CAPITAL MOVEMENTS AND ECONOMIC GROWTH IN DEVELOPED COUNTRIES

GEORGE H. BORTS · Brown University
KENNETH J. KOPECKY · Ohio State University

THE study of capital movements has occupied an anomalous position in the literature of international economics. Treated as an exogenous disturbance, it provided the occasion for early studies of balance-of-payments adjustment and early theories of the adjustment mechanism. But the early theorists assumed that capital movements, like unilateral transfers, were not a permanent part of the scene; and the early theories of adjustment did not deal satisfactorily with the concept of a permanent equilibrium with a nonzero balance on current account. For this reason little attention was given to the determination of the reverse flow of interest and dividends associated with the private financing of capital movements. For many years the last word was that of John E. Cairnes [4], who wrote about it in the nineteenth century.

The story has changed considerably in the last twenty years. The mathematical relation between capital export and the reverse flow of income payments has been explored by Evsey Domar [6], Dragoslav Avramovic [1], and Philip Neher [12]. A theory of the balance of payments that explains both the current and the capital accounts has been expounded by Lloyd Metzler [10] and Robert Mundell [11], and the relations between capital movements and economic growth have been treated by George Borts [3], James Ingram [7], Harry Johnson [8], and Jeffrey Williamson [13]. In these modern theories, equilibrium in the over-all balance of payments, in the market for commodities, and in the money market, implies that the balance on current account equals the excess of saving over domestic investment, and, in turn, equals the negative of the balance on capital account. Capital

movements are therefore explained by the determinants of saving and investment.

The theories of Metzler and Mundell are static in the same sense that the Keynesian model is static: the capital stock is constant, and investment is a function of the interest rate, with the equilibrium values of the variables persisting through time. The static approach, therefore, will not explain the determination of the flow of payments of interest and dividends, because a constant rate of capital flow implies a growing, not a constant, level of income payments to foreign investment. Moreover, the static model has nothing to say about the relation between economic growth and the flow of capital.

In this paper we use a growth model to generate a country's equilibrium pattern of investment and saving, flow of capital, and the return flow of interest and dividends from overseas. Investment is explained by the long-run equilibrium conditions of the capital market — in the sense that a particular level of investment is required to maintain an equilibrum relation between the stocks of labor and capital, and the flow of output. Thus, the level of investment depends upon the interest costs of borrowing, the parameters of the production function, the relative prices of productive factors, and the growth rate of output. In general, a country will have a higher level of investment, the higher its rate of growth, the lower the interest cost of borrowing, and the greater the elasticity of output with respect to capital.

The return flow of interest and dividends depends on the past history of capital flows into or out of a country. A country that has exported capital will experience an inflow of interest and dividend payments that are, properly, part of its gross national product (GNP). Consequently, current saving, which depends in part on the level of GNP, will be influenced by the extent of capital flows in previous periods. The model must therefore contain two relations between capital flows and saving: one, the direct relation that constitutes the definition of the capital flow, and the second, the feedback from interest and dividends through GNP to the level of saving.

One important implication of our work is that all monetary magnitudes may grow at the same rate as the return flow of dividends and interest, and this will be the rate of growth of GNP. Thus, in dynamic equilibrium, a country remains a debtor or a creditor forever, and

changes in this status must be explained by parameter changes in the model. This is an advance over Domar's earlier findings that the return flow of payments might grow faster than foreign investment.

A second result is that movements of capital are explained independently of interest differentials among countries, and take place in the face of the same worldwide interest rate.

A third result is that capital movements are explained independently of monetary and exchange-rate policy. Instead, they are determined by the nonmonetary characteristics of the economy. Our model indicates that, ceteris paribus, a country lends *more* abroad the lower its real-growth rate, the higher its saving (plus taxes) rate, the smaller the share of output paid to capital, the smaller the government deficit, and the higher the world interest rate.[1] These parameters are used to provide a statistical verification of the model.

1   NET FACTOR INCOME EARNED ABROAD

A. CONCEPT AND MEASUREMENT

When a country's balance of payments is in equilibrium, a surplus on current account will be offset by a deficit on capital account. Such a country is said to be transferring goods and services abroad and financing the transfer by an export of capital. The real transfer might also be financed by gifts, reparations, or flows of international money. We shall, however, assume that all real transfers are financed by securities transactions in the capital account, and we shall correct the data insofar as other methods of financing are quantitatively important.

The securities flows making up the balance on capital account generate a reverse flow of interest and dividends that we shall designate as net factor income earned abroad (NFIEA). NFIEA ap-

---

[1] Professor Lorie Tarshis correctly pointed out in his comments on this paper that this relation between lending and the world interest rate is a "partial," not an "aggregative," relation. It is clear that for the world as a whole, saving equals investment, and the observed relations between world lending and the interest rate depend on which schedules have shifted over time.

pears in the balance of payments as part of the current account, and in the national income accounts as part of a country's GNP. NFIEA makes up the difference between GNP (the total income earned by the residents of a geographic area) and gross domestic product (GDP – the total income earned by the resources employed in a given area). Thus, NFIEA is generated because of geographic differences between the site of employment and the residence of the resource owner, and it will normally consist of payments both to labor and capital. We shall assume, however, that NFIEA consists only of payments to capital, and adjust the data where there is evidence that payments to labor are significant in magnitude. In a closed economy NFIEA would, of course, be zero.

NFIEA is a measure of the net debtor or creditor status of a country, because it reflects the past history of capital flows between one country and the rest of the world. We shall, in the rest of the paper, use NFIEA as the dependent variable to be explained.

The magnitude of variations in NFIEA among developed countries may be seen in Table 1. For each of thirteen member countries of the Organization for Economic Cooperation and Development, we have computed the ratio of NFIEA to GNP in 1965.

The first column uses the data from the national income statistics of the country. The ratio varies from −1.64 per cent for Canada (a debtor position) to +1.87 per cent for Switzerland (a creditor position). These ratios are lower than one might expect from a steady history of capital flowing into Canada and out of Switzerland; and we suspect that they will approach their long-run steady-state values in a number of decades. We may illustrate the long-run steady-state value by the following hypothetical calculations for Canada, which will be followed, in a later section, by a more explicit model that may be applied to all of the countries:

The NFIEA will grow over time because of new borrowing or a change in the rate of return that foreign owners earn on old borrowing. Assume that the rate of return has remained constant, and that the current deficit was financed entirely by long-term borrowing. Then write D as NFIEA, $\dot{D}$ as its rate of change over time, r as the interest cost of borrowing, and B as the balance on current account. We have $\dot{D} = rB$. Assume that D grows at the same rate as GNP, a rate denoted as

TABLE 1

Ratios of Net Factor Income Earned Abroad to
Gross National Product for Thirteen OECD
Countries, 1965

Country	Observed Ratio	Corrected Ratio
Austria	−.0023	+.0096
Belgium	+.0007	+.0177
Canada	−.0164	−.0170
Denmark	−.0013	+.0049
France [a]	+.0069	+.0154
Germany	−.0041	+.0100
Ireland [b]	+.0138	+.0438
Japan	−.0022	−.0001
Netherlands	+.0107	+.0328
Norway	−.0100	−.0086
Sweden	+.0023	+.0107
Switzerland	+.0187	+.0673
United Kingdom	+.0112	+.0165

SOURCE: NFIEA and GNP are taken from
publications of the International Monetary Fund
[14, 15] and the Organization for Economic Co-
operation and Development [16, 17, 18].
    [a] Metropolitan France.
    [b] 1964.

g. We then have $D = (r/g)B$. Write GNP as Z, and $D/Z = (r/g)B/Z$.
For the sake of illustration, assume a 10 per cent cost of borrowing,
and a 4 per cent growth rate. For Canada, the observed B/Z is equal to
−2 per cent. That is to say, in the ten years up to 1965, Canada ex-
perienced deficits on current account that averaged 2 per cent of GNP.
We would then expect the steady-state value of D/Z to equal −5 per
cent, instead of the observed −1.64 per cent.

The second column in Table 1 contains a more precise measure
of the ratio of NFIEA to GNP. Examination shows that the corrected
ratios in this column are generally greater algebraically than the raw
ratios of the first column. The corrections took three forms, and were

made to obtain a measure of NFIEA that is closer to the theoretical entity than the published statistics.

1. There is an asymmetry in the way in which the national accounts treat foreign — as opposed to domestically generated — payments to capital. Capital that is domestically owned and domestically employed generates a number of types of income that are included in gross product: interest and dividends, retained earnings, depreciation, corporate income taxes, and rental income. When capital is owned abroad, however, not all the gross income imputed to it is included in the balance-of-payments or GNP accounts. Present measurement of NFIEA is consistent with the idea that the balance-of-payments accounts include only cash transactions. This treatment understates the income that capital earns abroad, because it fails to include the total cash flow of foreign investment accruing to the owner or shareholder. It is our contention that the balance of payments should include an imputed value for retained earnings. If a dollar of earnings is retained abroad, it should be recorded simultaneously as a payment to the domestic owner (appearing in the current account) and a reinvestment (appearing in the capital account). Therefore, the first correction we have made in NFIEA is an imputation to include retained earnings on the equity portion of foreign investment. (An Appendix providing details of this correction will be supplied by the authors upon request.) In general, this correction will increase the absolute magnitude of NFIEA, raising the absolute values of the ratios in the table. It is also our contention that depreciation on foreign-owned capital should be entered in the country's GNP, although it is not part of the balance of payments or of NFIEA. In that way, GNP would include both gross domestic investment (GDI) and gross foreign investment (GFI).

2. The second and third corrections are made in order to account for overseas resource transfers that do not generate a return flow of NFIEA. The model we use predicts NFIEA as if it were generated by *all* overseas transfers. If some transfers are financed by foreign-exchange reserves or constitute gifts in the form of reparations, then the observed NFIEA will fall short of what the theory predicts. We have corrected NFIEA by adding an imputation of what the interest and dividend flow would be if reparations flows yielded a return like an ordinary foreign investment. The reparations constituted a significant

item in the balance of payments of Austria, Germany, and Japan, and the correction explains, in part, why their ratios increase algebraically, as seen in the second column of Table 1.

The third item to be corrected is the flow of international reserves. Again a correction is made, imputing interest to the stock of accumulated reserves. This correction explains, in part, the increase in NFIEA for France, Germany, and Switzerland. (The Appendix to this paper also provides details of these corrections.)

B. A PRELIMINARY TEST

In the hypothetical example of the previous section, it was assumed that the change in NFIEA equaled the borrowing rate multiplied by the balance on current account. Consequently, it is assumed that no changes occur in the return on old investments. These assumptions have been tested by the use of a sign comparison: the year-to-year change in NFIEA (as corrected) should have the same sign as the balance on current account. For the thirteen countries, data are available for almost every year from 1956 through 1965, 113 observations in all.[2]

We have tabulated the simultaneous occurrence of increases or decreases in NFIEA with the sign of the balance on current account, leading to the following contingency table.

Net Factor Income Earned Abroad	Balance on Current Account	
	Positive	Negative
Rose	44	21
Fell	14	34

The probability that these observations were generated at random may be rejected by using a chi-square test at a 1 per cent level of sig-

[2] Irish data were not available for 1956, 1957, and 1965; Japanese data were unavailable for 1956. Moreover, the observations for 1960 were not included in the sample because of large speculative movements of funds.

nificance. Thus, we have some indication that NFIEA may be explained by the model presented below.

2 MODELS OF GROWTH AND CAPITAL MOVEMENTS

THE relationship between NFIEA, the balance of payments, and GNP may be explored through a simple growth model. All monetary magnitudes grow at the same rate in the steady-state solution, and the results of this solution will be presented first. We shall derive the determinants of NFIEA as a percentage of GNP. The solutions will depend upon the parameters of the growth model: the rate of growth of GNP, the rate of interest, the savings-income ratio, the share of GNP spent and taxed by government, and the share of GDP invested by private business.

NFIEA is treated as the result of all past lending,

$$D_t \equiv \sum_{\tau=1}^{t} r_\tau B_\tau, \tag{1}$$

where D_t is NFIEA in year t, the present, and r_τ is the interest-rate terms on which lending occurred in year τ. If we assume that the interest rate remains unchanged over time, or that changes in the current interest rate have no effect on past loan contracts, we may write the time derivative of (1) as

$$\dot{D}_t = r_t B_t. \tag{2}$$

Changes in NFIEA thus occur because of current lending. Assume, in addition, that all surpluses on current account are financed by deficits on capital account. B_t is therefore measured by the balance on current account or its negative, the balance on capital account. Assume that the market for goods and services is continuously in equilibrium, so that B_t equals the excess of saving over investment (these being defined, for the moment, to include taxes and government spending). We may then write

$$\dot{D}_t = r \text{ [saving-investment]}. \tag{3}$$

Assume that saving is a fixed proportion, s, of GNP (Z_1), and investment is a fixed proportion, i, of GDP (Z_2), and that all monetary magnitudes grow at the percentage rate g. We then have

$$gD = rsZ_1 - riZ_2. \tag{4}$$

Ignoring foreign depreciation charges for the moment, we know that NFIEA, by definition, is the difference between GNP and GDP:

$$D \equiv Z_1 - Z_2. \tag{5}$$

By substitution, we then obtain

$$Z_1 = Z_2 \left[\frac{g - ri}{g - rs} \right]. \tag{6}$$

It will turn out that stability of the solution requires that both the numerator and the denominator be positive. We also obtain solutions for B_t, the level of current lending (balance of payments on current account), and D_t, NFIEA:

$$B = Z_1 \left[\frac{g(s - i)}{g - ri} \right], \tag{7}$$

and

$$D = Z_1 \left[\frac{r(s - i)}{g - ri} \right]. \tag{8}$$

Thus, the long-run steady-state debtor or creditor position of the country depends on the difference between s, the share of GNP saved and taxed, and i, the share of GDP privately invested (and spent by government). In the statistical investigations to be described in later sections, we shall concentrate on the dependent variable D/Z_1.

Equation (8) provides an explanation for the ratio of NFIEA to GNP, which is in terms of four parameters: r, the interest rate; g, the growth rate; s; and i. With the aid of a more explicit model, these parameters may be shown to depend on a larger number of behavior coefficients. The model will be presented in this section, together with detailed analyses of s and i.

THE SHARE OF GNP SAVED

Total saving in the economy includes household and business saving and government taxes. When we are dealing with gross saving, depreciation will be included. The following assumptions have been made:

1. *Net private saving* by households and business is assumed to be a function of national disposable income. Gross private saving will equal net private saving plus depreciation on all owned capital, whether employed at home or abroad. Introduce the following symbols:

S = Net private saving
DEP_N = Depreciation on all owned capital
T = Taxes collected on personal and corporate income
Q = Taxes collected from excises

We shall assume a saving function

$$S = \alpha[Z_1 - DEP_N - T - Q]. \tag{9}$$

2. *Government saving.* Further, it will be assumed that T (income taxes) is a given fraction τ of GNP at market prices, and Q (excise taxes) a given fraction ψ of GDP at factor cost. It will turn out that τ and ψ have slightly different effects on capital movements, because excise taxes will affect the profitability and level of investment.

3. *Depreciation,* which is included in gross saving, occurs on all owned capital, whether employed at home or abroad. For a country that is a net borrower this means that some depreciation on domestically employed capital is part of some other country's gross saving and GNP. Depreciation will be treated like net profit, as part of the total return to capital. Rather than regard it as a physical phenomenon, we shall instead argue that, just as some r per cent measures the net return to capital, there is an $(r + \beta)$ per cent that measures the gross return. The percentage β is therefore the portion of the total return to capital that cannot be considered as net return. This approach permits a direct estimate of the depreciation on capital employed at home and abroad. On capital employed at home, we may define domestic depreciation as

$$DEP_d \equiv \beta \times \text{value of home-employed capital}.$$

If we think of GDP, Z_2, as produced by a Cobb-Douglas production function, with capital-coefficient b, then with a competitive capital market, the flow of gross income to home-employed capital is $(r + \beta) \times$ value of capital, which equals $bZ_2/(1 + \psi)$. The $(1 + \psi)$ term in the denominator converts Z_2 from market prices to factor prices because of excise taxation. Therefore,

$$\text{value of home-employed capital} \equiv bZ_2/(r + \beta)(1 + \psi) \qquad (10)$$

and

$$\text{domestic depreciation} \equiv \beta bZ_2/(r + \beta)(1 + \psi). \qquad (11)$$

Let us assume that the same depreciation factor applies on home-employed and foreign-employed capital. (This problem is less important for a net debtor.) Then the value of foreign-employed capital is the discounted value of NFIEA, D/r, and assuming that all of NFIEA is equity return, foreign depreciation $\equiv DEP_F \equiv (\beta/r) \times$ NFIEA. These two methods of estimating depreciation will be carried into the model.

THE SHARE OF GDP INVESTED

For the purpose of this paper, investment was defined to include government spending, as it appears in the national income accounts. We shall assume that the government spends a given fraction, θ, of GNP, and we shall not break this total down between consumption and investment.

Gross private investment consists of depreciation on domestically employed capital plus net increases in the stock of domestically employed capital. We have already indicated that the depreciation function may be derived from a neoclassical production function. The investment function will be treated in a symmetric fashion. Again, assume that the value of domestically employed capital is described by equation (10). Further assume that b, β, and r remain unchanged. Increases in the stock of capital can be in either physical or money units, and be related to long-run changes in Z_2. Write the net value of domestically employed capital as KP_K, where P_K is the price and K the net physical stock. P_K may bear little resemblance to the GDP deflator. Further assume that P_K has a known path through time with a given growth rate,

γ, which may be positive or negative. Then net investment may be written as $\dot{K}P_K$, where the dot denotes a time derivative. From equation (10), net investment equals

$$\frac{b\dot{Z}_2 - b\gamma Z_2}{(r + \beta)(1 + \psi)}. \tag{12}$$

Again assume that g is the growth of Z_2. Then net investment is equal to

$$\frac{bZ_2}{(1 + \psi)(r + \beta)} (g - \gamma) \tag{13}$$

and gross investment is equal to

$$\frac{bZ_2}{(1 + \psi)(r + \beta)} (g - \gamma + \beta). \tag{14}$$

It should be noted that when P_K, the price of capital goods, has the same time path as the GDP deflator, the term $g - \gamma$ becomes, simply, the growth of GDP in real terms. On the other hand, if capital goods were imported, the term $g - \gamma$ would decompose into the sum of the real rate of growth of GDP plus a term that measured changes in the terms of trade between GDP and imported capital goods.

DEFINITIONS OF NET FACTOR INCOME EARNED ABROAD

The above considerations lead to new definitions of the relation among GNP, GDP, and NFIEA. Previously NFIEA was simply GNP − GDP, or $Z_1 = Z_2 + D$. Now we have

$$Z_1 = Z_2 + D + DEP_F = Z_2 + D \left[\frac{r + \beta}{r}\right].$$

Depreciation on foreign-employed capital is added to NFIEA before adding up to GNP. The sum of NFIEA and foreign depreciation will be called gross factor income earned abroad (GFIEA). Where NFIEA was denoted as D, GFIEA is $(r + \beta/r)D$. We may then proceed, as earlier, to derive an equilibrium ratio of NFIEA to GNP. As before, we have

$$\frac{gD}{r} = B = \text{net saving} + \text{taxes} - \text{net investment} - \text{government spending.} \tag{15}$$

Substitute for the four entities in brackets

net saving $= \alpha[Z_1 - DEP_N - T - Q]$,

taxes $= T + Q = \tau Z_1 + \left[\dfrac{\psi}{1+\psi}\right]Z_2$,

net investment $= \dfrac{b(g-\gamma)}{(\beta+r)(1+\psi)}Z_2$,

government spending $= \theta Z_1$,

$DEP_N \equiv DEP_D + DEP_F$,

$DEP_D \equiv \dfrac{\beta b Z}{(\beta+r)(1+\psi)}$, and

$DEP_F \equiv \dfrac{\beta}{r} D$.

We obtain the following relation between D (NFIEA) and GNP.

$$\frac{D}{Z_1} = \frac{r}{r+\beta}\left[\frac{N_2 - (1+\psi)(g-N_1)}{N_2}\right], \tag{16}$$

where

$N_1 \equiv (\beta + r)[\tau(1-\alpha) + \theta] + \alpha r$, and

$N_2 \equiv (1+\psi)g - b(g-\gamma) + \alpha\beta(1-b) + \psi[\beta + r(1-\alpha)]$.

Equation (16) is the predicted long-run, steady-state ratio of NFIEA to GNP. The ratio of GFIEA to GNP is obtained simply by multiplication through both sides by $(r + \beta/r)$. The ratio D/Z_1 depends on a number of parameters that have been estimated for each country. Shown next to each parameter is the sign of the partial derivative of D/Z_1 with respect to the parameter, evaluated at a zero net debtor position:

r the interest rate +
β the depreciation rate +
α the saving coefficient +
τ the income tax rate +
ψ the excise tax rate +
g the growth of GDP −
γ the growth of prices of imported capital goods +
θ the share of GNP spent by government −
b the gross share of GDP imputed to capital −.

We see that a country will lend more, the higher the world interest rate, its depreciation rate, its saving rate, its tax rates; the *faster* the increases of prices of imported capital goods; the *lower* its growth rate; the share of GDP spent by government; and the gross share of output imputed to capital.

3 BEHAVIOR ASSUMPTIONS

IN THE preceding section, we presented a growth model that yielded an equilibrium steady-state ratio of NFIEA to GNP. The underlying assumptions of this model are that it allows all domestic monetary magnitudes to grow at the same rate, g, and that the interest cost of borrowing remains unchanged. In order to show precisely how the results are derived, it is necessary to specify a model for an open, growing economy. While the following assumptions may appear unrealistic, they do have the property of yielding the solutions derived earlier. After the model is presented, we shall comment on alternative sets of assumptions that might be employed. We shall describe in detail only those behavior assumptions that are added to the ones made in the previous section.

It is assumed that the country may be characterized as producing a single commodity, which may be consumed at home by households or government, or exported abroad; all investment goods are imported. The country is at full employment and uses labor and accumulated capital to produce its one commodity. The economy is characterized by pure and perfect competition and fixed exchange rates. The demand for the export commodity is infinitely elastic at the world price, and this demand function grows over time at a rate determined in the rest of the world. Thus the price level in this country is the same as the price of exports.

The level of employment is determined by demographic conditions, and the level of output per worker is determined by the ratio of capital to labor and the technological level of the production function. It is assumed that the world capital market is perfect and the supply is of

infinite elasticity to individuals in this country, so that they may borrow or lend unlimited amounts with no effect on the world interest rate. This interest rate and the terms of trade will together determine the equilibrium ratio of capital to labor in the country; and in conjunction with the technological level of the production function, determine output per worker. Thus total output and the price level are determined under this model, and they determine gross domestic product at market prices. Through time GDP will grow, because of increases in the labor supply, in export prices, and in the level of output per worker due to autonomous technological change.

The economy may be represented by a system of 21 equations having 21 variables. The methods of solution and the stability conditions are given in the Appendix at the end of this paper.

$$X \equiv X_c + X_e + X_g. \tag{17}$$

Definition of output disposal into c, consumption; e, exports; g, government.

$$Z_2 \equiv XP_x. \tag{18}$$

Definition of gross domestic product at market prices.

$$P_x = P_0 e^{\rho t}. \tag{19}$$

Infinitely elastic world demand for exports, growing at rate ρ.

$$X = A_t L^{1-b} K^b. \tag{20}$$

Cobb-Douglas production function with autonomous technological change, growing at rate μ.

$$A_t = A_0 e^{\mu t}. \tag{21}$$

$$L = L_0 e^{\lambda t}. \tag{22}$$

Full employment assumed, with labor force growing at rate λ.

$$(r + \beta)KP_K = \frac{bXP_x}{1 + \psi}. \tag{23}$$

Equilibrium in capital-goods market.

$$r = \bar{r}.$$ (24)

Interest rate given in world market.

$$Z_1 = Z_2 + D + DEP_F.$$ (25)

Definition of GNP.

$$S = \alpha[Z_1 - DEP_N - T - Q].$$ (26)

Net national saving function.

$$I \equiv \dot{K}P_K + DEP_D.$$ (27)

Definition of gross domestic investment.

$$P_K = P_0 e^{\gamma t}.$$ (28)

Time path of price of imported capital goods.

$$X_g P_X = \theta Z_1.$$ (29)

Government demands a fixed proportion of GNP.

$$Z_1 \equiv X_c P_X + S + T + Q + DEP_N.$$ (30)

GNP is consumed, or saved, or taxed.

$$T = \tau Z_1.$$ (31)

Income tax function.

$$Q = \frac{\psi}{1 + \psi} Z_2.$$ (32)

Excise tax function.

$$DEP_N \equiv DEP_D + DEP_F.$$ (33)

$$DEP_D \equiv \beta K P_K.$$ (34)

$$DEP_F \equiv \frac{\beta}{r} D. \tag{35}$$

$$D \equiv r\Sigma B. \tag{36}$$

$$B \equiv XeP_x - I + D. \tag{37}$$

Balance on current account.

This simple model will not explain a number of relevant phenomena. First, the level of output is not responsive to changes in aggregate demand. Full employment is assumed, and output grows at a constant rate, because of the instantaneous adjustment of the capital stock, which keeps labor and capital growing at the same rate. Second, there are no monetary variables in the model. The price level is exogenously determined by the world demand for exports. It would be possible to add a function describing the demand for money, but in order to retain the original conclusions, one would have to assume that the supply of money grew at the same rate as did the rest of the system. Moreover, money would have to be fiat money, and not a commodity domestically produced or imported. Third, the explanation of investment, while dynamic, is nevertheless unsophisticated. There are no lags in the response of entrepreneurs to changes in profit, and consequently no investment cycles in the response to parametric changes. Fourth, the price level and the price of exports are identical. There is no domestic goods sector, and no mechanism by which changes in the terms of trade alter the internal allocation of productive resources. Fifth, there is no relation between the prices of exports and the volume of exports. Exports are in fact a residual, determined as the difference between domestic production and domestic uses of output. Sixth, we assume a fixed interest rate, determined in the international capital market, at which borrowing and lending freely occur. There are no constraints in the form of increasing interest costs as the volume of borrowing expands.

Some of these limitations are impossible to alter without giving up the major hypotheses that come out of the model. Others are abstractions introduced for convenience, and could be eliminated in a more detailed specification of economic relationships. A few examples will be given.

1. If the level of output were responsive to changes in aggregate demand, the system's rate of growth would be, presumably, independent of demographic and technological variables, and would depend, instead, on the growth of private and government spending and on the growth of the money supply. The present model is a conscious choice to explain flows of capital in a framework that is independent of aggregate demand variables. Nevertheless, one could, with alternative assumptions, generate a model in which unemployment existed, so that output would be responsive to aggregate demand.

2. The model could be adapted to include a monetary sector, with corresponding changes in the solution for the level of capital export that was privately financed. If a monetary sector is introduced, then behavior equations — consistent with the regimes of fixed exchange rates in the current world economy — would have to be introduced for the supply of money.

3. Some experiments were made with equations for lagged investment behavior. In the steady-state solutions, they did not increase the explanatory power of the model.

4. It is not necessary to use a one-sector model. This is done as a statistical convenience. Other models developed have included a domestic good, whose price bears an equilibrium relation to the price of exports. This relation shifts over time if there are differential rates of technological change or differences in capital intensity in the production functions for exports and domestic goods.

5. It is not necessary to assume an infinitely elastic demand for exports. Models using negatively sloped demand functions have been developed. The solutions then depend on the rate of growth of world export demand, and the price and income elasticity of export demand.

6. One assumption that cannot be sacrificed is the fixed return on investment. Balanced-growth solutions with full employment are not possible if the return on investment changes through time.

4 STATISTICAL TESTING

TWO types of test were performed on the model. In the first, the parameters of the model were used as independent variables in a multiple-

regression estimation of the variable D/Z_1. In the second, a predicted level of D/Z_1 was derived for each country, and then compared with the actual level. The predicted level is a short-run value based on the steady-state value of D/Z_1.

A. MULTIPLE REGRESSION

For each country and each observation period, we can measure the values of the parameters of the model: g, α, b, r, ψ, τ, θ, and the value of the dependent variable. Methods of measurement are described in an Appendix that is available upon request. We have 39 observations, three on each country, constituting the periods 1956–59; 1960–62; 1963–65. The individual observations were considered independent of each other, and this assumption could not be contradicted by time-period effects measured through dummy variables. Moreover, no attempt was made to stratify the sample by region or country dummy variables. The regressions of D/Z_1 on these independent variables yielded the coefficients shown in Table 2, with standard errors in parentheses.

The five columns of Table 2 show estimated regression coefficients and standard errors for a selectively reduced group of independent variables. In the first column, all independent variables are used, and all but τ (the income-tax rate) have the correct signs. That is, the sign agrees with the partial derivative of the steady-state solution for D/Z_1 with respect to the independent variable. Significant coefficients are found for g, α, and b. There are a number of reasons why τ should come out with an incorrect sign. First, it is correlated with θ, the government-spending rate, and with ψ, the excise-tax rate. Elimination of τ (column 2), yields estimates of coefficients for ψ and θ that have the correct sign and exceed their standard errors.

The interest-rate variable, r, is also of small significance in explaining D/Z_1 although the sign of the coefficient is correct. We suspect two reasons. First, because of difficulties in measuring the interest cost of borrowing, there are errors in measuring r. Second, the interest rate does not vary substantially from one country to another, or from one time period to the next. In fact the theory that generates our hypothesis does not require interest differentials in order to explain flows of capital.

TABLE 2

Regression Coefficients with D/Z_1 as Dependent Variable: Thirteen
Countries, Thirty-nine Observations, 1956–65

Independent Variable	Regression Equations				
	(1)	(2)	(3)	(4)	(5)
g	−.915	−.953	−.799	−.799	−.789
	(.240) [a]	(.200)	(.170)	(.178)	(.174)
α	+.669	+.679	+.556	+.613	+.609
	(.143)	(.137)	(.108)	(.109)	(.107)
b	−.227	−.231	−.214	−.207	−.190
	(.072)	(.070)	(.060)	(.072)	(.060)
r	+.004	+.015	−	+.082	−
	(.182)	(.175)		(.179)	
ψ	+.147	+.195	−	−	−
	(.209)	(.133)			
τ	−.041	−	−	−	−
	(.138)				
θ	−.125	−.171	−.116	−	−
	(.173)	(.079)	(.067)		
Constant term	.088	.087	.101	.051	.055
R	.754	.754	.734	.708	.706

[a] Standard errors are shown in parentheses.

Column 3 of the table shows the four most significant variables:
g, α, b and θ. Column 5 shows that deletion of θ has only a minor effect
on the other coefficients. In both columns 3 and 5, the coefficients of
g, α, and b are significant at 1 per cent.

These four variables not only show the most significant coeffi-
cients, but they also carry the greatest weight, quantitatively, in ex-
plaining D/Z_1. The quantitative significance of each independent var-
iable is shown in Table 3, where we have its sample mean and variance,
each multiplied by its regression coefficient from column 1 of Table 2.

Whether measured by the product of sample mean and regression
coefficient, or sample variance and regression coefficient, the four var-
iables g, α, b, and θ carry the greatest quantitative importance. Thus

TABLE 3

Independent Variables in Regression

Variable	Sample Mean	Sample Variance ($\times 10^{-3}$)	Sample Mean $\times$ Regression Coefficient	Sample Variance $\times$ Regression Coefficient ($\times 10^{-3}$)
g	.064	0.44	−.058	−.40
α	.139	1.46	.093	.98
b	.381	2.83	−.087	−.64
r	.133	0.36	.001	
ψ	.126	0.99	.019	.15
τ	.178	2.04	−.007	−.08
θ	.245	2.24	−.031	−.28

the theory that identified seven independent variables is left with four survivors: the rate of growth, the saving ratio, the capital coefficient, and the rate of government spending.

Confidence in the value of these coefficients is enhanced by comparison with a study carried out by G. H. Borts on data for regions of the United States. The regression of D/Z_1 on g, α, and b was made for the forty-eight contiguous states for the year 1953. The coefficients and their standard errors are shown in the first column of Table 4. There is a remarkable similarity in these results as compared with the OECD countries shown in the columns of Table 2.

It was noted earlier that the observation sample for the present study consists of three repeated observations on 13 countries. The possibility of an unnoticed change in economic structure is therefore present. Two checks were employed: First the regressions were rerun to see if elimination of the first period (1956–59) would influence the results. The data for this period are likely to be less reliable than for later periods. Furthermore, the postwar freedom of capital movements only began at the end of the 1950's. When the regression of column 5, Table 2, is rerun without the 1956–59 data, we obtain coefficients that are still highly significant and virtually unchanged numerically. These are

TABLE 4

Table of Regression Coefficients: D/Z_1 as
Dependent Variable

Independent Variable	(1)	(2)
g	−.918	−.794
	(.511)	(.238)
α	+.677	+.641
	(.163)	(.130)
b	−.197	−.172
	(.117)	(.073)
Constant	+.056	.045
R	.705	.726
Number of observations	48	26

shown in column 2, Table 4. Thus, if a change in economic structure occurred after 1959, it does not show up in the coefficients. The second check was the use of dummy variables in the regression to determine the possible existence of structural change that influenced all countries simultaneously in a given period. None of the dummies was significant. We did not make use of regional or individual country dummies, for lack of a priori reasons for such identifications.[3] Nevertheless, calculating the residuals from the regression shown in column 1, Table 2, there are persistent overpredictions or underpredictions for the following countries, with no discernible pattern:

D/Z_1 Overpredicted	D/Z_1 Underpredicted
Canada	Austria
France	Denmark
Japan	Ireland
Norway	Switzerland
Sweden	
United Kingdom	

[3] Two fishing expeditions into the data are worth reporting on. In the first, the countries were divided by size into large (0) and small (1), and the dummy was significantly

B. PREDICTION OF STEADY-STATE RATIOS

The parameters of the model were used to estimate a steady-state value of D/Z_1 from equation (16), in the section dealing with models of growth and capital movements. This steady-state value would be approached over time if the parameters held their values throughout and there were no other disturbances to the system. Of course, such a case is unthinkable. Nevertheless, as a first step, the constructed values of D/Z_1 were correlated with the observed values; the constructed values made use of parameters for each of the three periods, 1956–59, 1960–62, and 1963–65. Thus, we had 39 constructed estimates of D/Z_1, three for each country. Each constructed estimate of D/Z_1 was compared with the observed value for the same period, and a correlation coefficient of +.39 was obtained, significant but not large. However, this is a very poor test of the empirical validity of the model, since the parameter values, and consequently the asymptotic value of D/Z_1, change from year to year. A second test is suggested by the differential equation that is solved to give a time path for NFIEA and GNP. This prediction equation may be illustrated by returning to the very simple growth model presented earlier in the paper. It will be recalled that we obtained a steady-state solution for Z_1 and Z_2 (GNP and GDP):

$$Z_1 = Z_2 \left[\frac{g - ri}{g - rs} \right].$$

The full solution contains, in addition, a transitional term that reflects the initial conditions. If we write the bracketed expression above as z, then the full solution is

$$Z_1(t) = z \times Z_2(t) + C e^{rst},$$

where

$$C = Z_1(0) - Z_2(0) \times z.$$

positive, indicating that the small countries, on the average, lent more than the large ones. The meaning is unclear. In the second foray, the countries were divided into borrowers (0) and lenders (1). The dummy was positive, indicating that the function fitted to all observations would underestimate the volume of borrowing. This is consistent with the finding that the variance of predicted D/Z_1 is less than the variance of observed D/Z_1.

Therefore, with $Z_2(t)$ growing at the rate g, we also have

$$\frac{Z_1(t)}{Z_2(t)} = z + \frac{C}{Z_2(0)} e^{(rs-g)t},$$

an expression that will converge to z if $rs - g$ is negative.

As a consequence, the expression D/Z_1 equals

$$\frac{D(t)}{Z_1(t)} = 1 - \frac{1}{z + \dfrac{C}{Z_2(0)} e^{(rs-g)t}}.$$

This is the prediction equation for D/Z_1, which may be used once we have a value for

$$\frac{C}{Z_2(0)} = \frac{Z_1(0)}{Z_2(0)} - z.$$

$Z_1(0)/Z_2(0)$ is obtained from the observed (1956–59) values of Z_1 and Z_2. The (1960–62) value for z is derived from the steady-state equation:

$$z = \frac{g - ri}{g - rs}.$$

Thus the term $C/Z_2(0)$ is specified. The 1960–62 period is treated as occurring one period later than the 1956–59 period, and D/Z is thus estimated:

$$(D/Z)(60\text{--}62) = 1 - \frac{1}{z + \dfrac{C}{Z_2(0)} e^{(rs-g)}}.$$

This estimate is referred to as $\bar{D}/\bar{Z}$. When the actual observations are compared with the predicted values, we obtain the following regression relation:

$$D/Z = -.00018 + .981 \bar{D}/\bar{Z}.$$
$$(.024)$$
$$R = .993$$

Here we have used 26 observations and predictions, 13 for the 1960–62 period and 13 for the 1962–65 period. While these results look impressive and yield a regression coefficient insignificantly different from

unity, there is an alternative hypothesis against which the theoretical prediction must be judged. The alternative hypothesis is simply that the ratio D/Z_1 for one period is best predicted by the observed ratio for the preceding period. A simple way to test the alternative hypothesis is to use the lagged value as a second independent variable to determine the statistical significance of its coefficient. We then obtain a multiple regression relation

$$D/Z_1 = -.00011 + .791\bar{D}/\bar{Z} + .186[D/Z](t - 1).$$
$$(.221) \qquad (.216)$$
$$R = .993$$

We see that the use of the lagged value neither adds explanatory power nor yields a statistically significant coefficient. The conclusion is that the prediction based on the theoretical model provides a good explanation of the ratio of NFIEA to GNP.

5   CONCLUSION

THE MOST impressive statistical confirmation comes from the multiple-regression tests. The agreement in sign between the estimated coefficients and the partial derivatives of D/Z_1 indicates that each parameter (but τ) affects the dependent variable as predicted. Further, there is striking agreement between the estimates of the coefficients of g, α, and b from data for OECD countries and for the 48 contiguous states of the United States.

We are less impressed with the results of the last test, because the D/Z_1 ratios for each country are reasonably stable through time. While the preceding period D/Z_1 value does not provide much additional explanation, it is, nevertheless, highly correlated with subsequent values.

Assuming that the theory provides a valid explanation of capital movements, what have we learned that we did not know before? There are three major conclusions.

First, movements of capital can be explained by the same factors that explain the growth of an economy: the growth of population and

technology, the improvement in the terms of trade between exports and imported capital goods, the saving rate, and the capital-coefficient. Government policy directed toward influencing capital movements can operate on these parameters.

Second, it is not necessary to introduce monetary factors to explain why or how capital transfers occur. Monetary variables may influence capital movements, however, if the excess demand for money has an influence on the excess demand for goods. In the present model, such an influence was not assumed. Our assumptions imply that monetary and foreign-exchange policies directed toward target values of international reserves have no influence on the balance of trade, and only affect the balance on private capital account and the reported level of NFIEA. The tests on the data do not repudiate this assumption.

Third, the theory of balance-of-payments adjustment should be enlarged to take these possibilities into account.

APPENDIX: THE SOLUTION AND STABILITY OF THE MODEL

IN THE solution for Z_1 (GNP), two principal substitutions are required. These include the equilibrium condition for Z_1 and the growth rate of Z_2 (GDP).

Since the model contains physical commodities valued at a set of prices and long-term securities valued as the assets that households, firms, and the government can demand and supply, we need to specify only one condition of market equilibrium. A one-country model of this type should properly specify four markets: goods, securities, money, and foreign exchange. We have assumed that the money market and the balance of payments are in equilibrium. Thus equilibrium in the securities market implies equilibrium in the goods market. The equilibrium conditions for Z_1 can be found by equating the demand and supply functions for Z_1. From the demand side,

$$Z_1^d = C + G + I + E - MP_M + D + DEP_F, \tag{38}$$

where $E = X_e P_x$, MP_M represents the value of imports, $C = X_c P_x$, and I represents gross domestic investment (GDI). The supply equation is

$$Z_1^s = C + S + T + Q + DEP_N. \tag{39}$$

Equating the two, we have

$$E - MP_M + D = S + T + Q - G - \text{net } I. \tag{40}$$

This equation says that net foreign investment equals net national savings minus net domestic investment plus the government's surplus. We shall substitute equation (40) for B, the balance on current account, whenever B appears in the solution of Z_1.

The growth rate g of Z_2 depends only upon certain parameters and is therefore constant and independent of the other economic relationships in the model. We can derive g as follows:

Multiplying the price of output (19) and the production function (20) gives us

$$XP_x = P_x A_t L^{1-b} K^b. \tag{41}$$

Take the log derivative of XP_x with respect to time, and substitute the specified growth rates of P_x, A_t, and L. Denote the growth rate of XP_x as g.

$$g = \rho + \mu + (1 - b)\lambda + \frac{b\dot{K}}{K}. \tag{42}$$

An expression for $\dot{K}/K$ can be obtained from capital's equilibrium condition in equation (23). It equals

$$\frac{\dot{K}}{K} = g - \gamma. \tag{43}$$

Substituting (43) into (42) gives us

$$g = \frac{\rho}{1 - b} + \frac{\mu}{1 - b} + \lambda - \frac{b\gamma}{1 - b}. \tag{44}$$

Since g is not a function of time in (44) we can write XP_x as

$$XP_x = X_0 P_{x0} e^{gt} \tag{45}$$

for a given initial condition $XP_x(0) = X_0 P_{x0}$.

We are now ready to solve the model in terms of the variable Z_1. From (25) and (35) we obtain

$$Z_1 = Z_2 + \left(\frac{\beta + r}{r}\right)D. \tag{46}$$

The time derivative of this equation is

$$\dot{Z}_1 = \dot{Z}_2 + \left(\frac{\beta + r}{r}\right)\dot{D}. \tag{47}$$

Since $D = rB$, we can substitute equation (40) for B. From (45) we know that $\dot{Z}_2 = gZ_2$. Therefore, (47) can be rewritten as

$$\dot{Z}_1 = gZ_2 + (\beta + r)[S + T + Q - G - \text{net } I]. \tag{48}$$

From the equations of the model, the values of S, T, Q, G, and net I can be described solely as functions of Z_1 and Z_2. Consequently (48) can be written as

$$\dot{Z}_1 - N_1 Z_1 = \frac{N_2}{1 + \psi}\, X_0 P_{x0} e^{gt}, \tag{49}$$

where
$N_1 \equiv (\beta + r)[\tau(1 - \alpha) + \theta] + r\alpha$ and
$N_2 \equiv (1 + \psi)g - b(g - \gamma) + \alpha\beta(1 - b) + \psi[\beta + r(1 - \alpha)]$.

Equation (49) is a linear nonhomogeneous differential equation that has constant coefficients. Its solution is

$$Z_1(t) = \frac{N_2 \times X_0 P_{x0} e^{gt}}{(1 + \psi)(g - N_1)} + c_1 e^{N_1 t} \tag{50}$$

where $c_1 = $ constant of integration.

Since by inspection $N_2 > 0$, we must impose the stability condition $g - N_1 > 0$ in order to ensure that the model has a positive solution for Z_1.

The econometric tests performed on the model are concerned principally with the value of D/Z_1. This ratio can be derived in the following fashion:

Dividing equation (50) by $XP_x \equiv Z_2$ we obtain

$$\frac{Z_1}{Z_2} = \frac{N_2}{(1 + \psi)(g - N_1)} + \frac{c_1 e^{(N_1 - g)t}}{X_0 P_{x0}}. \tag{51}$$

As long as the stability condition is satisfied, Z_1/Z_2 will approach the value $N_2/(1 + \psi)(g - N_1)$ as $t \to \infty$. Assuming that the long-run steady-state solution has been attained,

$$\frac{Z_2}{Z_1} = \frac{(1 + \psi)(g - N_1)}{N_2}. \tag{52}$$

From equation (46) we can write D/Z_1 as

$$\frac{D}{Z_1} = \left[1 - \frac{Z_2}{Z_1} \right] \frac{r}{r + \beta}. \tag{53}$$

Substituting equation (52) for Z_2/Z_1 we obtain as the steady-state value of D/Z_1

$$\frac{D}{Z_1} = \frac{r}{r + \beta} \left[\frac{N_2 - (1 + \psi)(g - N_1)}{N_2} \right]. \tag{54}$$

The long-run debtor or creditor position of the nation depends on the sign of the term $N_2 - (1 + \psi)(g - N_1)$. A positive value indicates that the country is a net creditor in its long-term lending; a negative sign implies a net debtor position in relation to the rest of the world.

REFERENCES

1. Avramovic, Dragoslav, *Debt Servicing Problems of Low Income Countries*. International Bank for Reconstruction and Development. Baltimore, Johns Hopkins Press, 1960.
2. Borts, George H., "Growth and Capital Movements Among U.S. Regions in the Postwar Period." *American Economic Review, Papers and Proceedings*, 58 (May, 1968), pp. 155–161.
3. ———— "A Theory of Long-Run International Capital Movements." *Journal of Political Economy*, 72 (August, 1964), pp. 341–359.
4. Cairnes, J. E., *Some Leading Principles of Political Economy Newly Expounded*. New York, 1874.
5. Denison, Edward F., *Why Growth Rates Differ*. Washington, D.C., Brookings Institution, 1967.

6. Domar, Evsey, "The Effect of Foreign Investment on the Balance of Payments." *American Economic Review*, 40 (December, 1950), pp. 805–826.

7. Ingram, James, *Regional Payments Mechanisms: The Case of Puerto Rico.* Chapel Hill, University of North Carolina Press, 1962.

8. Johnson, Harry, "Equilibrium Growth in an International Economy." *Canadian Journal of Economics*, 19 (November, 1953), pp. 478–500.

9. Lewis, Cleona, *The United States and Foreign Investment Problems.* Washington, D.C., Brookings Institution, 1948.

10. Metzler, Lloyd, "The Process of International Adjustment Under Conditions of Full Employment: A Keynesian View," reprinted in R. E. Caves and H. G. Johnson, eds., *Readings in International Economics.* Homewood, Richard D. Irwin, Inc., 1968.

11. Mundell, Robert, "Capital Mobility and Stabilization Policy Under Fixed and Flexible Exchange Rates," reprinted in R. E. Caves and H. G. Johnson, eds., *Readings in International Economics.* Homewood, Richard D. Irwin, Inc., 1968.

12. Neher, Philip, "A Neo-Classical Theory of International Capital Movements," unpublished doctoral dissertation, Brown University, 1966.

13. Williamson, Jeffrey, "Real Growth, Monetary Disturbances, and the Transfer Process: The United States, 1879–1900." *Southern Economic Journal*, 29 (January, 1963), pp. 167–180.

14. International Monetary Fund, *Balance of Payments Yearbook, 1955–1965.* Washington, D.C.

15. ――― *International Financial Statistics, Supplement to 1966–1967 and Vol. 22, No. 6.* June, 1969, Washington, D.C.

16. Organization for Economic Cooperation and Development, *Statistics of National Accounts 1950–1961.* Paris, 1964.

17. ――― *National Accounts Statistics, 1956–1965.* Paris.

18. ――― *General Statistics, 1964.* Paris.

COMMENTS

LORIE TARSHIS

STANFORD UNIVERSITY

The two papers that have been assigned to me for comment, when read successively, will create a state of at least mild schizophrenia in most readers. The first, by Dobell and Wilson, which attempts to assess policy alternatives, relies very strongly, though by no means wholly, on the effects to be expected from changes in relative yields earned on securities issued in Canada and in the United States. Shifts in relative interest rates, or something like them, are at least partly responsible for shifts in the balance of payments and in the capital accounts, even when the initiating development is a substantial change in the Canadian tax structure. The other paper, by Borts and Kopecky, seeks to account for flows of capital without the slightest reference, so far as I can see, to yield differentials; nevertheless, the independent variables it specifies seem to explain recent experience to a surprising degree.

It is clear that each of these studies, in its own way, can contribute something to our understanding of movements of capital. It is equally clear — but rather unfortunate — that collaboration between the two pairs of authors was surprisingly — to use that term again — lacking. Indeed, it is doubtful that their work stems from the same general discipline, an observation that throws an unflattering, though not necessarily inaccurate, light upon the state of the subject.

The Borts-Kopecky study does not deal directly with capital movements; instead it focuses on the factors that determine the ratio of NFIEA to the GNP. But if we assume, as the authors do, no change over time in the rate of return on assets held abroad, then the long-run maintenance of that ratio will imply, for a country that begins life as a net creditor, a growth in its net capital exports that eventually will match the growth in its GNP; if the ratio rises, it implies an even faster growth in its net capital exports. Thus, when the authors isolate factors that would, according to them, lead to a rise in that ratio, I shall simply take it to mean that these factors would also lead to a rapid in-

crease in — and sooner or later a high rate of net capital exports from — the country in question.

They reach their results by analyzing a model from which almost everything has been stripped away — some will feel that the simplifying has gone too far and that even some essentials have been removed.

Their model seems to consist of one very small country embedded in a very big and rather passive world that sometimes looks like outer space. The small economy's net exports are determined directly by saving minus investment, suitably defined. Its net exports, it must be emphasized, are treated as a mere residual — or a balancing item that must take whatever value is required for the maintenance of equilibrium in the goods market. Both investment and saving, in turn, are determined by such factors as the economy's rate of growth, its rate of saving, its own rate of interest (which, however, equals the rate in the rest of space), the rate of depreciation of its capital assets, its tax rate, the share of its GNP purchased by government, and capital's imputed share in its GDP. It is notable that conditions outside the economy play no role in the determination of its exports. Now, clearly, one cannot argue with an identity, although one can question the uses to which it is put. Its most dangerous feature is, of course, that by itself it can tell us nothing about what is cause and what is effect — or, more generally, about the directions in which causal influences operate. Of course, we can interpret their equations as doing no more than establishing the fact that there is a complex functional relationship involving all the variables they mention — and, in a richer (and, I would hold, more fruitful) model, many more of them. Their list of variables includes those that they regard as their primary dependent variables. But on that interpretation their work may tell us little about what determines capital movements.

There may be something to be said for assuming that an economy's net exports are determined in such a way when that country is selling in a perfectly competitive market, for then it can dispose of all its output at a price that is independent of the amount it chooses to sell. And if, at the same time, its domestic buyers have a prior claim upon that output, its net exports would be determined as is done in the authors' model. However, it is not obvious that any economy — even the smallest — begins to meet these conditions. Indeed, the only example that

seems even to approach these conditions is — or rather was — South Africa in the days when it knew it could sell gold without limit at $35 an ounce.

Once we explicitly take into account a feature that is surely *central* to any problem of international economics — namely, that there must be at least two economies — we can see how misleading the authors' assumption that net exports and, subsequently, net capital movements, are a mere residual, must be. Their results presumably apply to any other country, too, and not simply to the one on which our attention was first focused. Hence, their conclusion that, to take an example, a country's *net* exports will rise in direct proportion to the level of world interest rates, would apply to the other country — assuming that there are only two — just as it does to the first. So a rise in world interest rates would lead to an increase in the *net* international lending of each country. Likewise, a rise in the tax rate of each country would lead both to expand their *net* lending simultaneously and not simply their gross lending. And so would a general decline in their rates of growth.

I admit that in stating my objection in these terms I compound the error of composition. However, it is difficult to resist the temptation to do so as a means of bringing out clearly that the authors, in their empirical tests, seem to fall into the same trap. A result in which net exports and net lending of both countries rise simultaneously is not so much paradoxical as it is surrealist. And the resolution of what I shall call the paradox must be either that a country's net exports are not residually determined, or, as an alternative, that the beginning point for one country, which must be a net debtor if the other is a net creditor, makes a real difference in the results. I do not find it in the least upsetting to be forced to conclude that the first point is correct and that all the variables — taxes, saving, investment, exports, imports, and even capital movements — are, in fact, mutually determined and, indeed, are determined by forces operating on both sides of the border; that, for example, something that induces investors in one country to buy securities from investors in another may lead (or the purchase itself will lead) to a modification of the forces that determine tax yields, domestic investment spending, net capital exports, and so on, in both countries.

When I began to work on this paper and noted the absence of differential interest rates, I felt as though I were hearing, "Look, Dad, no hands." As I thought more about it, and realized that their model makes a country's exports no more than a balancing item — an Errors and Omissions figure, if you will, in its goods-market accounts — I began to hear, "Gee whiz, Dad, no feet either!" And when I got to the end and saw that one country's capital movements were to be explained without the least reference to the situation in other countries, I couldn't help wondering whether there was even a bike on the road. Simplification seems to have gone too far.

In our earlier discussions questions were raised about the explanatory power of a model that has two countries and only one money, as a common-currency area implies; even more questionable is a model designed to explain international capital movements with only one currency and one country, or at least one currency, one country, and outer space.

I grant that my remarks might be less appreciated *if* the authors' analysis were meant to apply to, say, Luxemburg or San Marino. But their empirical tests suggest that they also had larger economies such as France, Germany, or Japan in mind.

And yet with so little at hand, they seem able to explain so much. An equation having only the single economy's rate of growth, its saving rate, and the share of its GDP imputed to capital in it, and one in which the first two are of paramount importance, gives results for these larger economies which are decidedly well correlated with the observed values for the rates mentioned earlier.

I suppose for one who makes no claim to being an econometrician, that the most congenial explanation for this can be found in the remarks Bryant and Hendershott made in their paper. In any event, I cannot take seriously the very excellent results of an empirical test of a relationship which is theoretically unpersuasive — at least to me. There appears to be less to their results than meets the eye.

The paper by Dobell and Wilson is at once more ambitious — because it does grapple with the problem of mutual interdependence — and less ambitious, because it seeks to isolate the effects of certain specific changes in Canadian taxes by holding all other factors constant.

Here, the results are, in a way, not at all surprising—even though that itself is surprising, as I shall try to show.

Most of what I shall call the temporarily final effect of what amounts to a rise in the tax on the corporate profits of Canadian firms, together with the exposure of those profits to the personal-income tax, seems to have its source in a reduction in the payments abroad of dividends by foreign-owned firms as well as in the discouragement that nonresidents would face in purchasing Canada's securities. But at least it is comforting to find that one's intuition is not completely wrong when attention is paid, as the authors do, to various indirect effects— in the money and securities markets, in the goods markets and so on.

Not that their model is altogether general, or indeed that it is even always general enough to answer the questions they place before us in a really useful way. Investment spending, for example, is permitted to respond to changes in securities markets. But the final equilibrium, in the authors' sense of the term, does not allow for changes in invest- ment that might be induced by changes in expected yields on new proj- ects. This limitation is not to be criticized, though taking it to suggest something about the time path of the process and implying that their answer is at least true for, say, the end of the first year, would, I think, be a mistake.

If I have any worry, then, about their procedures and their results, it comes down to what I hold to be an insufficiently careful statement of their theoretical work.

Suppose that two kinds of securities are issued, one in Canada, and the other in the United States. And suppose, to begin with, that some of each are held on both sides of the border. Now, if the Canadian government were to raise the tax on the profits of Canadian corpora- tions—and the tax could not be "passed on"—this would result in a reduction in the yield offered by Canadian securities at their old price. But it would not necessarily lead to any movement of capital (con- sidering, here, only the stock of securities already issued). Indeed, if all investors were affected in exactly the same way—or thought they were—there would not be even any transactions as a result of the new tax. Transactions could occur only if some investors reacted dif- ferently to this higher tax than did other investors. And their trans-

actions would only be *international* in character — and thus comprise a capital movement — if investors on one side of the border figured that their after-tax yield was affected by more or by less than investors on the other side estimated theirs to be. That could, of course, happen. Indeed, if Canadian investors could claim some credit against their personal income tax, while investors in the United States could not (as seems likely with the proposals under study), Canada would export capital. But if the tables were turned, and American investors were allowed to claim part credit against their personal income tax for this higher tax on the profits of the Canadian firms in which they held shares, while Canadian investors were not able to do this, Canada would *import* — not export — capital as a result of such a tax rise.

Space does not permit me to develop these notions about the effects of changes in the rates of taxes, but I believe that these effects hold equally for changes in the rates of interest. And they create some doubt in my mind as to measurements of interest-rate sensitivity obtained in the usual way — including those used by Dobell and Wilson. Not every differential change in interest rates — assuming, for example, that in the absence of capital mobility rates in one country would rise and in the other decline — is bound to bring forth "normal" capital movements, or indeed *any* capital movements — even when objective restrictions on foreign investment are lacking. So much depends upon the causes of the differential shift in interest rates. And so much, too, depends upon the differences in speculative opinion among the investors of each of the countries taken separately.

For the study in question this implies that the empirically determined values for the interest-rate sensitivity of flows of capital are likely to be wide of the mark, unless the model used to determine these values is a good deal more complex than those normally used. The results are perhaps not very sensitive to the values taken, but they must be sensitive to something; and most of the other parameters look no more promising.

BELA BALASSA

JOHNS HOPKINS UNIVERSITY

We are indebted to Dobell and Wilson and to Borts and Kopecky for their interesting and provocative contributions to the conference. At the same time, one is struck by differences in the methods of analysis used in the two papers. Borts and Kopecky suggest that international capital flows are explained by differences in ex ante saving and investment and not by differences in yields. By contrast, variations in yields associated with proposed tax reforms occupy a central place in Dobell and Wilson's analysis of the possible effects of these reforms on capital movements and the balance of payments in Canada. Instead of comparing the two papers, however, I will comment on them individually. Following customary procedure, I will emphasize points of disagreement rather than agreement.

Dobell and Wilson have estimated the effects of alternative tax-reform proposals on capital flows and on the balance of payments in Canada. They also show the revenue effects of the proposed reforms and their impact on domestic capital markets, saving, and investment. A distinction is made between the "impact effect" that appears in the first round, the "final effect" that provides an unconstrained solution after all equilibrium conditions are satisfied, and the "compensated effect" that involves the imposition of balance-of-payments and aggregate-demand constraints on the solution of the model.

In the introduction to the paper, the authors note that they seek to develop "a consistent macroeconomic model of Canada" (p. 519) from which the effects of alternative tax reforms can be derived. Instead of estimating the model from time-series observations, however, they use extraneous information on various economic relationships, obtained from a variety of sources, as building blocks for the model. Several questions arise in connection with this procedure.

There is, first, the question of whether the estimates of the individual relationships are consistent with each other, since they have been derived by the use of different methods and refer to different time periods. Second, the results are affected by the lack of estimates concerning some of the relationships pertaining to international capital

flows, such as the yield sensitivity of the three types of portfolio invest-
ment included in the model: foreign purchases of Canadian bonds,
foreign purchases of Canadian stocks, and Canadian purchases of
foreign securities. Third, the conclusion that "the available empirical
evidence suggests that foreign direct investment in Canada is not very
sensitive to changes in yields on marketable securities" (p. 532) may
not be applicable when the effects of proposed tax reforms are evalu-
ated, because decisions are likely to be more sensitive to once-for-all
changes in yields than to changes that may be considered temporary.

According to Dobell and Wilson's estimates presented in Table 4,
the "impact effect" of the proposed reforms would entail an improve-
ment in Canada's balance of payments in the area of $140–$200 mil-
lion. This result would follow largely because of the reduced outflow of
dividends and, apart from the White Paper proposals, reductions in
Canadian purchases of foreign securities. Accordingly, under the as-
sumption of fixed exchange rates and an accommodating monetary
policy, balance-of-payments equilibrium and the maintenance of ag-
gregate demand would require an expansionary fiscal policy in the form
of increases in government expenditure or reductions in taxes.

The estimates of the impact effect on the balance of payments are,
however, sensitive to the assumptions made. Moreover, the policy
recommendations are affected by the separation of the changes follow-
ing the tax reform into those included under the impact effect and those
subsumed under the final effect of the unconstrained solution. I will
consider these questions as they pertain to foreign direct and portfolio
investment in Canada.

Dobell and Wilson note: "The estimated negative shock effects of
the Carter proposals on investment in the extractive sector are based
on a study of that sector by G. D. Quirin. Since the revenue impact of
the mineral-industry reforms proposed in the White Paper is estimated
to be negligible for the first five years, we shall assume that these re-
forms will also have no effect on investment" (p. 547). We cannot judge
the reasonableness of Quirin's estimate, since the methods used are not
indicated in the paper under discussion. As to the effects under the
White Paper proposals, the assumption that investors would not be
affected by tax increases publicly scheduled for five years hence is
open to question. Since the period of recoupment in extractive indus-

tries is rather long, anticipations tending to reduce the amount invested by both domestic and foreign firms are likely to be at work.

Questions also come to mind concerning the author's treatment of the effects of tax reform on investment which takes place outside the extractive sector. Such investment is supposed to depend on the marginal corporate-tax rate, which would not change under any of the reforms. While this may be the appropriate assumption with respect to capacity expansion by existing firms, it would not be appropriate for investment by new firms. For new firms, the average — rather than the marginal — tax rate will be relevant. The rise in the average tax rate under the three reform proposals would thus provide disincentives to investment by new firms — domestic as well as foreign — and thereby tend further to reduce foreign direct investment in Canada.

The authors' results concerning the flow of funds from — or to — existing subsidiaries of foreign companies are also open to criticism. In nonextractive industries where investment is assumed to remain unchanged, the capital requirements of these firms would go up by the full amount of the increased tax payment, while in extractive industries capital requirements would rise by the difference between the increase in tax payments and the decrease in investment by foreigners. It is further assumed that nonresident firms would continue to finance their increased capital requirements from domestic and foreign sources in the same proportions as heretofore. Correspondingly, the outflow of dividends would be reduced by 83 per cent of the increase in capital requirements in nonextractive industry and 77 per cent in extractive industry (Table 3). This decrease in the outflow of dividends accounts, in turn, for 60 to 80 per cent of the estimated improvement in the Canadian balance of payments under the three proposed tax reforms.

Dobell and Wilson thus assume a passive behavior on the part of the international corporation: increased taxes would affect neither the decision to invest nor the share of financing from Canadian sources. Rather than financing the increase in tax requirements through reduced outflow of dividends, however, the reduced availability of funds generated internally might well induce foreign companies to augment the share of borrowing in Canada or to reduce planned investment by their subsidiaries. At any rate, the relationship between the uses of financing for new investments and for increased taxes on the one hand,

and that between the sources of foreign financing from the inflow of capital and from reduction in dividends on the other, is at best tenuous. All in all, the balance-of-payments effects of the proposed tax reforms on direct investment and dividend flows might then well be unfavorable rather than favorable for Canada's balance of payments.

Further questions concerning the effects of the proposed tax reforms on portfolio investment also come to mind. The authors note that for the typical investor in the 35–40 per cent marginal bracket, the combined effect of changes in corporate and personal taxes would lower the marginal tax burden on income from corporate sources under the Carter proposals and increase it under the White Paper. The importance of the latter is said to be negligible, while the former would affect Canada's balance of payments favorably by inducing a switch from foreign to domestic securities. By contrast, the impact effect of the tax-reform proposals on investment in Canadian securities by foreigners is taken to be nil.

The asymmetrical treatment of portfolio investment by Canadians and foreigners reflects the assumption that while the former will react immediately to changes in after-tax yields resulting from the tax reform, the latter will adjust their portfolios only after a time lag. These assumptions do not appear realistic, however. As reductions in the rate of personal taxes are not applicable to them, foreign investors will tend to switch out of Canadian securities that will offer lower after-tax earnings and dividend yields at the higher corporate-tax rates. And there is no reason to assume that foreign investors would postpone making such decisions.

It should be added that adverse changes in Canada's balance of payments due to the sale (or reduced purchase) of Canadian securities by foreigners would tend to be much greater than the beneficial change that would result from switching by Canadians. On the one hand, the volume of securities in question is substantially greater in the first case than it is in the second; on the other, the absolute magnitude of the change in yields is greater for the foreign investor than it is for the Canadian, for whom there are compensating changes in personal taxes. By including transactions in Canadian securities by foreigners under the "impact effect," there is little doubt that the balance-of-payments

effects of the proposed tax reforms on portfolio investments would be unfavorable.

These considerations suggest the conclusion that, in the absence of compensatory fiscal policies, the tax reforms proposed in recent years may well lead to a deterioration rather than an improvement in Canada's balance of payments. This conclusion has important implications for policy making. While, on the basis of their results, Dobell and Wilson presumably would advise the government to accompany tax reform by an expansionary fiscal policy, under the modified assumptions suggested here a deflationary policy might be in order.

In their paper, Borts and Kopecky set out to explain flows of international capital and factor payments within the framework of a growth model. In the simplest formulation of the model, net foreign lending is derived as the difference between ex ante saving and investment which, in turn, depend on the exogenously determined gross national and gross domestic products. Yield differentials do not enter into the determination of foreign investment and the rate of interest is assumed to be the same in all countries.

The model will generate a stream of international factor payments that will grow at the same rate as the economy, while the absolute amount of these payments – at any one point in time – will depend on the growth rate, the rate of interest, and the net capital flow. Apart from the special case when the rate of growth equals the interest rate, however, international factor payments will not equal the capital flow, so that indebtedness will change in absolute amounts though not as a proportion of the GDP.

The model is developed further by separating private and public savings, and including depreciation, the share of GDP imputed to capital, the increase of prices of imported capital goods, income and excise tax rates, and the share of GNP spent by government as variables. Subsequently, the model is specified in greater detail by postulating an aggregate production function of the Cobb-Douglas type with technological change, and assuming that the country produces a single commodity that is either consumed domestically or exported and faces infinitely elastic demand abroad. Investment goods are imported in the amount necessary to provide for the country's investment needs,

which are determined by the condition that the capital stock must grow at the same rate as does the supply of labor. The amount exported is a residual sufficient to cover the capital outflow net of international factor payments as well as the value of imports.

These modifications do not alter the basic character of the model. Economic growth is taken to be exogenous, depending only on the growth of the labor supply and the rate of autonomous technical change. In turn, domestic saving and investment will depend on the GNP and the GDP, respectively; and, for given depreciation rates, the rate of interest, tax rates, and prices of capital goods, both will grow at the same rate of equilibrium as the GDP (and GNP). Now, as foreign investment is taken as a residual — the difference between domestic saving and investment — it, too, will grow at this rate and so will foreign factor payments.

The determination of capital flows is thus mechanistic in the model; these flows are assumed to equal the difference between domestically determined saving and investment. No inquiry is made, however, regarding the way in which decisions on foreign investment are arrived at. Should one wish to specify the behavior assumptions concerning the determination of foreign investment, these would have to involve international differences in the rates of return. But once rates of return are introduced, these may also affect domestic saving and investment, which is not allowed in the model.

The absence of behavior assumptions concerning the determination of foreign investment, coupled with the lack of a feedback from rates of return to investment and saving, makes the model appear unrealistic as a description of the real world. A further deficiency is the lack of feedback from foreign investment to economic growth; it is assumed that the latter affects the former but not vice versa.

These weaknesses of the model may be illuminated by a historical example: the flow of capital from Britain to the so-called regions of recent settlement in the early part of the century. At that time, an increasing proportion of British savings were invested abroad. With the share of saving in national income remaining at 10–15 per cent a year, foreign investment came to surpass one-half of domestic saving in Britain.[1] These flows cannot be explained by reference to saving

[1] Cf. A. K. Cairncross. *Home and Foreign Investment, 1870–1913.* Cambridge, Cambridge University Press, 1953.

propensities and the investment needs of exogenously determined economic growth in the capital exporting and importing areas. Rather, capital movement between the two areas responded to investment opportunities, as they were perceived by lenders and borrowers. The flow of capital, in turn, importantly affected the rate of economic growth in Britain as well as in the regions of recent settlement — reducing the rate of growth in the former and increasing it in the latter. Thus, rather than being exogenous, growth has been a *result* of capital flows.

These considerations focus attention on weaknesses in the logical structure of the model. Instead of the causation going from economic growth to investment and saving, and then again to capital flows, one may wish to explain capital flows by international differences in the rates of return, which will affect investment and saving and, ultimately, the rate of growth of the economy. In a more sophisticated model, the two explanations may be combined, that is, one may take account of interactions and feedbacks among the relevant variables.

But how about the statistical results obtained with the model? Due to its year-to-year volatility, the authors do not take capital flows as the dependent variable but use, instead, the amount of foreign factor payments (NFIEA) or, more precisely, the ratio of these factor payments to GNP. Combining data of thirteen industrial countries, excluding the United States, for three subperiods after World War II, they regress this ratio on the variables referred to earlier. The ratio of foreign factor payments to GNP appears to be positively correlated with the saving coefficient, and negatively correlated with the rate of economic growth, the share of GDP imputed to capital, and, in one of the regressions, the share of GNP spent by the government. The coefficient of determination is approximately .5.

While these results are consistent with the hypotheses advanced by the authors, they are consistent with other hypotheses as well. As noted above, the outflow of capital associated with receipts on the fac-tor-payments account will tend to reduce the rate of economic growth. Moreover, to the extent that a high share of capital corresponds to a high rate of return, the situation will attract foreign investment and thus give rise to factor payments abroad. In permitting a larger amount of private and public investment, the inflow of capital will also tend to be associated with a relatively high share of government spending in

GNP. Finally, the possibilities of investment abroad may encourage saving by providing a higher rate of return than would be obtainable otherwise. This might have happened in France around the turn of the century, when it appeared that the high rates of intèrest paid on Russian bonds induced saving, even on the part of low-income classes.

The statistical results are thus consistent with alternative hypotheses and further testing would be necessary to choose among them, or, rather, efforts would need to be made to test a more sophisticated model that specified interactions among the relevant variables as suggested above. Similar considerations apply to the close correspondence of the regression results obtained from the model at hand and from Borts' earlier work on the (then) 48 states of the United States. This correspondence indicates the similarity of the factors affecting international and interregional capital flows but is consistent with hypotheses other than those advanced by the authors.

I come, finally, to the relationship between observed and steady-state values of the ratio of foreign factor payments (NFIEA) to GNP. Having obtained a low correlation between the two, the authors construct predicted values by utilizing the simplest form of the model and compare these with observed values for the previous period. The correlation coefficient between "constructed" and observed values is .99. But, as the authors also note, the results are hardly impressive considering the stability of the ratio of NFIEA to GNP.