model, volume of imports and price of exports are determined endogenously, with domestic demand, costs and international prices used as explanatory variables. However, with the exception of energy suppliers, non-OECD countries are taken as price takers, with their export prices assumed to follow that of competitors. Food and raw materials are taken as a function of demand within the OECD. Such single country estimates are passed to the trade linkage model where a consistent export volume (by way of share equations) and import price estimates are determined. This is undertaken by allocating country-based estimates of global import demand among individual exporting countries, which, in turn allows for the determination of import prices for each country. The main determinant of the export share is the export market growth elasticity, which, itself, depends on past trends, competitiveness and the commodity export composition of a country. These export and import prices are, in turn, passed to the individual country models, as revised inputs. The process is then iterated, in order to arrive at an internationally consistent model solution. Global consistency between import and export volume is enforced by combining the structure of the system, as described
above, with parameter restrictions, across a set of export volume equations. In general, this trade linkage is similar to the one used in Project LINK and proposed for use by Bank-GEM. However, while, in LINK, consistency is achieved by estimating exports, allowing for possible factors to influence the share-based estimation, parameter restriction plays a significant role in INTERLINK. According to Dalsgaard et al (2001) the model does not allow for forward looking behavior even though expectations about future changes in policies or market circumstances are often as important as the events themselves. Further more, most of INTERLINK’s main behavioral equations were last estimated in the mid-1990s, and may therefore not adequately capture the extent to which more recent systemic changes might have influenced economic behavior in the OECD countries (Dalsgaard et al, 2001: 9).

Another recent model very closely related to INTERLINK is the ‘new’ small global forecasting model of OECD, focused on US Euro area and Japan, described in Rae and Turner (2001). This model focuses on the production of globally – consistent short–term forecasts of the major aggregates for the US, the Euro area and Japan and models the rest of the world in a very aggregate manner (as a single block). The key variables in the model are output, inflation, the trade balance, and import prices which are modeled to be driven by monetary and fiscal policy, exchange rates and world demand (Rae and Turner 2001:4). The regional models are directly linked through trade, interest rates and exchange rates. In addition, the model assumes that output and inflation in the rest of the world depends on developments in the three main regions, and transmitted to the rest of the world through the trade equations. Commodity prices are assumed to be endogenous variables which depend on world output and inflation. Rae and Turner (2001) characterize their model essentially as a demand side model where output is based on an IS-type relationship although this relationship has been split into domestic demand and net export components rather than being modeled as a single reduced form equation. Potential output is assumed exogenous. While very different in size and structure the small model can be thought of as a simplified version of INTERLINK’s demand side model. One difference, however, is that this model is based on quarterly data where as INTERLINK and the forecasting round use semi-annual data (see Rae and Turner, 2001: 5-6 for details).

Chui et al (2002) built a North-South trade model identified as ‘new trade, new growth’ model. In this model, there are three sectors in each region: a high-technology manufacturing sector which produces an expanding variety of differentiated products; a traditional sector that produces a single traded homogeneous product; and R&D sector which produces blueprints for new or copied manufactured goods. All sectors use two factors of production consisting of skilled labor and unskilled labor while total supply of each type is exogenously fixed for both regions.
and there is no labor mobility across the two regions; and the labor market is assumed to clear. The model also assumes competitive output markets for the traditional and R&D sectors while it assumes monopolistic structure for the manufacturing sector. Under these assumptions, Chui et al (2002) made four different assumptions regarding the R&D sector of the South (see Chui et al, 2002: 145): (1) no R&D at all - the region specializes in traditional products and a stagnant range of manufactured goods varieties; (2) there is R&D sector that engages in imitation (resulting in North-South product cycle scenario); (3) imitation and innovation combined; and (4) the South only innovates in its R&D sector. The results of such different scenarios in their model are four distinct stages of development, i.e., from the ‘lowest’ to the highest or most advanced. The authors then show that the factors that determine which of these stages exist are the speed at which the South absorbs ideas from the North; the factor endowment in both regions; the relative ease of copying; and the relative efficiency of the South.

More recently, Schiff and Wang (2006) carry out an empirical study of the direct and indirect effects of North-South and South-South trade-related technology diffusion. The trade impact channels they identify include North-South trade-related foreign R&D; the diffusion of foreign R&D to the South through South-South trade; the diffusion of North-North trade-related R&D to the South through North-South trade; and the further diffusion of the North-North trade-related R&D to the South through the South-South trade (Schiff and Wang, 2006: 832). Their empirical analysis relies on open economy endogenous growth theory to estimate (the logarithmic specification of) total factor productivity (TFP) on foreign and domestic stock of R&D using a sample consisting of 16 manufacturing industries in 24 developing countries over the period 1976-1998 while the North consists of 15 OECD countries. Using 2-, 3- or 4-digit level international commodity classification (SITC Revision 2) based data, they find that both the North-South and the South-South trade related foreign R&D have a positive impact on TFP in the South, with the former being larger in magnitude than the later. They conclude that technology diffuses more rapidly through North-South than South-South trade. Accordingly, they suggest that opening up a country’s economy especially to the North where most of the R&D activity is performed leads to an increase its TFP and a rise in income (Ibid: 844).

Similarly, Dinopoulos and Segrestrom (2006) develop a dynamic general equilibrium model of North-South trade and economic growth where the regions are distinguished by their R & D capabilities. In their model, both innovation and imitation are endogenously determined; so is the degree of wage inequality between Northern and Southern workers. The industrial structure in the model is such that there is a continuum of industries where, in each industry, firms are distinguished by the quality of the quality of the products they produce (quality increasing due to
R&D activity). Firms in each industry complete in price and maximize profits; labor is the only factor of production; production technology is characterized by constant return to scale (CRS); labor markets are perfectly competitive in both regions. They have also assumed the “ice berg” type transportation costs separating the two regions. Further more, it is assumed that there is free entry into R & D activity and southern firms are assumed to engage exclusively on copying Northern innovation rather than doing their own R and D activity. Based on these assumption Dinopoulos and Segerstrom (2006) find, among other things, that stronger intellectual property rights protection would simply generate substantial rents for Northern innovators at the expense of consumers and southern producers.

NiGEM is another detailed multi-country model that covers all OECD economies that treats the rest of the world in blocks (HM Treasury, 2003: 229). The trade equations in this model depend on demand and relative competitiveness effects (NIESR Website). Exporters are assumed to compete against those who export to the same market through prices. Demand is given by the imports in the market to which the country has previously exported while imports depend upon import prices relative to domestic prices and demand. The model covers trade in goods and services, with export prices and import prices being linked for consistency using the Armington matrices for demand and prices. In the latest version of the model, a single equation is specified for export and import of goods and services of each country and a common elasticity is employed across all countries. For countries with large export share (such as Canada and Australia) NiGEM disaggregates the equation for export price of goods and services into two: one equation for commodities another for non-commodities. The model for commodity price is a simple weighted average of commodity prices with weights determined by their share of commodity exports in the year 2000 (HM Treasury, 2003; NIEST Website accessed on October 6, 2006). The non-commodities prices being determined mainly by the domestic and export price of competitors.

The Oxford Model (OEF, 2005) attempts to combine vector auto regression (VAR) approach which is strong in terms of short–term forecasting and generation of stylized facts but weak in economic structure with that of a CGE approach. The ‘core’ of the latest version of the model comprises 24r country models together with six blocks and more than 20 ‘emerging market’ country models (OEF, 2005: 30). The model is based on the income expenditure accounting framework where, in the long-run, each of the economies behaves like the textbook description of a one sector economy under Cobb-Douglas technology in equilibrium. Demand is modeled as follows: consumption is a function of real incomes, real financial wealth, real interest rates and inflation. Investment equations are influenced by “q-theories”, in which the rate of investment is
determined by its opportunity cost (minus or plus taxes and allowances). Countries are assumed to be “small” (i.e., exports are determined by demand and a country can not determine its own terms of trade). Exports are modeled as a function of world demand and the real exchange rate and imports are determined by real domestic demand and competitiveness (OEF, 2005: 5). In general, the Oxford model is more or less a market clearing (or neoclassical) macroeconomic model in the long-run although it features ‘Keynesian’ flavour in the short and medium term.

COMPASS (Comprehensive Model of Policy Assessment) is a new generation of global econometric models that is sectorally disaggregated. It is based on evolutionary theory in which agents are assumed to decide under conditions of bounded rationality in non-perfect markets set up (Meyer et al, 2004). COMPASS has 36 sectors and 53 countries and regions. Trade and financial linkages. Countries are linked through multisectoral bilateral trade as well as international financial markets. The structure of the model is depicted as a wheel where the bilateral trade model forms the axis and country (macro, input-output and energy) models form the spokes (See Meyer et al, 2004, Figure 1 for the details). In the multi-sectoral trade model component of COMPASS, the approach taken is to calculate the vector of import prices for every country and to estimate the shares of country i in the imports of good j in country k depending on relative import prices for good j in different countries so that the vector of exports can be calculated for every country by definition (Meyer et al, 2004). Both COMPASS and its offspring GINFORS (Global Interindustry Forecasting System) put trade as the central mechanism by which interdependences among economies are expressed. In terms of coverage, even though the number of countries has increased with the upgrading of COMPASS to GINFORS, the focus still remains on EU and OECD countries where OPEC members and the rest of the world are modeled just as two additional aggregate regions.

Finally, we concluded this section by looking at the new and interesting approach to global macro modeling introduced by Pesaran and Schuermann (2001) and Pesaran et al (2003) and Pesaran, and Smith (2006). Its uniqueness comes from the use of recent advances in time series econometrics (VAR, cointegrating systems and VAR Error Correction Models) whose applications so far had been limited to a single country (region). As Pesaran and his co-authors, the strengths of their global vector autoregressive (GVAR) approach lies in its flexibility in taking the various inter-linkages in the global economy in a fairly simplified set-up. They first estimate individual country (region) specific vector error-correction models (VECM) where the domestic macroeconomic variables such as GDP, the general price level, the level of short-term interest rate, exchange rate and money supply are related to corresponding foreign variables constructed exclusively to match the international trade and finance pattern of the
country under consideration. For estimation purposes and inference, the authors contend that the country-specific foreign variables can be treated as exogenous for most countries when N (number of countries) is sufficiently large; a notable exception being the US economy (Pesaran et al., 2003).

They model the relationships for individual economies using a simple log-linear VAR specification. The individual country models are then combined in a consistent manner to generate forecasts for all the variables in the world economy simultaneously. In this global model (GVAR), the country-specific models together with the relations linking the exogenous variables of the country-specific models to the variables in the rest of the global model form a complete system ((Pesaran et al., 2003: 6). Since data limitations even for moderate values of N would not allow a full system estimation of the global model, the authors propose to estimate the parameters of the country-specific models separately, treating the foreign price variables as exogenously given (except possibly the US), while maintaining a general specification for correlation of shocks across the different countries/regions. The different economies in the model are allowed to interact through three separate but inter-related channels: (1) direct dependence of the matrix of country-specific variables/factors on the vector of foreign variables specific to the country under consideration; (2) dependence of the country-specific variables on common global variables such as oil prices; and (3) non-zero contemporaneous dependence of shocks in country i on the shocks in country j, measured via the cross country covariances.

The GVAR has encountered mixed reception in the subsequent global modeling literature. Dennis and Lopez (2004) appreciate the compactness of this approach and the fact that it is straightforward to implement but doubt its usefulness for wide policy applications given its inability to assess the sectoral impact of shocks, limited dynamic structure and theoretical foundation. Further, they mentioned that it puts more emphasis on the time series properties of macroeconomic data than on economic theory (Dennis and Lopez, 2004: 2). According to Waallis (2004) mainstream multi country models were developed from national economy models to facilitate the study of mainly policy and shock transmission and economic linkages through trade and finance; however, in GVAR, he noted, such important international linkages can only be implicit rather than explicit (Wallis, 2004: 2). For instance, in standard global models trade link, the dependence of exports and imports on income in the receiving country and relative prices is captured directly in the structural models whereas in reduced form models such as GVAR it is solved out via the national income identity to yield a relationship between domestic and foreign variables including the price variables (see Wallis, 2004). Thus, trade makes only an implicit contribution to the output equations, a contribution that is acknowledged by the authors.
(Pesaran and Schuermann, 2001: 19) by the use of trade weights to construct the aggregate foreign variables. Furthermore, Wallies (2004) noted, emphasis on the forecasting purpose of the model reduces the ability of the model for economic story-telling; and hence the apparent well established fact that that the best forecasting model and the best policy analysis model are unlikely to coincide (Wallies, 2004). Notwithstanding his criticism, Wallies (20044) nevertheless, noted that GVAR could be regarded as a natural benchmark for use in global economic forecast evaluation.

Table 3.2: Summary of Trade Linkages

<table>
<thead>
<tr>
<th>N-S models</th>
<th>Uses trade share matrices</th>
<th>Uses endogenous determination of trade variables</th>
<th>Directly links macro variables to commodity market</th>
<th>Uses disaggregated commodities</th>
<th>In goods market the North is quantity clearing while South is price clearing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taplin (1973); UNCTAD, Project LINK (1973)</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No (both are price clearing)</td>
</tr>
<tr>
<td>Beenstock (1988)</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No (both are price clearing)</td>
</tr>
<tr>
<td>Darity &amp; FitzGerald (1982)</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Walley’s (1984)</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Krugman (1979), Dollar (1986)</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Taylor (1981); and Marquez &amp; Pauly (1987)</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Taylor (1981); and Marquez &amp; Pauly (1987)</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Findlay (1980, 1981); and Molana and Vines (1989)</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No (both are price clearing)</td>
</tr>
<tr>
<td>Murshed (1990)</td>
<td>No</td>
<td>Yes</td>
<td>Limited</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Muscatelli and Vines (1991)</td>
<td>No</td>
<td>Yes</td>
<td>Limited</td>
<td>No</td>
<td>No (both are price clearing)</td>
</tr>
<tr>
<td>Algoskoufis &amp; Varangis (1992)</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No, (interest also clears)</td>
</tr>
<tr>
<td>STAC (Vos, 1994)</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Model</td>
<td>Price Clearing North</td>
<td>Price Clearing South</td>
<td>Price Clearing Overall</td>
<td>Price Clearing Overall in the North is Limited</td>
<td>Price Clearing Overall in the North is Limited</td>
</tr>
<tr>
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<td>------------------------------------------------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>Bank-GEM (1991, 1994)</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No (both are price clearing)</td>
</tr>
<tr>
<td>Sarkar (1992, 1994, 1996, 1997)</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>MULTIMOD (IMF) (Masson et al. 1990) and MULTIMOD, Mark III (Laxton 1998)</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>MSG2 (McKibbin and Sachs, 1991) McKibbin and Wilcoxen (1995, Revised 1998)</td>
<td>No,</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No (both are price clearing)</td>
</tr>
<tr>
<td>INTERLINK, OECD, 1988; Rae and Turner (2001); (Dalsgaard et al, 2001)</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No (price clearing in the North is limited)</td>
</tr>
<tr>
<td>Chui et al (2002)</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>COMPASS, GINFORS MOSUS (see Meyer et al, 2004).</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
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<td>The Oxford Model (OEF, 2005)</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
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<td>Pesaran and Schuermann (2001) and Pesaran et al (2003) and Pesaran, and Smith (2006).</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>NIGEM (NIESC Website),</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
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<td>Dinopoulous and Segrestrom (2006)</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
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<td>Schiff and Wang (2006)</td>
<td>No</td>
<td>Yes</td>
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IV. Summing Up

So far, we have examined both the theory and practice of North-South modeling. The theoretical section of this discussion has shown that the assumed stylized facts, or view of the economy, will determine the structure of the North-South models, which are developed. As a result, the implications of particular shocks or policies could vary across different types of model.

An interesting conclusion may be arrived at when these theoretical models are contrasted with the stylized facts in relation to Africa. African countries are price takers within the international commodity market, with the market for their commodities characterized by price clearing. An ‘unlimited’ labour supply is also found to represent a plausible hypothesis for most of these countries. Moreover, African nations will tend to trade with (Northern) countries, which have excess capacity, and which are dominated by big firms with price making capacity. In fact, as demonstrated by Yeats (1991), for some commodities, such as metals, African countries will tend to pay an average premium of 23 per cent above the unit value for other developing countries (Yeats, 1991: 201). Many studies (see Alemayehu 2002) show the extent to which African countries are dependent on Aid. These countries are also likely to be the worst risk for private lenders, and commercial banks in particular. These stylized facts underscore the relevance of the Kalecki-Lewis model in depicting analytically the incorporation of these national economies into the world economy. However, this incorporation would not be complete without, first, describing the financial interaction of these economies. Hence, the literature about the determinants of official inflows, combined with an international credit rationing hypothesis will need to be integrated into the Kaleckian-Lewis model, in order to strengthen the relevance of this model for Africa. This line of argument stands as the main justification for adopting this structure, in the model constructed in the following section.

Two other important issues arise from the survey of models, presented in this study. Firstly, undertaking a survey of existing models is extremely important in identifying the specific linking mechanisms, which will need to be incorporated, during model construction. Hence, the linkages identified within these models will be used to guide the construction of the model, set out below. Secondly, the above survey demonstrates that the modeling of the South remains extremely rudimentary. Indeed, in the case of Africa, such modeling has been neglected almost entirely. The major implication of these findings is that insufficient account has been taken of the basic macro features of the South within existing North-South models. This implies a
need to identify the salient macro features of African economies and to integrate these within a North-South modeling framework. Hence, the following section will be devoted to such an exercise.
References


Pesaran, M. Hashem and Ron Smith (2006)‘ Macroeconometric Modelling with Global Perspective’ CWPE Cambridge Working Papers in Economics 0604


