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A KALECKI-KEYNES MODEL OF WORLD TRADE,
FINANCE, AND ECONOMIC GROWTH

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ABSTRACT

Borrowing from the insights of Michal Kalecki and John Maynard Keynes, this essay presents a highly-aggregative model of the world economy that highlights the crucial role of international credit flows in the short to medium term. The Center nations (or the developed industrial nations) produce and export a capital good that is used in all sectors of the world economy while the Periphery (or the developing nations) produces an export good that is used only in productive sectors at the Center. The model also includes an international banking zone that allocates credit to the Center and the Periphery--with a preference for lending to the Center. The model displays certain crucial features of international economic interdependence, while simultaneously revealing the decisive role of investment and income distribution at the Center in determining flows of world trade and finance. In addition, the model facilitates exploration of the consequences of the current massive levels of state indebtedness held by Third World countries as well as the contradictions of the current international "liquidity crisis."

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Introduction

This paper employs a highly aggregative, two-region model of the world economy to facilitate examination of certain fundamental issues involving prospects for economic advance by the non-industrial or industrializing nations (the Periphery). These issues are considered in the context of a particular structure of production and trade by the Periphery with the advanced industrial nations (the Center). The issues include the following:

- (1) How can the recent massive build-up of external debt by the developing countries be explained?
- (2) Must the Third World countries rely upon the old metropolitan powers for their engine of economic growth?
- (3) Can the Third World countries serve as an engine of growth for the old metropolitan powers?
- (4) What is the impact of fiscal and monetary policies pursued in either region on the overall performance of the world economy?
- (5) Given the prevailing structure of the world economy, is it reasonable to expect the poorer nations of the world to "catch up" with the richer nations?

To pursue these matters, the model presented here highlights the important role of international credit flows in the chronological short to medium term. The model locates the dynamic forces driving worldwide growth and distribution at the Center through the use of a neo-Ricardian cost-determined trade model with an international credit mechanism. Second, it permits the modelling of financial flows through an international credit mechanism not merely as automatic compensation for trade imbalances left uncleared by relative price movements, i.e., terms of trade variations inclusive of exchange rate variations, but instead as a result of shifts in the economic accumulation balance at the Center (savings, investments, etc.). The Center is "dominant" because of an asymmetry in the structure of Center-Periphery trade. The Center utilizes (or "consumes") its own export commodity, but the Periphery only finds a market for its export commodity at the Center. As a consequence, despite the global interdependence this model depicts, the characteristics of investment and income distribution at the Center are decisive in determining the flows of world trade and finance.

Unlike many neo-Ricardian models this one, as mentioned above, consciously adopts a short to medium term cast rather than the more familiar long period equilibrium style. This makes it permissible for sectoral rates of profit to differ. In Kalecki's sense, degrees of monopoly can differ across sectors.

The multinational banking system is depicted as drawing a red line between the Center and the Periphery. The Center's credit requirements always are met first. The banks offer the Center an unlimited quantity of credit at a fixed set of terms (a combination of interest rates and maturities). Thus, the volume of lending to the Center is demand-determined. After the Center's requirements are met the multinational banks then proceed to lend the difference to the Periphery in a manner where the quantity of credit supplied is positively related to the terms.

The paper proceeds in sections: (1) In the first section we present the price structure for the four types of goods produced internationally. (2) In the second section we model the Center economy. (3) Next we model the Periphery economy. (4) In section four we outline the determinants of the allocation of credit on an international scale. (5) The fifth section integrates all the preceding strands to present the full model and to put it through its paces. (6) The sixth and final section illustrates the implications of the model for the five questions raised at the outset.

Since the dynamic thrust in the model appears to originate with the production of capital-goods at the Center, there is a self-conscious flavor reminiscent of models of "classical dependency," for example the ECLA school's structuralist conception of the world economy. There is a Lewis-Nurkse flavor (see Darity) to the model in the sense that expansion at the Center means expansion in the Periphery, and contraction at the

Center means contraction in the Periphery. But unlike the Lewis-Nurkse model the dependence is reciprocal between Center and Periphery in this model. Nevertheless, the Periphery does not have the capacity to spur its own growth by generating an internal demand for its export good. This feature in particular gives our model a historical specificity to the contemporary world, although some aspects of the credit mechanism and the movement of finance to the Periphery may evoke memories of earlier episodes in global economic history (see, e.g., Leland Hamilton Jenks on the movement of finance from Britain to the rest of the world in the late 19th century.)

Our model bears some resemblance to the one advanced by Nicholas Kaldor in his 1975 Presidential address to the Royal Economic Society. It also has an affinity with the structuralist models of "imported" inflation developed by some Scandinavian researchers (see Aukrust and Edgren, Faxien, and Odhner) in the late 1960s.

I. THE INTERNATIONAL PRICE STRUCTURE

In our Center-Periphery model there are four goods produced in the world economy. The Center produces capital-goods, K , and wage-goods, W . Capital-goods are utilized as an input in the production of all four sectors' output. Wage-goods are not traded and are consumed solely at the Center. The Periphery produces an export good, R , as well as an agricultural good, A . The Periphery export good is used in both capital-goods and wage-goods

production at the Center but is not used at all in the Periphery itself. The agricultural good is non-traded and consumed only at the Center.

Note that it is irrelevant whether the Periphery export good is viewed as a primary product (raw materials, petroleum, or tropical produce) or as a manufactured intermediate good. What matters is the assumption that demand in the Periphery is "incomplete" in the sense that there is no demand for its own export commodity at home.¹

Following Kalecki the current period price of each of the four goods can be treated as a mark-up over unit labor costs and all other unit costs. For simplicity we make the extreme "one hoss shay" assumption that capital-goods depreciate completely and instantaneously at the end of each period. Capital-goods made in the preceding period are used in the current period to make the new output in each sector. They then disappear altogether.

The price equations for each sector follow:

$$P_W = (1+Z_W)[w_C l_W + P_K^P q_W + P_R^m m_{RW} + i_W d_W] \quad (1)$$

$$P_K = (1+Z_K)[w_C l_K + P_K^P q_K + P_R^m m_{RK} + i_K d_K] \quad (2)$$

$$P_R = (1+Z_R)[w_P l_R + P_K^P + i_R d_R] \quad (3)$$

$$P_A = (1+Z_A)[w_P l_A + P_K^P q_i + i_A d_A] \quad (4)$$

Each P_i is the current price of the respective sector's output. Each Z_i is the mark-up factor for the particular sector, while w_c is the average nominal wage prevailing at the Center and w_p is the average nominal wage prevailing in the Periphery. Sectoral labor-output ratios are given by each l_i ; i_i is the percentage of each sector's outstanding nominal debt that comes due during the current period--both interest payments as well as payments on principal; and each d_i is the sector's nominal debt-output ratio. P_K^P is the past period price of capital-goods; q_i is each sector's ratio of old capital-goods to newly produced output. Finally m_{RW} and m_{RK} are the Periphery's export good to wage-goods ratio and export good to capital-goods ratio in the Center's productive sectors. All nominal terms are measured in Center currency.

Because of our short to medium term characterization of the relevant period for the model, we treat z_i , w_i , w_p , l_i , P_K^P , q_i , m_{RW} , m_{RK} , i_i , and d_i as fixed. Substitution of (3) into (1) and (2) gives us a fully-determined set of output prices without any reference to supply and demand:

$$P_w^* = (1+z_w)[w_c l_w + P_K^P q_w + (1+z_R)(w_p l_R + P_K^P q_R + i_R d_R) m_{RW} + i_w d_w] \quad (1')$$

$$P_K^* = (1+z_K)[w_c l_K + P_K^P q_K + (1+z_R)(w_p l_R + P_K^P q_R + i_R d_R) m_{RK} + i_K d_K] \quad (2')$$

$$P_R^* = (1+z_R)[w_P l_R + P_K^P q_R + i_R d_R] \quad (3')$$

$$P_A^* = (1+z_Z)[w_P l_A + P_K^P q_A + i_A d_A] \quad (4')$$

The stars indicate that equation (1') through (4') are reduced form expressions for each of the prices. Prices are entirely cost-based. The model altogether cordons off price determination from quantity determination, as will be made even clearer below.

Each z_i , or each sector's mark-up factor, can be interpreted as the sectoral rate of profit. Since each is fixed for the period of the model and each z_i is strictly positive, all sectors must generate a "surplus" above costs. Variations in total profits will be attributable to fluctuations in quantities sold but will not affect the sector by sector rates of profit. Changes in total profits, however, can be associated with a high degree of variance in the performance of individual enterprises within a sector. When the total profits of a particular sector falls due to a decline in the volume of sales, some firms may find themselves achieving less than the sector-wide rate of profit and even may go bankrupt.

II. THE CENTER ECONOMY

Gross domestic product at the Center measured in Center currency is the sum of the money values of each sector's output:

$$P_c y_c = P_w * W + P_K * K \quad (5)$$

where P_c is an aggregate price index and y_c is an aggregate output index. Under the short to medium term assumption that P_w and P_K are cost-determined under the specifications of equations (1') and (2'), the rate of growth of real GDP at the Center simplifies to:

$$\dot{y}_c = \sigma_w \dot{W} + \sigma_K \dot{K} \quad (6)$$

where σ_w and σ_K are the respective shares in nominal GDP for wage-goods and capital-goods. The dots over the variables indicate percentage rates of change. In the context of this model real growth in Center output is a weighted average of the growth rates for each of the Center's productive sectors.

The demand for wage-goods is the sum of the proportions of wages and profits, net of taxes, spent on consumption plus government expenditure on wage goods, inclusive of transfer payments. Therefore the equality condition between wage-goods supply and demand will read as follows:

$$P_w * W = c_1 (w_c N_c - T_{wc}) + c_2 (\pi_w - T_{\pi w}) + c_3 (\pi_K - T_{\pi K}) + G_{wc} \quad (6)$$

$$0 < c_1, c_2, c_3 < 1$$

Under (6) T_{wc} is taxes taken from wages, $T_{\pi w}$ is taxes taken from profits generated in the wage-goods sector, and $T_{\pi K}$ is taken from profits generated in the capital-goods sector. The terms π_w and π_K are the total nominal profits from each sector and G_{wc} is nominal government expenditure on wage goods.

Each c_i is the marginal propensity to consume out of each category of income. In general c_1 will be larger than either c_2 or c_3 . We adopt the extreme version of Kalecki's simplification that sets $c_1 = 1$ and $c_2 = c_3 = 0$ which reduces (6) to:

$$P_w * W = w_c N_c - T_{wc} + G_{wc} \quad (7)$$

As long as the gap separating c_1 from c_2 and c_3 is large this simplification will not affect the analysis in an important way.²

In equations (6) and (7) N is the total volume of employment--i.e., the sum of each sector's employment:

$$N_c = N_w + N_K \quad (8)$$

which, via the technical coefficients, becomes:

$$N = l_w W + l_K K \quad (9)$$

Substitution of (9) into (7) yields:

$$P_w * W = w_c (l_w W + l_K K) + (G_{wc} - T_{wc}) \quad (10)$$

We can rearrange (10) to derive an expression that explicitly links the volume of wage goods produced to the volume of capital goods produced:

$$W = H_c (w_c l_K K + G_{wc} - T_{wc}) \quad (11)$$

$$H_c \equiv 1 / (P_w^* - w_c l_w) > 0$$

The term $H_c \cdot w_c l_K$ "magnifies" K upward to give the output of wage-goods as a partial function of the total production of capital-goods in the current period.

The total capital-goods produced, K , is the sum of the amount used at home in wage-goods production, K_w , and in capital-goods production, K_K , as well as the amount exported to the Periphery, K_X :

$$K = K_w + K_K + K_X \quad (12)$$

The supply and demand equality for capital-goods will be expressed as follows:

$$P_K^* K = (1 - S_{CW}) (\pi_W - T_{\pi W}) + (1 - S_{CK}) (\pi_K - T_{\pi K}) + \lambda L_{CC} + P_K K_X + G_{KC} \quad (13)$$

The terms S_{cw} and S_{ck} are the savings propensities out of profits generated in wage-goods and capital-goods production. What is not saved is spent on new capital-goods. There is no outright hoarding taking place in this model. Profits either go toward purchases of new capital-goods that will be used in production during the next period or go toward savings. The savings flow, which will be modeled in greater detail below, goes into deposits with the multinational banks.

The short term character of our model means we assume corporations have full information about current costs and prices at the time they make their expenditure commitments on newly produced capital goods. But they are uncertain about the costs and prices they will face in the future period when they sell the output they will make with the capital-goods purchased today. Their uncertainty is "subjective" in Keynes' sense. As a consequence, they follow a rule of thumb in dividing the use of their profits between purchases and savings.

The parameter λ_L is the proportion of newly borrowed funds directed toward purchases of new capital-goods by Center enterprises, and L_{cc} is the quantity of new credit they demand in the current period.³ The expression P_K/K_X is the nominal demand for capital-goods from the Periphery, and G_{KC} is the nominal expenditure by the Center government on new capital-goods.

It is the loan demand function that is the site of the action that provides the dynamic forces propelling the Center

economy. We offer the following linear behavioral expression for the aggregate loan demand by Center enterprises:

$$L_{CC} = \alpha_0 - \alpha_1 \pi_c + \alpha_2 \pi_c^e - \alpha_3 t_c \quad (14)$$

$$\pi_c \equiv \pi_w + \pi_K$$

The α_i parameters are all positive constants. α_0 represents the autonomous or constant component of Center private sector loan demand. The variable π_c is the aggregate profits earned at the Center. The negative sign on the parameter α_1 that precedes π_c is justified as follows: When more and more corporations face a current profit squeeze they encounter cash flow problems. They then seek greater liquidity through external finance. Therefore the demand for credit bears a negative relationship to current profits. The higher are current profits, the less likely corporations are to seek external finance. We effectively treat external and internal finance as substitutes.

On the other hand, ceteris paribus, when corporations hold felicitous expectations about future profits they will be less hesitant to take on additional debt today. Since π_c^e represents anticipated profits tomorrow by Center producers, contingent on making expenditures on capital-goods today, it functions as an index of producers' optimism, perhaps Keynes' notorious "animal spirits." π_c^e could depend on a host of considerations. Corporations have to gauge the course of fiscal and monetary

policy at the Center and their effects on interest rates, subsequent changes in nominal wages, the paths of prices of imported materials and exchange rates, as well as the price they will receive during the next period for the forthcoming output of wage- and capital-goods.

We treat π_c^e as "autonomous" to accomodate Keynes' emphasis on the relentless intractability of "knowing" the future. Strictly speaking the expectation π_c^e presumably has a nonzero elasticity with respect to current profits. However we view the relationship as so volatile that we opt for the simplifying tactic of treating expected profits as exogenous. It is the cyclical swings in π_c^e that give us the cyclical swings in the Center economy.

Finally t_c is the terms available for credit to Center corporations. Its value is inversely related to the demand for loans from the multinational corporations.

In addition, note that total profits at the Center can be expressed as follows:

$$\pi_c = (Z_w / (1 + Z_w)) P_w * W + (Z_K / (1 + Z_K)) P_K * K \quad (15)$$

Merging (13), (14), and (15) gives us:

$$P_K * K = (1 - S_{cK}) [(Z_K / (1 + Z_K)) P_K * K - T_{\pi K}]$$

$$+ (1 - S_{cW}) [(Z_w / (1 + Z_w)) P_w * W - T_w]$$

$$\begin{aligned}
 & + \lambda_L \alpha_0 - \lambda_L \alpha_1 [(Z_K / (1 + Z_K)) P_K * K \\
 & + (Z_W / (1 + Z_W)) P_W * W] + \lambda_L \alpha_2 \pi_c^e \\
 & - \lambda_L \alpha_3 t_c + P_K K_X + G_{KC} \tag{16}
 \end{aligned}$$

which, in turn, by using (11) is equivalent to:

$$\begin{aligned}
 P_K * K &= (1 - S_{CK}) [(Z_K / (1 + Z_K)) P_K * K - T_{K}] \\
 & + (1 - S_{CW}) [(Z_W / (1 + Z_W)) P_W * H_c (w_c l_K K + G_{WC} - T_{WC}) - T_{W}] \\
 & + \lambda_L \alpha_0 - \lambda_L \alpha_1 [(Z_K / (1 + Z_K)) P_K * K \\
 & + (Z_W / (1 + Z_W)) (P_W * H_c) (w_c l_K K + G_{WC} - T_{WC})] \\
 & + \lambda_L \alpha_2 \pi_c^e - \lambda_L \alpha_3 t_c + P_K K_X + G_{KC} \tag{17}
 \end{aligned}$$

Equation (17) can be rewritten as follows:

$$\begin{aligned}
 & \{ P_K * - (1 - S_{CK}) (Z_K / (1 + Z_K)) P_K * \\
 & - (1 - S_{WC}) (Z_W / (1 + Z_W)) P_W * H_c w_c l_K \\
 & + \lambda_L \alpha_1 (Z_K / (1 + Z_K)) P_K * + \lambda_L \alpha_1 (Z_W / (1 + Z_W)) P_W * H_c w_c l_K \} K =
 \end{aligned}$$

$$\begin{aligned}
 & (1-S_{cw})(Z_w/(1+Z_w))(P_w * H_c)(G_{wc} - T_{wc}) \\
 & - \lambda_L \alpha_1 (Z_w/(1+Z_w))(P_w * H_c)(G_{wc} - T_{wc}) \\
 & - (1-S_{cw})T_{\pi K} - (1-S_{cw})T_{\pi w} + \lambda_L \alpha_0 \\
 & + \lambda_L \alpha_2 \pi_c e^{-\lambda_L \alpha_3 t_c} + P_K * K_X + G_{KC} \tag{18}
 \end{aligned}$$

Equation (18) can be simplified to take the following form:

$$K = X [Q_0 + Q_1 (G_{wc} - T_{wc}) + P_K * K_X] \tag{19}$$

$$Q_0 \equiv \lambda_L \alpha_0 + \lambda_L \alpha_2 \pi_c e^{-\lambda_L \alpha_3 t_c} + G_{KC}$$

$$- (1-S_{CK})T_{\pi K} - (1-S_{cw})T_{\pi w}$$

$$Q_1 \equiv (1-S_{cw} - \lambda_L \alpha_1)(Z_w/(1+Z_w))P_w H_c$$

$$X \equiv (P_K - (1-S_{CK})(Z_K/(1+Z_K))P_K *$$

$$- (1-S_{cw})(Z_w/(1+Z_w))P_w * H_c w_c 1_K$$

$$+ \lambda_L \alpha_1 (Z_K/(1+Z_K))P_K * + \lambda_L \alpha_1 (Z_w/(1+Z_w))P_w * H_c w_c 1_K)^{-1}$$

Equation (19) can be interpreted as a quasi-reduced form expression for the production of capital-goods in the current period. If t_c is fixed at t_c^* by the assumption that an unlimited quantity of credit is available to the Center at the competitively determined terms t_c^* (see Figure 1 where L_c^D is the overall Center demand for credit and L_c^S is the supply) and if the fiscal variables representing decisions by the Center's policymakers are taken to be autonomous, then the only endogenous variable in (19) is K_X , the quantity of capital-goods demanded by the Periphery. That provides the link to the structure of the Periphery economy.

The parameter X is the capital-goods demand multiplier. In straightforward fashion (19) indicates that an increase in the autonomous component of Center private sector loan demand, improved producer expectations of future profits, a rise in the government's deficit in both wage-goods and capital-goods expenditure, or an increase in export demand from the Periphery all push up the production of capital-goods in the current period.

To complete the construction of the model of the Center economy we now need only the equation for the government's budget deficit, BUD_c , which appears immediately below:

$$BUD_c = G_{KC} + G_{wc} - T_{\pi c} - T_{wc} + \delta_c D_{GC} = L_{CG} \quad (20)$$

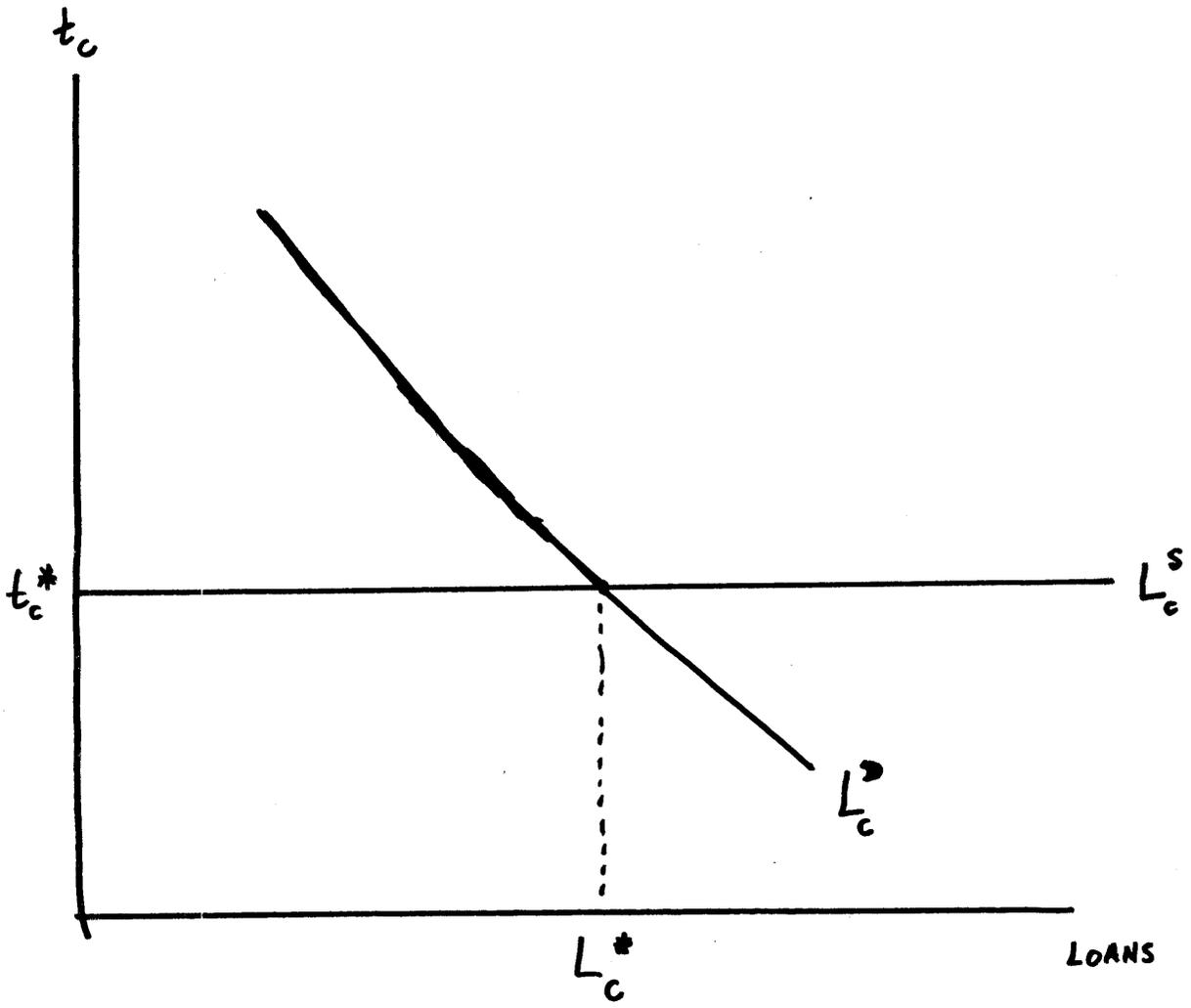


Figure 1

where D_{GC} is the outstanding public sector debt, δ_c is the proportion of D_{GC} paid off in the current period, and L_{CG} is the public sector loan demand. The Center government is assumed to finance its deficit solely by borrowing from the multinational banking sector, which is the only creditor in this model.

The total Center demand for credit is the sum of the private sector and the public sector demands for new loans:

$$L_c^D = L_{cc}^D + L_{CG}^D \quad (21)$$

Simultaneously the Center makes deposits out of current profits, with the multinational banks. Center savings, which become liabilities for the banking sector, can be expressed as follows:

$$S = s_{cw}\pi_w + s_{CK}\pi_K \quad (22)$$

III. THE PERIPHERY ECONOMY

Gross domestic product at the Periphery, also measured in Center currency, is the sum of the money values of each of its sector's output:

$$P_P y_P = P_R * R + P_A * A \quad (23)$$

Here P_p is the Periphery's aggregate price index and y_p is an aggregate output index. With P_R^* and P_A^* fixed, the rate of growth of real GDP in the Periphery is:

$$\dot{y}_p = \sigma_R \dot{R} + \sigma_A \dot{A} \quad (24)$$

where σ_R and σ_A are the respective shares in nominal GDP for the Periphery's export commodity and its agricultural output.

The demand for the Periphery's export is structurally determined by production requirements at the Center, given the scale of output at the Center:

$$R = m_{RW} W + m_{RK} K \quad (25)$$

Using (11) and (19), equation (25) becomes:

$$R = J P_K^* K_X + J Q_0 + (J Q_1 + m_{RW} H_c) (G_{wc} - T_{wc}) \quad (26)$$

$$J \equiv (m_{RW} H_c w_c 1_K + m_{RK}) \cdot X > 0, \text{ when } X > 0.$$

Again, using extreme Kaleckian assumptions, the Periphery's demand for its nontraded good can be expressed simply as:

$$P_A^* A = w_p N_A + G_A - T_{WA} \quad (27)$$

where G_A is government spending on foodstuffs, inclusive of consumer subsidies, and T_{WA} is taxes out of wages. Equation (27) is equivalent to:

$$P_A^*A = w_P(1_R R + 1_A A) + (G_A - T_{WA}) \quad (28)$$

which is, in turn, the same as:

$$A = H_P (w_P 1_R R + G_A - T_{WA}) \quad (29)$$

$$H_P \equiv 1 / (P_A^* - w_P 1_A) > 0$$

Substitution of (26) into (29) yields:

$$A = H_P \{ w_P 1_R [J P_X^* K_X + J Q_0 + (J Q_1 + m_{RW} H_C) (G_{WC} - T_{WC})] + G_A - T_{WA} \} \quad (30)$$

The key remains determination of the Periphery's demand for capital-goods from the Center, K_X , which is the only endogenous variable remaining in equations (25) and (30). Note that the periphery's own demand for capital-goods stimulates home production in both the R and A goods sectors via the stimulus to Center production of K goods.

This is truly an interdependent world economy, but there is an important asymmetry. The Periphery cannot engage in private

sector expenditure to encourage production of its export-good and since agricultural output is derivative from the performance of the export sector, it cannot do so with the A-sector either. In contrast, since the Center uses K-goods at home, Center producers are, in classic Kaleckian fashion, masters of their own fate. The more they spend themselves on capital-goods, the higher their own profits!

To proceed we specify the Periphery demand for capital goods as follows:

$$P_k * K_X = (1 - s_{PR})(\pi_R - T_{\pi R}) + (1 - s_{PA})(\pi_A - T_{\pi A}) + \xi_L L_{PC} + G_{KP} \quad (31)$$

The parameters S_{PR} and S_{PA} are the savings propensities out of Periphery profits. The Periphery enterprises, whether private or public, also spend, on average, a fixed proportion of their profits on acquisition of new capital goods. Obviously, π_R is the total profits generated in the export-goods sector, and π_A is the total profits generated in the agricultural sector while $T_{\pi R}$ and $T_{\pi A}$ are the respective sectoral profit rates. ξ_L is the proportion of newly borrowed funds directed toward importation of capital-goods, and L_{PC} is the demand for credit from producers at the Periphery. G_{KP} is the Periphery government's expenditure on capital-goods.

Periphery demand for credit by productive enterprises is given the following linear specification:

$$L_{PC}^D = \beta_0 - \beta_1 \pi_P + \beta_2 \pi_P^e - \beta_3 t_P \quad (32)$$

Total profits at the Periphery can be expressed as follows:

$$\pi_P = (Z_R/(1+Z_R))P_R * R + (Z_A/(1+Z_A))P_A * A \quad (33)$$

Combining (31), (32), and (33) we obtain:

$$\begin{aligned} P_K * K_X &= (1-S_{PR}) [(Z_R/(1+Z_R))P_R * R - T_{\pi R}] \\ &+ (1-S_{PA}) [(Z_A/(1+Z_A))P_A * A - T_{\pi A}] \\ &+ \xi_L \beta_0 - \xi_L \beta_1 [(Z_R/(1+Z_R))P_R * R \\ &+ (Z_A/(1+Z_A))P_A * A] + \xi_L \beta_2 \pi_P^e \\ &- \xi_L \beta_3 t_P + G_{KP} \end{aligned} \quad (34)$$

Using (26) and (30), equation (34) becomes:

$$\begin{aligned} P_K * K_X &= (1-S_{PR}) \{ [(Z_R/(1+Z_R))P_R * [J P_K * K_X \\ &+ J Q_0 + (J Q_1 + M_{RW} H_C) (G_{wc} - T_{wc})] - T_{\pi R} \}] \\ &+ (1-S_{PA}) \{ [(Z_A/(1+Z_A))P_A * H_P \{ w_P l_R [J P_K * K_X \\ &+ J Q_0 + (J Q_1 + M_{RW} H_C) (G_{wc} - T_{wc})] \\ &+ G_A - T_{WP} \} - T_{\pi A} \}] + \xi_L \beta_0 \\ &- \xi_L \beta_1 (Z_R/(1+Z_R))P_R * [J P_K * K_X + J Q_0 \end{aligned}$$

$$\begin{aligned}
 &+ (J Q_1 + m_{RW} H_C) (G_{wc} - T_{wc})] \\
 &- \xi_L \beta_1 (Z_A / (1 + Z_A)) P_A * H_P \{ w_P^1 R [J P_K * K_X \\
 &+ J Q_0 + (J Q_1 + m_{RW} H_C) (G_{wc} - T_{wc})] + G_A - T_{WA} \} \\
 &+ \xi_L \beta_2 \pi^e - \xi_L \beta_3 t_p + G_{KP} \quad (35)
 \end{aligned}$$

Equation (35) can be simplified to:

$$\begin{aligned}
 K_X = &V [U_0 + U_1 (G_A - T_{WP}) + U_2 (G_{wc} - T_{wc}) \\
 &+ U_3 Q_0 - \xi_L \beta_3 t_p] \quad (36)
 \end{aligned}$$

$$\begin{aligned}
 V &= P_K * - (1 - S_{PR} - \xi_L \beta_1) (Z_R / (1 + Z_R)) P_R * - J P_K * \\
 &- (1 - S_{PA} - \xi_L \beta_1) (Z_A / (1 + Z_A)) P_A * H_P w_P^1 R J P_K * \\
 U_0 &= \xi_L \beta_0 + \xi_L \beta_2 \pi^e + G_{KP} - (1 - S_{CR}) T_{\pi R} - (1 - S_{PR}) T_{\pi A} \\
 U_1 &= (1 - S_{PA}) (Z_A / (1 + Z_A)) P_A * H_P - \xi_L \beta_1 (Z_A / (1 + Z_A)) P_A * H_P w_P^1 R \\
 U_2 &= [(1 - S_{PR} - \xi_L \beta_1) (Z_R / (1 + Z_R)) P_R * \\
 &+ (1 - S_{PA} - \xi_L \beta_1) (Z_A / (1 + Z_A)) P_A * H_P w_P^1 R] (J Q_1 + M_{RW} H_C) \\
 U_3 &= [(1 - S_{PR} - \xi_L \beta_1) (Z_R / (1 + Z_R)) P_R * \\
 &+ (1 - S_{PA} - \xi_L \beta_1) (Z_A / (1 + Z_A)) P_A * H_P w_P^1 R]
 \end{aligned}$$

The only remaining endogenous variable that needs to be solved for is t_p -- the terms offered at the Periphery. This will require specification of the supply of loans function for the Periphery, which we present in the next section with our characterization of the multinational banking system.

To complete our presentation of the Periphery economy we need to provide the Periphery's government budget constraint. It takes the following form:

$$BUD_P = G_A + G_{KP} - T_{\pi P} - T_{WP} + \delta_P D_{GP} = L_{GP} \quad (37)$$

The deficit in the Periphery, BUD_p , is also financed by borrowing from the multinational banking system in the amount L_{GP} . δ_p is the proportion of the Periphery's outstanding debt paid off in the current period and D_{GP} is the Periphery government's outstanding debt, including the indebtedness of public sector enterprises. Therefore total loan demand in the Periphery, L_p^D , is:

$$L_p^D = \beta_0 - \beta_1 \pi_p + \beta_2 \pi_p^e - \beta_3 t_p + L_{GP} \quad (38)$$

IV. The International Credit Mechanism

This section provides a highly simplified exposition of the international credit mechanism focusing on the role of financial intermediaries. The multinational banks generally are assumed to prefer to lend to the Center. The political risks associated with making new loans to the Periphery lead international lenders to desire to distribute available credit to the Center first.

We could just as well argue that the multinational banks follow a Branson-type scheme. Conceivably they could identify an array of expected rates of return on projects across the globe with the largest proportion of high expected rates, inclusive of risk premia, being located in the Center and the lowest proportion being located in the Periphery. If investment declines at the Center more high return projects are eliminated from the Center's array. This will shift the attention of bankers to projects lower on the ladder, resulting in a greater flow of bank finance to the Periphery. But we opt for the assumption that the

banks segment the market for loans between the Center and Periphery--thereby offering the Center an unlimited supply of credit (Figure 1) while offering the Periphery more credit only at stricter terms (Figure 2).

The total new credit the multinational banks wish to make available worldwide is contingent upon the inflow of deposits into their coffers. These deposits are equivalent to the savings out of profits from each of the four sectors in the model. The total quantity of desired new lending, L_s , is a multiple, γ , of the new deposits:

$$L_s = \gamma \cdot (S_{CK} \pi_K + S_{CW} \pi_W + S_{PR} \pi_R + S_{PA} \pi_A) \quad (38)$$

Obviously, γ can be interpreted as the deposit multiplier, and in general will be considerably greater than unity.⁴ When there are no reserve requirements the only limit on γ is set by the bankers' own nervousness about the risks associated with lending funds to such an extent that they cannot meet their own liabilities. Furthermore, equation (38) implies that the banks are indifferent between the sources of their new deposits.

Out of this total desired volume of lending the multinational banks first meet the Center's lending requirements. As a result, the supply of credit to the Center L_c^s is determined by the Center's demand for credit at the fixed terms t_c^* :

$$L_c^s = \alpha_0 - \alpha_1 \pi_c + \alpha_2 \pi^e - \alpha_3 t_c^* + L_{CG}^D \quad (39)$$

In contrast, the supply of loans to the Periphery, L_p^s , takes the following form:

$$L_p^s = g_0 + g_1(L_s - L_c^s) + g_2 t_p + g_3 r_p + g_4 j^e \quad (40)$$

The parameters g_0 , g_1 , g_2 , g_3 and g_4 all are nonnegative constants. g_0 represents the autonomous or steady ongoing volume of multinational bank credits issued to the Periphery, while g_1 is the coefficient weighting the residual volume of credit that the banks wish to lend worldwide after meeting the Center's requirements. The larger the volume of credit that the Center fails to absorb, the more eager the multinational banks will be to lend to the Periphery.⁵ The term $(L_s - L_c^s)$ thus captures the "redlining" behavior of the multinational banks. We assume $L_s > L_c^s$ always so that some funds are made available to the Periphery.

Furthermore, equation (40) makes the supply of loans to the Periphery bear a positive relationship with the terms, t_p , that the banks can offer as well as with r_p , which is the overall repayment rate on loans made to the Periphery. Finally, the term j^e is intended to capture the banks' expectations of receiving what amounts, de facto, to insurance from the Center government on their loans made to the Periphery. In the world we depict the market clearing value t_p^* always exceeds the terms offered to the Center, t_c^* .

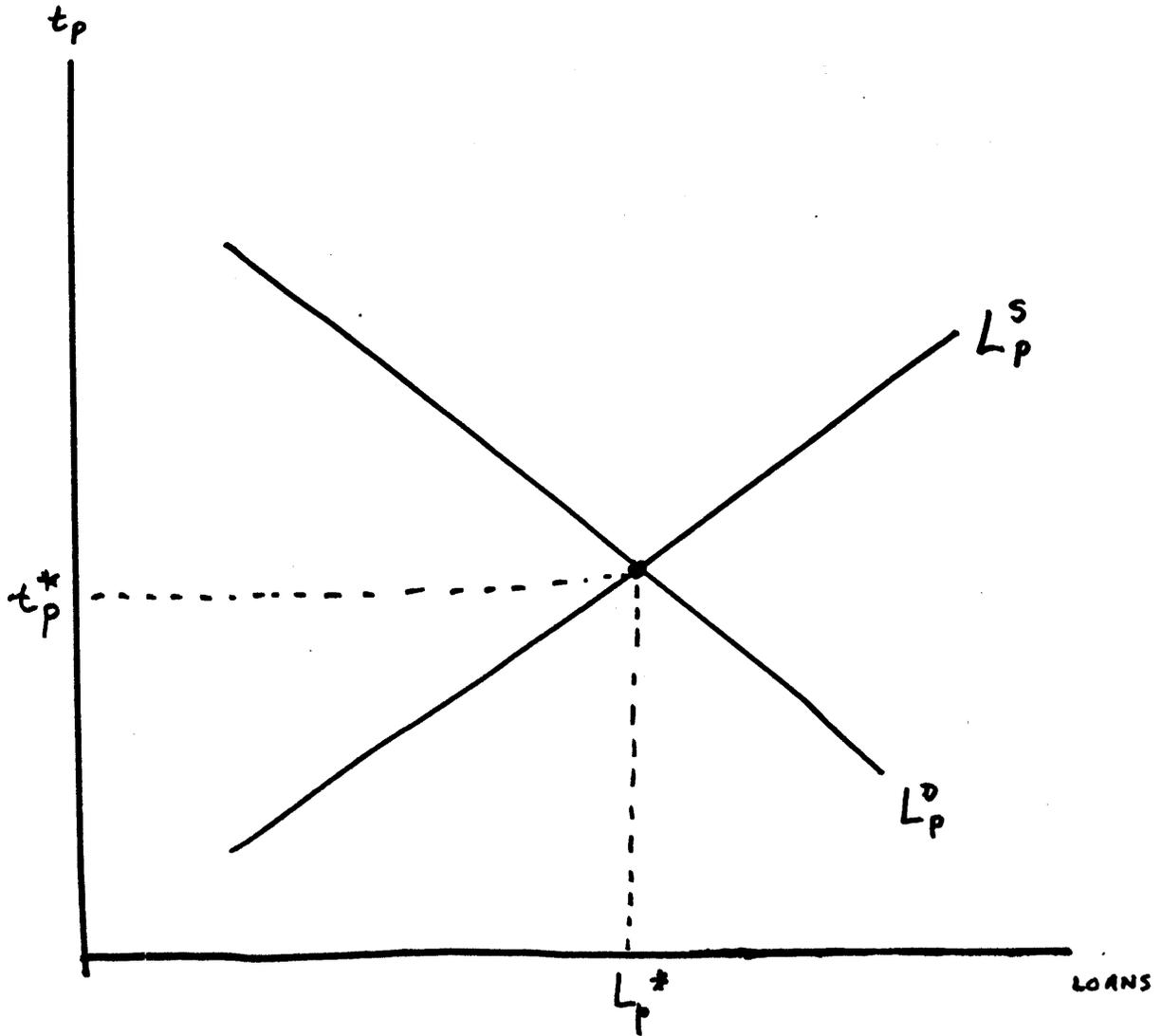


Figure 2

Substitution of (38) and (39) into (40) yields:

$$\begin{aligned} L_P^S = & g_0 + g_1 \gamma (S_{CK}^{\pi K} + S_{cw}^{\pi w} + S_{PR}^{\pi R} + S_{PA}^{\pi A}) \\ & - g_1 \alpha_0 + g_1 \alpha_1 \pi_c - g_1 \alpha_2 \pi_c^e + g_1 \alpha_3 t_c^* \\ & - g_1 L_{CG}^D + g_2 t_P + g_2 t_P + g_3 r_P + g_4 j^e \end{aligned} \quad (41)$$

which is the same as:

$$\begin{aligned}
 L_p^S = & g_0 + g_1 (\gamma S_{CK} + \alpha_1) (Z_K / (1 + Z_K)) P_K * X [Q_0 + Q_1 \\
 & (G_{wc} - T_{wc}) + P_K * K_X] \\
 & + g_1 (\gamma S_{cw} + \alpha_1) [Z_w / (1 + Z_w)] J P_w * H_c (w_c l_K X [Q_0 + Q_1] G_{wc} - T_{wc}) \\
 & + P_K * K_X] + G_{wc} - T_{wc} \\
 & + g_1 \gamma S_{PR} [Z_R / (1 + Z_R)] J P_R * [J P_K * K_X + J Q_0 + (J Q_0 + M_{RW} H_c) (G_{wc} - T_{wc})] \\
 & + g_1 \gamma S_{PA} [Z_A / (1 + Z_A)] J P_A * H_p (w_p l_r [J P_K * K_X + J Q_0 \\
 & + (J Q_0 + m_{RW} H_c) (G_{wc} - T_{wc})] \\
 & + G_A - T_{WA} - g_1 \alpha_0 - g_1 \alpha_2 \pi_c^e + g_1 \alpha_3 t_c^* - g_1 L_{CG}^D \\
 & + g_2 t_p + g_3 r_p + g_4 k^e \tag{42}
 \end{aligned}$$

Note that equation (42) displays several interesting features. Those factors which increase absorption of credit by the Center reduce the loan supply to the Periphery. For example, an expanded government deficit at the Center does not "crowd out" the private sector's access to finance at the Center, but it does "crowd out" the Periphery's access to finance. However, this could be more than offset by the stimulative effects of government spending on profits worldwide. A rise in nominal profits anywhere in the world will raise the loans made available to the Periphery, but an increase in anticipated future profits at the Center will decrease the loan supply for the Periphery. A rise in the terms offered to the Center (an upward parallel shift in the horizontal Center loan supply schedule) will raise the volume of loans made available to the Periphery.

Substitution of (36) for K_X into (42) gives us an expression for the loan supply in the Periphery where the only remaining endogenous variable is t_p . Combining (26), (30), (32) and (36) results in an expression for the loan demand where t_p is, again, the only remaining endogenous variable. By setting the loan supply and demand equal we can solve for the reduced form expression for the terms on loans made to the Periphery. Adjustment in terms for loans at the Periphery clears the international market for credit. We obtain the following messy equation on these assumptions:

$$\begin{aligned}
 t_p^* &= C \{ E_0 - E_1 (G_{wc} - T_{wc}) - E_2 (G_A - T_{wp}) - E_3 Q_0 - E_4 U_0 \} & (43) \\
 C &= \{ g_2 + [\beta_1 (z_R / (1 + Z_R)) P_R * J P_K * V - g_1 (\gamma S_{CK} + \alpha_1) (Z_K / (1 + Z_K)) P_K^2 V] L_3 \\
 &+ [\beta_1 (z_A / (1 + Z_A)) P_A * H_{P_P} P_R * J P_K * V - g_1 (\gamma S_{CA} + \\
 \alpha_1) (Z_W / (1 + Z_W)) P_W * H_{C_C} P_K * X P_K * V] L_3 \beta_3 \} \\
 E_0 &\equiv \beta_0 - g_0 + g_1 \alpha_0 + g_1 \alpha_1 \pi_c^e - g_1 \alpha_3 t_c^* + g_1 + L_{CG}^D + L_{GP} \\
 &- g_3 r_p - g_4 j^e + \beta_2 t_p^e \\
 E_1 &\equiv g_1 (\gamma S_{CK} + \alpha_1) (Z_K / (1 + Z_K)) P_K * X Q_1 + g_1 (\gamma S_{CK} + \alpha_1) (Z_K / (1 + Z_K)) P_K^2 X V U_2 \\
 &+ (g_1 (\gamma S_{CA} + \alpha_1) (Z_W / (1 + Z_W)) P_W * H_C) w_{C_C} P_K X Q_1 + 1) \\
 &+ g_1 \gamma S_{PR} (Z_R / (1 + Z_R)) P_R * (J Q_0 + m_{RW} H_C) \\
 &+ g_1 \gamma S_{PR} (Z_R / (1 + Z_R)) P_R * J P_K V U_2 + g_1 \gamma S_{PA} (Z_A / (1 + Z_A)) P_A * H_{P_P} P_R (J Q_0 + m_{RW} H_C) \\
 &+ g_1 \gamma S_{PA} (Z_A / (1 + Z_A)) P_A * H_{P_P} P_R * J P_K * V U_2 + \beta_1 (Z_R / (1 + Z_R)) P_R * (J Q_1 + m_{RW} H_C) \\
 &+ \beta_1 (Z_R / (1 + Z_R)) P_R * J P_K * V U_2 + \beta_1 (z_A / (1 + Z_A)) P_A * H_{P_P} P_R (J Q_1 + m_{RW} H_C) \\
 &+ \beta_1 (z_A / (1 + Z_A)) P_A * H_{P_P} P_R * J P_K * V U_2 \\
 E_2 &\equiv g_1 (\gamma S_{CK} + \alpha_1) (Z_K / (1 + Z_K)) P_K^2 * X * V * U_1 + g_1 (\gamma S_{CA} + \\
 &\alpha_1) (Z_W / (1 + Z_W)) P_W * H_{C_C} P_R * X P_K * V U_1
 \end{aligned}$$

$$\begin{aligned}
 & + g_1 (\gamma S_{PR}) (Z_R / (1+Z_R)) P_R * J P_K * V U_1 + g_1 \gamma S_{PA} (Z_A / (1+Z_A)) P_A * H_P \\
 & + g_1 \gamma S_{PA} (Z_A / (1+Z_A)) P_A * H_P w_P^1 P_R^1 J P_K * V U_1 \\
 & + \beta_1 (Z_A / (1+Z_A)) P_A * H_P + \beta_1 (Z_A / (1+Z_A)) P_A * H_P w_P^1 P_R^1 J P_K * V U_1 \\
 E_3 \equiv & g_1 (\gamma S_{CK} + \alpha_1) (Z_K / (1+Z_K)) P_K * X + g_1 (\gamma S_{CK} + \alpha_1) (Z_K / (1+Z_K)) P_K * X^2 V U_3 \\
 & + g_1 (\gamma S_{CA} + \alpha_1) (Z_w / (1+Z_w)) P_w * H_c^1 K^X \\
 & + g_1 (\gamma S_{CA} + \alpha_1) (Z_w / (1+Z_w)) P_w * H_c^1 X P_K * V \\
 & + g_1 \gamma S_{PR} (Z_R / (1+Z_R)) P_R * J + g_1 \gamma S_{PR} (Z_R / (1+Z_R)) P_R * J P_K * V U_3 \\
 & + g_1 \gamma S_{PA} (Z_A / (1+Z_A)) P_A * H_P w_P^1 P_R^1 J + g_1 \gamma S_{PA} (Z_A / (1+Z_A)) P_A * H_P w_P^1 P_R^1 J P_K * V U_3 \\
 & + \beta_1 (Z_R / (1+Z_R)) P_R * J + \beta_1 (Z_R / (1+Z_R)) P_R * J P_K * V U_3 \\
 & + \beta_1 (Z_A / (1+Z_A)) P_A * H_P w_P^1 P_R^1 J + \beta_1 (Z_A / (1+Z_A)) P_A * H_P w_P^1 P_R^1 J P_K * V U_3 \\
 E_4 \equiv & g_1 (\gamma S_{CK} + \alpha_1) (Z_K / (1+Z_K)) P_K^2 X V + g_1 (\gamma S_{CA} + \\
 & \alpha_1) (Z_w / (1+Z_w)) P_w * H_c^1 X P_K * V \\
 & + g_1 \gamma S_{PR} (Z_R / (1+Z_R)) P_R * J P_K * V + g_1 \gamma S_{PA} (Z_A / (1+Z_A)) P_A * H_c^1 P_R^1 J P_K * V \\
 & + \beta_1 (Z_R / (1+Z_R)) P_R * J P_K * V + \beta_1 (Z_A / (1+Z_A)) P_A * H_P w_P^1 P_R^1 J P_K * V
 \end{aligned}$$

The intuition behind the complicated expression in (43) is quite straightforward. The equation implies that ceteris paribus stricter terms for loans at the Center, which reduce the Center demand for credit, expand the supply for the Periphery thus easing the terms for the Periphery. Similarly, improvements in the Periphery's repayment rate (a rise in r_p) or improved expectations of "insurance" of loans to the Periphery (a rise in j^e) both shift the supply curve rightward, again easing terms. Greater optimism on the part of producers at the Center or at the Periphery stimulates their respective demand for loans, thereby raising the terms faced by Periphery borrowers as well.

V. The Full Model in Operation

The complete model now can be solved for all sectoral quantities of output if we retrieve the following six equations:

$$t_p^* = C [E_0 - E_1(G_{wc} - T_{wc}) - E_1(G_A - T_{WP}) - E_3 Q_0 - E_4 U_0] \quad (43)$$

$$K_X = V [U_0 + U_1(G_A - T_{WP}) + U_2(G_{wc} - T_{wc}) + U_3 Q_0 - \epsilon_L \beta_3 t_p^*] \quad (36)$$

$$K = X [Q_0 + Q_1(G_{wc} - T_{wc}) + P_K * K_X] \quad (19)$$

$$W = H_C (w_C l_K K + G_{wc} - T_{wc}) \quad (11)$$

$$R = m_{RW} W + R_K K \quad (25)$$

$$A = H_P (w_P l_R R + G_A - T_{WA}) \quad (29)$$

The model effectively reduces to six equations in six unknowns. Working in sequence we obtain from (P3) first the market-clearing value for t_p^* , the terms at which loans are made available to the Periphery. Substituting t_p^* into (36) gives us the reduced form expression for K_X^* , the quantity of capital-goods exported to the Periphery. Substitution of K_X^* into (19) yields the reduced form expression for the total amount of capital-goods produced. Everything else follows directly since

all three of the remaining sectors' outputs are positively related to the quantity of capital-goods produced at the Center. When K is positive real GDP will be increasing in both the Center and the Periphery. When K is negative production contracts on a worldwide basis. We will inquire about what this implies for the Periphery's chances of catching up below.

In the remainder of this section of the paper we investigate a variety of comparative statics exercises. These exercises allow us to examine the effects on the world economy of a variety of policy measures taken at both the Center and the Periphery. It also enables us to present a representation of an international "business cycle" based upon fluctuations in producer optimism in both regions.

To produce results we have to establish, insofar as possible, the signs of certain critical parameters in the model. The particular summary symbols that need signing are X , Q_1 , J , V , U_1 , U_2 , U_3 , C , E_1 , E_2 , E_3 , and E_4 .

We will assume that the following conditions hold, which are sufficient to insure that all these summary symbols are positive:

$$S_{CK} + \lambda_L \alpha_1 < 1 \quad (44a)$$

$$S_{CW} + \lambda_L \alpha_1 < 1 \quad (44b)$$

$$S_{CR} + \lambda_L \alpha_1 < 1 \quad (44c)$$

$$S_{CA} + \lambda_L \alpha_1 < 1 \quad (44d)$$

$$1 > (1 - S_{CK}^{-\lambda} L^{\alpha_1}) (Z_K / (1 + Z_K)) +$$

$$(1 - S_{CW} - \lambda_L \alpha_1) (Z_w / (1 + Z_w)) (P_w^* / P_K^*) H_{CW}^1 K \quad (44e)$$

$$1 > (1 - S_{PR} - \lambda_L \alpha_1) (Z_R / (1 + Z_R)) P_R^* / P_K^* \\ + (1 - S_{PA} - \lambda_L \alpha_1) (Z_A / (1 + Z_A)) P_A^* H_{PW}^1 P_R^J \quad (44f)$$

$$g_2 + [\beta_1 (Z_R / (1 + Z_R)) P_R^* J P_K^* V \\ + \beta_1 (Z_A / (1 + Z_A)) P_A^* H_{PW}^1 P_R^J V] \xi_L^\beta > \\ g_1 (\gamma S_{CK} + \alpha_1) (Z_K / (1 + Z_K)) P_K^* V + g_1 (\gamma S_{CA} + \alpha_1) (Z_w / (1 + Z_w)) \\ P_w^* H_{CW}^1 P_R^J X P_K^* V] \xi_L^\beta \quad (44g)$$

The first four conditions (44a-d) imply that the sum of the savings rate out of each category of profits plus the marginal propensity to "substitute" away from borrowed funds as profits increase times the marginal propensity to spend borrowed funds on capital-goods is less than unity. Intuitively, the left hand side of inequalities (44a-d) constitute a measure of the extent to which newly generated profits are channeled away from direct expenditure on new capital goods. This diversion occurs both because a portion of profits are deposits with multinational and because profit growth leads to a substitution away from reliance on borrowed funds, a fixed proportion of which otherwise would be directed toward purchases of new capital-goods.

The intuition behind conditions (44e) and (44f), is less obvious. Essentially it amounts to saying that a weighted average of each region's commodity prices relative to capital-goods prices--weighted primarily by terms that capture the net direct

effect of newly generated profits on purchases of new capital goods and the profit rate parameter itself--is less than unity.

Finally condition (44g) sets limitations on the parameters of the loan supply and demand functions for the Periphery. The higher the elasticity of loan supply with respect to the terms, the greater the tendency of Periphery producers to substitute away from borrowed funds as current profits rise, and the weaker the multinational banks' tendency to supply credit not absorbed at the Center to the Periphery (in the limit, hyper-reluctance would mean $g_1=0$), the more likely condition (44g) is to hold.

There are a host of alternative assumptions that would yield a variety of signs on these summary symbols, but this set of assumptions--which is plausible--leads to the simplest of sign patterns: all signs are positive.

With conditions (44a-g) in mind, we now can explore several comparative statics exercises with the model. In addition to determine what is happening in this model as we perturb a particular exogenous variable we need only to ask what happens to the equilibrium level of capital-goods, K , since all of the other three sectors' output and employment levels must move in the direction.

(a) Greater optimism at the Center

If producers at the Center expect profits to increase in the future, we can trace the effects by asking how a rise in π_C^e will affect the quantity of capital-goods produced today. By taking the partial derivative of K^* with respect to π_C^e we obtain

$$\partial K^* / \partial \pi_c^e = [(1 + P_K * U_3) X + \xi_L \beta_3 C E_3 - C] \lambda_L \alpha_2 \quad (45)$$

which, at first glance, is ambiguous in sign. The last two terms in the sum in parentheses are a consequence of the effects of an improvement in Center optimism on the terms offered to the Periphery. The term $\xi_L \beta_3 C E_3$ reflects the tendency of the rise in Center producers' animal spirits to lower the terms by increasing profits and leading, in turn, to a greater expansion in the total credit made available at the Periphery. On the other hand, the term $-C$ reflects the tendency of Center producers to demand more credit as their optimism increases thus reducing the credit available to the Periphery. Which effect is stronger depends upon whether the product $\xi_L \beta_3 E_3$ is greater than or less than unity. If it is greater, the terms become easier; if it is less then the terms become stricter. But the overall effect on K^* must also include the direct effect of increased Center demand for capital-goods as optimism spreads, given by the product $(1 + P_K * U_3) X$. Presumably that product will ensure that the derivative is positive and that greater optimism at the Center spurs higher output and employment in capital-goods production and, ultimately, worldwide.

We can then generate cyclical swings in the world economy based upon upturns and downturns in producer optimism. A series of periods where π_c^e increases will mean ceteris

paribus that the world economy rides a wave of expansion; a series of periods where π_c^e declines will mean ceteris paribus that the world economy slides into a downspin.

The product $\xi_L \beta_3 E_3$ is significant from the standpoint of determining when on the cycle there is a debt build-up in the Periphery. If $\xi_L \beta_3 E_3$ is less than one then the terms for the Periphery become stricter as Center producers become more excited about future profits. The loan build-up in the Periphery would then occur when the world is in recession. Center credit demands presumably would weaken faster than profits decline, thus making the "dumping" of credit on the Periphery pick up steam. However, if $\xi_L \beta_3 E_3$ is greater than one, more optimism at the Center means easier terms for credit in the Periphery during the upswing. We even can conceive of regime switches if the product $\xi_L \beta_3 E_3$ changes magnitudes over time. Whether or not the process continues in a stable cyclical fashion will depend in part upon r_p , the Periphery's repayment rate as its producers' indebtedness grows.

Note also that the magnitude of the stimulus to world production provided by greater optimism at the Center depends directly on the parameter λ_L . λ_L is the proportion of borrowed funds channeled into purchases of new capital goods at the Center. If λ_L is small, i.e., if a large proportion of borrowed funds merely go toward refinancing all debts or paying off old debts, then the stimulus will be small. A large value for λ_L implies, ceteris paribus, a larger stimulus.

(b) Greater optimism in the Periphery

Suppose enterprise managers in the Periphery become more enthused about prospects for profits in the future, i.e., π_p^e moves upward. What then? The derivative of K^* with respect to π_p^e takes the following form:

$$K / \pi_p^e = X \cdot P_K \cdot \varepsilon_L \beta_2 (1 - C \beta_3) \quad (46)$$

Obviously this expression is ambiguous in sign as well. Greater producer optimism in the Periphery raises the Periphery's demand for credit, thereby raising the terms faced by the Periphery. If it raises the terms sufficiently, it might actually lead to a reduced Periphery demand for exports from the Center thus precipitating a worldwide decline in production. This would be the case if the elasticity of demand for loans at the Periphery with respect to the terms is exceptionally large. Then we could get the perverse result that $C \beta_3 > 1$ and a rise in π_p^e leads to an international recession. But as β_3 gets small the sign of (46) is more likely to be positive, leading to the intuitively plausible conclusion that greater optimism in the Periphery can provide some stimulation to the world economy.

(c) Banking sector illiquidity

The multinational banks could retrench on their issue of credit. They could retrench on a global basis which would mean a drop in γ or they could retrench in the Periphery which would mean

a drop in the parameters g_j in the loan supply function for that region (see equation (40) above). What will the consequence be?

Consider first a drop in γ . Even if terms stay fixed at the Center, they definitely will rise in the Periphery, reducing the Periphery's export demand, thus driving down production of capital-goods. If terms become more harsh at the Center as well--if the Center's supply curve for credit is displaced upward--then the situation could be modified depending upon how large the withdrawal from borrowing is by Center producers. This would depend on the size of α_3 which reflects the elasticity of Center producers' loan demand as the terms of loans change.

Retrenchment on credit in the Periphery alone will have a similar effect as a decline in γ when terms are unchanged at the Center. Now the fall in the parameters g_j will mean harsher terms for the Periphery, less borrowing, less importation of capital-goods, and less production worldwide.

Moreover, policymakers at the Center can produce a similar result by refusing to bail out the banks. The parameter j^e will fall, leading to a comparable chain of events. Or if the Periphery's enterprises or government become delinquent on their loan payments, i.e., r_p falls, this will lead to a similar pattern of economic decline.

Of course, the magnitude of the effects is contingent on the values of these parameters might take, but the direction of the effects is unequivocally downward. It is just as plain that greater liquidity will promote expansion in the world economy.

(d) Changes in unit costs of production

Suppose the general wage rate at the Center, w_c , is pushed upward. The first effect is to raise all commodity prices. The effect is direct at the Center and indirect in the Periphery via the higher price to be paid for capital-goods imports. The second effect, given constancy of the sectoral rates of profit, must be to raise nominal profits in each sector. This will raise both the direct sectoral demands for new capital-goods and the reserve base at the multinational banks through associated increases in saving.

Cost-push effects generally will be expansionary in a model of this type where variations in nominal expenditures are inherently non-neutral. As long as cost increases can be passed on as price increases, the cost increase becomes a demand stimulus. A much different story would have to be told if there was an inverse relationship between, for example, the wage rate and the profit.

But the general principle that a jump in nominal costs means a jump in nominal expenditures spurring quantity increases also illuminates the effects of a rise in wages in the Periphery as well as the old policy chestnut--devaluation of the currency in the Periphery. If w_p goes up, output prices in the Periphery will rise, again given constancy of the mark-up factors. This means, in turn, that output prices at the Center will rise also due to importation of R from the Periphery. The world economy's

production moves upward for the same reasons it does when w_c goes up.

Suppose the Periphery devalues its currency. This would mean a lower price for the Periphery's export measure in Center currency--or P_R becomes lower. Unless profit rates change elsewhere, all other output prices must decline pulling down sectoral profits and pulling down the world economy. Devaluation simply does not promote growth in the Periphery in this model.

Consider the flip side of the coin. The Periphery seeks to extract a higher rate of profit by forming a cartel in its export sector, thereby pushing up P_R . This "shock"--an oil price "shock," for example--actually stimulates the world economy by raising total profits everywhere, if profit rates remain unchanged elsewhere.

If, however, the Periphery succeeds in raising its profit rate for R one might expect other sectors' profit rates to decline. Then the outcome plainly is ambiguous. If profit rates fall at the Center, for example, it is possible for total profits there to decline. This would lower the Center's demand for capital-goods, reduce the funds deposited with multinational banks, and increase the Center's demand for credit since loans and profits are substitutes. Whether or not the Periphery's increased profits in the export sector compensate for its stiffer access to credit would depend on the magnitude of the profit gain. But if there is some inverse interdependence between sectoral profit rates, it is possible for the cartel strategy to

backfire. Otherwise, with profit rates unchanged elsewhere, a higher profit rate in the Periphery's export sector boosts the world economy.

This suggests that in this model price inflation is generally beneficial from the standpoint of raising output and employment. So why not push up all prices without limit? In fact, there is no reason to cease and desist as long as the multinational banks maintain a steady credit policy vis-a-vis the world and the Periphery (i.e., γ and the g_i 's must remain unchanged). Problems set in when the banks move toward a more conservative posture with regard to their lending practices. It is a stable climate of liquidity that accomodates the inflation and preserves expansion.⁶

Of course, even with a stable climate of liquidity an ultimate limitation remains on expansion. That limitation is the barrier set when there is full employment of the labor force--or no more labor is forthcoming to produce the additional output mandated by the growth in demand.

In a stable climate of bank lending practice, if the Center becomes less reliant on the Periphery's export good this is also an ill wind that blows no good from an employment and output perspective. The parameters m_{RW} and m_{RK} will decline, pushing down P_w^* and P_K^* when Z_w and Z_K remain fixed. The deflationary contraction will set in worldwide. Similarly, the Periphery will set off a downturn if it reduces its dependence on the Center's capital-goods, enabling it to lower q_R and/or q_A . Productivity

gains in any sector--declines in l_w , l_K , l_R , or l_A --all have similar adverse effects on employment and output. Cost-cutting means cutting production in this model.

VI. SOME FINAL QUESTIONS

At last we are prepared to reconsider the questions posed at the outset of the paper. We take them one by one.

(a) Why the debt crisis?

This model offers quite different insights into the reasons underlying the build-up of external debt in the Periphery from those offered customarily. It is a cyclical explanation rather than the stochastic explanation offered by Sachs and Bruno or the secular transition theory offered by Beanstock.

The Sachs-Bruno viewpoint has it that the rise in external debt, especially in the group of countries that Lawrence Franko (p. 292) somewhat ironically calls "the charmed circle of 10," is due to their needs to finance balance of payments difficulties brought on by the oil price shock. Sachs and Bruno, in particular, have pushed this position in a series of papers, but there are some unsatisfactory aspects to their argument, not the least of which is Beanstock's (p. 117) complaint that "...LDC borrowing on world capital markets was firmly established well before the OPEC oil price explosion. The LDC debt 'problem' existed before 1974."

Moreover, our model is qualitatively distinct from theirs. Unlike them we do not have to make any specific assumptions about returns to scale nor invoke diminishing returns to a fixed factor. Unlike them we fully distinguish between international movements of capital as commodities and as finance. We avoid altogether, by our extreme Kaleckian assumption, their characterization of the primary source of finance for undertaking new investment as household's personal savings. Moreover, we bypass entirely their tendency to solve their model "as a perfect foresight, intertemporal equilibrium..." (Bruno and Sachs, 1982, p. 2). The latter strikes us as a particularly odd assumption in light of the buildup of "nonperforming" loans owed to multinational banks--unless, perhaps, the banks also are suffering from stochastic shock!

Beenstock's (p.82) position has it that LDC indebtedness is an "equilibrium phenomenon" associated with LDC industrialization:

The steady growth of LDC indebtedness is not brought about by oil prices (although they may be important in the short term) but by a fundamental realignment in the world capital market which reflects LDC industrialization.

Beenstock argues that "the rate of return on capital" in LDCs rose relative to the developed countries at the start of the 1970s--an autonomous rise of sorts. Finance flowed to the LDCs in search of the higher rate of return. According to Beenstock (p.

119) the growth in LDC debt is desirable since it will finance economic development.

...LDC indebtedness is not simply a disequilibrium consequence of the behavior of world oil prices which threatens the international monetary system. It is an equilibrium or structural consequence of LDC industrialization. As such it should not be a cause for concern. Indeed, attempts to frustrate this process in the mistaken interest of world monetary stability will undermine the legitimate spread of world development.

We need not take such a felicitous view of the debt build-up in our model. After all, as Charles Kindleberger (p. 6) has pointed out, typically "...productive loans are not very productive and do not stay long out of default..." In our model, if ξ_L is very low only a small percentage of loans received by Periphery producers will make their way into purchases of capital-goods. They can be used to meet previous debt obligations by merely substituting one set of creditors for another, or dissipated in many other ways. Moreover, although we do not model this explicitly, government expenditure that relies upon borrowed funds need not go to purchases of capital-goods or agricultural output but could go instead to arms purchases or for bureaucrats' perquisites.

Beenstock offers as one piece of empirical support for his theory the observation that debt-service ratios did not display unusually high levels for developing countries between 1970 and 1979. However, data from 1981 onward does reveal a marked rise in the ratios--data which Beenstock did not have access to while his manuscript was in preparation.

Since our model offers a cyclical explanation, relative rates of profit need not change internationally for debt to grow in the Periphery. As we showed in Section 5a, external debt can build up in the Periphery on either the upswing or the downswing of the world economy--depending on the type of regime that prevails.

(b) Must the Center serve as the Periphery's engine of growth?

To the extent that expansion at the Periphery requires successful exports of R to the Center, then expansion at the Center is a prerequisite for growth in the Periphery. This is, as we noted above, the Lewis-Nurkse effect in the model. In this sense the Center must serve as the Periphery's engine of growth. Can the Periphery escape? If it can develop internal uses for its export good it can alter these circumstances. Expanded "South-South" trade or the development of a petrochemical industry in Saudi Arabia are examples of potential escape routes.

(c) Can the Periphery serve as an engine of growth for the Center?

The Periphery can spur production at the Center by importing larger quantities of capital-goods. If it could independently raise its demand for imports it could stimulate its own growth indirectly. This suggests, as Lawrence Franko (p. 292) has indicated that LDCs could serve as an engine of growth for the Center--as well as itself.⁷ But the financing of the purchases depends on prior profits generated in the Periphery--or access to additional credit, either for the producers or the government, which means further dependence on the Center's own profit-making experience and credit-seeking behavior. Ultimately, easier credit is the mechanism that would sustain the Periphery as a growth-leader for the Center, hence, greater indebtedness in the Periphery as well.

(d) What is the worldwide impact of fiscal and monetary policies pursued in either region?

What will be the worldwide effect of additional government spending at the Center? Suppose it is additional expenditure on capital-goods, perhaps in the form of subsidies to capital-goods producers to expand their operations. We can ask, how will K change with respect to a change in G_{KC} ? But we also have to ask, how will K change with respect to an increase in government borrowing, a rise in L_{CG} ? The total effect of the change in the equilibrium level of capital-goods is given by the sum of the following two partial derivatives:

$$\partial K^*/\partial G_{KC} + \partial K^*/\partial L_{CG} = X + X P_K^* [V U_3 + \xi_L \beta_3 (E_3 - 1) C_{g1}] \quad (47)$$

Typically, one would assume that the sign of the expression on the right hand side of (47) will be positive regardless of the sign of the term in brackets. As long as the first term, X, outweighs the remaining term, under our assumptions (44a-g) an increase in the Center government's deficit to purchase new capital goods stimulates the world economy. If, however, $(E_3 - 1)$ is negative and the product $\xi_L \beta_3 (E_3 - 1) C_{g1}$ is sufficiently large, then the increase in credit demands at the Center to finance purchases of new capital-goods excessively "crowds out" expenditure on capital-goods in the Periphery. This could drive K^* downward bringing W^* , R^* , and A^* down with it.

What about fiscal stimulation in the Periphery? Suppose the Periphery government spends more on purchases of capital-goods imports? Then we will have:

$$\partial K^*/\partial G_{KP} + \partial K^*/\partial L_{PG} = X P_K^* (V - \xi_L \beta_3 C) \quad (48)$$

In this case unambiguously the terms of loans worsen for the Periphery. The Periphery government's own expenditures crowd out borrowing and spending on capital goods out of borrowed funds by producers. Whether or not this adverse effect is sufficient to cause a contraction in the world economy depends on the term in parentheses. The term V captures the direct stimulus to capital-goods production from the additional expenditure. The

term $\xi_L \beta_3^C$ captures the indirect loss due to the harsher terms for credit in the Periphery.

Similar stories can be told about the conflicting effects of increased expenditure on wage-goods by the Center's government or agricultural goods by the Periphery's government. More interesting is the possibility of pursuing expansionary monetary policy in either region, a possibility we have not modelled explicitly. But suppose that the Center government could conduct an open market operation where it "borrows" without necessarily crowding out funds for the Periphery--then the purchases it makes on goods will be unambiguously expansionary. The same will be true for spending on commodities by the Periphery's government, i.e., if the Periphery can raise government spending without raising its taxes. This possibility would depend upon the relationship each region's central bank bears with respect to purely domestic commercial banks, which are not modelled here, as well as the multinational banking sector, which is modelled here.

(e) Can the Periphery ever catch up?

In the world we have depicted here, can the Periphery ever catch up? Specifically can it achieve the same level of GDP as the Center?

Recall that all sectoral growth rates move in the same direction as the growth rate for capital-goods production at the Center. Using equations (6) and (24) and assuming that fiscal policy in each region is not changing, the following expressions

provide the real rates of growth for each region as functions of the growth rate of capital-goods production:

$$\dot{y}_C = [\sigma_K + (\sigma_w H_C w_C l_K K)/W] \dot{K} \quad (49)$$

$$\dot{y}_P = [\sigma_R + \sigma_A (H_P w_P l_R R/A)] [(m_{RW} W/R) (H_C w_C l_K K/W) + m_{RK} K/R] \dot{K} \quad (50)$$

Since the rates of growth for each region move in the same direction and simultaneously depend upon K , the relative rates of growth depend upon the bracketed expressions. If they happen to be equal then growth rates in each region will be equal. If the Periphery's GDP is initially lower it will stay lower forever.

If the bracketed terms for the Periphery yield a larger product than the bracketed term for the Center, the Periphery will grow faster than the Center when the world economy is on an upswing. However, it also will contract more strongly on the downturn. For the Periphery to "catch up" the cyclical upswings would have to be longer than the downswings.

If the bracketed terms for the Periphery yield a smaller product than the bracketed term for the Center, the reverse will be true. The Periphery will lose relative ground on the upswing but gain relative ground on the downswing. Somewhat perversely to "catch up" it would be necessary for worldwide recessions to outlast worldwide waves of prosperity. Obviously, in either case,

if the swings are of similar lengths the Periphery will stay in the same relative position.

Therefore, prospects for the Periphery to gain ground in the context of this type of environment are dim at best. The mechanisms of world trade, finance, and economic growth presented here would tend to maintain persistent poverty for the poorer nations. Such a structure precludes parity.

FOOTNOTES

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¹ It should be added that in our model the Center does not import any final products from the rest of the world. This is, obviously, not entirely accurate. However, the production of finished goods in the developing countries is aimed primarily at their domestic markets, not for export to the Center (see Reich, especially, p. 45). We go a step further in slicing with Occam's razor by treating both the Center and Periphery as producing all of their final goods domestically.

² The assumption that $c_1=1$ is empirically defensible, especially in light of a recent study by Heskell, Pinkham, and Robinson (pp. 66-7). They found that the consumption-wage bill ratio for the advanced industrial countries typically is close to unity. For the United States over the period 1965 through 1978 they found the ratio to be highest in 1965 at 1.08 and lowest in 1970 at 1.01. The average level of the ratio was 1.03 "with a small standard deviation of 0.021" (p. 67). The United Kingdom's average over the same period was exactly unity. The trio conclude (p. 66) that this general finding suggests that in "Western-type economies" it is true that "either wage-earners do, in fact, spend all of their income, or their taxes and savings are directly offset by consumption expenditures out of capitalist income." Our model is premised on the former assumption. In Third World countries, the consumption-wage bill ratio typically is much larger than one, possibly indicating large expenditures on consumption by non-wage earners (landlords, rentiers, etc.). Or it simply could mean extensive state subsidization of consumption.

³ Implicitly $(1-\lambda_L)$ is the proportion of newly acquired loans not used for capital-goods purchases. They may go toward covering or refinancing existing debts.

⁴Presumably, γ would equal unity if the multinational banks were faced with a 100 per cent reserve requirement.

⁵This is the credit "push" effect in multinational lending. It is compatible with Charles Kindleberger's view of international banking practice but it is self-consciously at odds with Irving Friedman's. Friedman claims the bankers passively accept loan applications rather than go out "reaching" for loans. The anecdotal evidence, at least, overwhelmingly favors the position that bankers do indeed push loans (e.g., Sampson).

⁶This is very much in the spirit of the sort of message Kindleberger has tried to advance for years on the urgent necessity of maintaining adequate liquidity in the world economy.

⁷Franko (p. 292) cites estimates from the LINK model that suggested that in the late 1970s that a 3 per cent rise in the annual growth rate in the LDCs would mean a 1 per cent rise in the OECD nations.

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