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INTERNATIONAL
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PAPERS

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STAFF PAPERS

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Distributional Aspects of Stabilization Programs in Developing Countries

OMOTUNDE JOHNSON and JOANNE SALOP*

PERSISTENT BALANCE OF PAYMENTS DEFICITS associated with rapid inflation and overvalued exchange rates tend to characterize the countries requesting the use of Fund resources in the upper credit tranches. In most cases, these problems are due to government budget deficits, financed by borrowing from the banking system, that result in excess demand, raising prices at home and spilling over into imports. As domestic costs and prices rise relative to foreign prices, changes in relative profitability cause resources to flow to the sectors that are more exclusively domestic, causing export and import-competing sectors to contract, relative to aggregate output. As the balance of payments deteriorates and the stock of international reserves diminishes, the authorities often impose restrictions and controls on imports to arrest the decline: requirements for import licenses are tightened; foreign exchange becomes increasingly subject to administrative allocation; and the exchange system itself becomes burdened with special tax and export bonus schemes. These measures tend to divert demand from imports to domestic production, and a fall in international reserves is avoided at the cost of additional domestic inflation and often a slowing of economic growth.

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Ms. Salop, economist in the Special Studies Division of the Research Department, is a graduate of the University of Pennsylvania and Columbia University. Before joining the Fund, she was on the staff of the Board of Governors of the Federal Reserve System.

The solution to these problems lies in reducing domestic demand to a level commensurate with the country's real productive capacity and sustainable borrowing capacity. Hence, the restraining of expenditure figures largely in programs associated with the use of Fund resources. Moreover, because of wage and price rigidities, the sizable monetary and fiscal contraction that is often needed to restore equilibrium tends to have serious adverse short-term and medium-term consequences for real output and employment. In this setting, currency depreciation has often been a useful complement to the restraint of demand. Devaluation not only raises the domestic price of exports and import substitutes, thereby providing incentives for the expansion of output in these sectors, but also, by reducing the relative price of nontraded goods and domestic factors of production, induces a shift of domestic demand to these goods and factors. In this way, the unemployment problem that restraint creates in the nontraded goods industries is mitigated.

The measures taken as part of stabilization programs inevitably have repercussions on the distribution of income. For example, a reduction in a food subsidy favorably influences those paying for it, including future generations, at the expense of its beneficiaries. Other distributional effects are indirect and reflect the necessary changes in relative factor rewards that are associated with the movement toward external balance. If the economy in question produced only one good for which the demand by the rest of the world were perfectly elastic with respect to price, this would not be an issue. In terms of our example, the reduced consumption of food would simply translate into diminished imports or increased exports; no movement of factors of production across sectors and no further change in factor incomes would be required. Hence, the sole distributional effect would be the initial one. However, economies like this exist only as artificial constructs. In the real world, reducing aggregate demand sets in motion a train of economic consequences, all of which have distributional effects, such that the sustainable equilibrium ultimately attained will be characterized by a distribution of income different from that observed immediately following the implementation of the program.

Additional channels through which stabilization programs affect the distribution of income can also be identified. In particular, if a program is successful in reducing inflation, and if financial stability exerts a positive influence on growth and development, then it is surely relevant to ask how inflation, as well as

growth and development, affect the pattern of income distribution and particularly the share of the poorest segments of the population. In general, lower-income groups tend to have the least access to assets whose values rise *pari passu* with inflation¹ and are most likely to hold their savings in a monetary form. That these same groups are often the weakest in their ability to secure effective indexation of their wages strongly suggests that reducing inflation has egalitarian implications.

The distributional effects of growth and development are less clear. The available empirical evidence suggests that the income share of the poorest 40 per cent of the population increases with the growth rate, but that it first decreases and then increases with development.² However, the absolute level of income of the poorest 40 per cent does tend to rise throughout the relevant range, and some countries have designed their policies to provide the poor with an equitable share in economic growth.³

A detailed analysis of the ultimate distributional effects that derive from financial stability, although desirable, is beyond the scope of this paper. Aside from indicating general trends and tendencies, the approach is to present an analysis of the distributional effects both of the policy instruments most commonly used in connection with programs supported by the use of Fund resources and of the structural changes that balance of payments adjustment tends to induce. This analysis is supplemented with examples drawn from case studies of stabilization programs in Bolivia (1972-73), Ghana (1966-70), Indonesia (1966-74), and

¹ Using U. S. and U. K. data, Tait found that people's responsiveness to inflation, in terms of adjusting their portfolios, rose with wealth. See Alan A. Tait, "A Simple Test of the Re-Distributive Nature of Price Changes for Wealth Owners in the United States and United Kingdom," *Review of Economics and Statistics*, Vol. 49 (November 1967), pp. 651-55. While behavior in the United States and the United Kingdom does not establish the point for the developing countries, this evidence provides some support for a hypothesis that is reasonable on a priori grounds.

² In general, the hypothesis of a U-shaped relationship between the degree of income equality and per capita income (first proposed in 1955 by Kuznets) has been tested by a number of investigators using cross-sectional international data. Although the evidence is broadly consistent with the U-shaped hypothesis, it is generally acknowledged that there have been large deviations from the regression curve. See Simon Kuznets, "Economic Growth and Income Inequality," *American Economic Review*, Vol. 45 (March 1955), pp. 1-28. See also Edmar L. Bacha and Lance Taylor, "Brazilian Income Distribution in the 1960s: 'Facts,' Model Results and the Controversy," *Journal of Development Studies*, Vol. 14 (April 1978), pp. 271-97.

³ See Hollis Chenery and others, *Redistribution with Growth* (Oxford University Press, 1974).

the Philippines (1970-76).⁴ In each of these cases, excessive fiscal deficits contributed substantially to the balance of payments problem, and in three of the four, a decline in export prices or adverse weather also played a role. The programs all relied on monetary and fiscal restraint to contain demand and on currency depreciation to moderate the unemployment and to correct the misallocation of resources arising from overvaluation of the exchange rate. Despite these and other broad similarities, however, the individual economic structures and problems differ widely, and their comparative study illustrates the range of problems confronting developing countries in their adjustment to payments imbalances.

The paper is organized as follows. Section I discusses some general principles that bear on the relationship between the balance of payments and the distribution of income. Section II focuses on the distributional effects of the specific measures included in the stabilization programs associated with the use of Fund resources. Section III presents the findings and conclusions, citing evidence from the stabilization programs studied.

I. The Balance of Payments and the Distribution of Income

Prior to considering the specific questions raised by stabilization programs, it is useful to establish whether there exists a general relationship between the balance of payments and the distribution of income. In studying this relationship, the focus can be fruitfully narrowed to concentrate on the connection between the balance of trade and the distribution of income. To be sure, variations in the capital account may signal a change in the level of autonomous capital inflows, which, by affecting investment, play an important role in shaping the future structure of the economy and the ultimate distribution of income. Nevertheless, over the time horizon of concern to this paper, it is largely through the market for goods and services that the external sector bears on the distribution of income.

⁴ For detailed discussion of the individual programs and their distributional impact, see the original, longer version of this paper, Johnson and Salop, "Distributional Aspects of Stabilization Programs in Developing Countries: A Preliminary Study with Special Application to Bolivia, Ghana, Indonesia, and the Philippines" (unpublished, International Monetary Fund, October 17, 1979).

The analysis begins with an economy in internal and external balance. In other words, there is full employment ⁵ and the current account deficit is offset by autonomous capital inflows. The effects of an increase in government spending are then considered, with particular attention to any change in relative factor earnings. From this new position of external imbalance, the distributional effects of adjustment (i.e., the return to the initial equilibrium) are investigated. Throughout the analysis, it is assumed that the nature of any restrictions on the current and capital accounts remains unchanged. In addition, the treatment is limited to two factors of production—capital and labor. These assumptions greatly simplify the analysis without detracting from the general points to be made.

The full employment absorption model suggests that an increase in the government deficit reduces net exports. ⁶ Moreover, according to this model, the ultimate degree of deterioration in the trade balance is independent of whether the additional government purchases are of imports or of domestic goods, since any increment to demand for the latter will crowd other sources of demand into additional imports or lead to a reduction in exports. Nevertheless, the composition of the increase in government expenditure does affect the distribution of income. If, for example, the increase in demand is directed exclusively at exports and imports, factor prices are unaffected, and the immediate distributional effect ⁷ then depends on the actual distribution of the increased fiscal benefits and the burden of financing. Alternatively, if much of the increase in demand is for nontraded goods, resources are redirected away from the traded goods industries toward the nontraded goods industries, and prices and factor rewards will rise in the industries supplying this market, bringing associated distributional changes.

While the equilibrium—in terms of the composition of output and the structure of prices and factor payments—that ultimately

⁵ The concept of full employment used here is a macroeconomic one. Thus, it may include substantial amounts of structural and frictional unemployment as well as considerable underemployment in the traditional sector. What is important for our purpose is that a *ceteris paribus* increase in the production of one good entails a decline in the production of another.

⁶ See J. Marcus Fleming, "Domestic Financial Policies Under Fixed and Under Floating Exchange Rates," *Staff Papers*, Vol. 9 (November 1962), pp. 369–80.

⁷ This ignores intertemporal distributional effects, that is, increased consumption today at the expense of consumption tomorrow.

emerges depends on many forces, of critical importance to the distributional consequences is the potential mobility of capital and labor over the time frame of interest.⁸ The pure theory of international trade suggests that, with factor prices flexible and labor and capital perfectly mobile between industries and perfectly immobile internationally, relative returns to labor and capital will vary with a change in the composition of output according to the relative factor intensities in the affected industries.⁹ For example, if the traded sector is more capital intensive, its contraction vis-à-vis the more labor-intensive nontraded goods sector will cause wages¹⁰ to rise relative to returns on capital, inducing a rise in the capital/labor ratio throughout the economy.

Nevertheless, over the short run to medium run, neither capital nor labor is as mobile as assumed in the neoclassical analysis. Financial capital is mobile across industries and across countries when controls do not impede its flow; but physical capital, once in place, tends to be fairly specific and costly to move. While institutional factors and specialized skills also limit the degree of labor mobility across industries, labor tends to be much more mobile than capital over the short run to medium run. Accordingly, this discussion is restricted to the situation of fixed capital and labor of varying degrees of mobility.

Under this assumption, differential returns to capital across sectors are generated by changes in relative prices, while the more mobility that labor has across activities, the less can relative wages change. Thus, with perfect labor mobility, the movement of labor in response to higher wages in one sector ensures that wages will remain equal across all activities, even while the returns on capital are rising and falling, respectively, in the expanding and contracting sectors. On the other hand, if labor is

⁸ See Eli Heckscher, "The Effect of Foreign Trade on the Distribution of Income," Ch. 13 in *Readings in the Theory of International Trade*, ed. by Howard S. Ellis and Lloyd A. Metzler (Homewood, Illinois, 1950), pp. 272-300; reprinted from *Ekonomisk Tidskrift*, Vol. 21 (1919), pp. 497-512.

⁹ This follows automatically from the usual assumption that the production functions are homogeneous. Accordingly, marginal products depend only on capital/labor ratios. Equating relative marginal products with relative factor rewards produces the cited relationship. See Ronald Findlay, *Trade and Specialization* (Harmondsworth, England, 1970), for a complete and compact discussion of the pure theory model.

¹⁰ "Wages," in this paper, should be interpreted in its broad sense as the factor return to labor. Clearly, this return often will not take the form of a payment by the employer to an employee; this is especially likely to be true in the agricultural sector of a developing country.

less than perfectly mobile, then wage differentials across activities can persist. Under this assumption, an increase in demand for the relatively labor-intensive nontraded goods will still put upward pressure on wages throughout all sectors of the economy;¹¹ however, wages will tend to rise by more in those activities that produce primarily for the domestic market. If labor is perfectly immobile, wages in the traded sector will not change, while they will rise even more in the nontraded goods activities than in the case of perfect labor mobility. It is not central to the argument, but worth noting, that an implication of perfect factor immobility is that the size of the export sector does not change in response to variations in the composition of demand. The ultimate composition of the trade balance will then be wholly determined by demand conditions, that is, by how much of the spillover in demand for nontraded goods goes to imports as opposed to exports.

While nominal wages are thus likely to rise as a result of an increase in demand, the effect on real wages is uncertain. With some labor mobility, nominal wages rise relative to traded goods prices but fall relative to nontraded goods prices.¹² Hence, the overall effect on the real wage depends on the relative magnitudes of the increases in wages and prices¹³ as well as the proportions of traded and nontraded goods in the consumer's market basket. Nevertheless, two more definite observations can be made here. First, because nominal wages tend to rise by a greater degree in the nontraded goods sector,¹⁴ the real wage of workers in that sector is more likely to rise with expansion. Second, the more immobile is labor, the smaller is the rise in nominal wages that is consistent with full employment in the traded goods sector. In such a setting, an expansion in domestic

¹¹ As long as physical capital is immobile, this result is independent of whether nontraded goods are relatively more or less capital intensive. This result can be understood most easily by considering the traded goods sector. The movement of labor out of the traded goods sector raises its marginal physical product there, and, with a fixed price for exports, its marginal revenue product. Accordingly, the nominal wage rises.

¹² Again appealing to neoclassical marginal productivity theory, the expansion in the nontraded goods activities implies that the marginal physical product of labor declines there. This is equal to the nominal wage divided by the price of nontraded goods.

¹³ These will be determined by demand elasticities and the degree of labor mobility.

¹⁴ Except, of course, in the extreme case of perfect labor mobility.

demand is likely to imply either reduced real wages or unemployment to workers in the traded sector.

If the hypothetical increase in demand under discussion proves unsustainable,¹⁵ adjustment, consisting of a reversal of the increased expenditure, is required. For our purposes, two aspects of this process are of interest. First, the requisite cuts in spending will have a direct effect on the distribution of income, appropriately measured, if, as is inevitably true, the distribution of the net benefits to be curtailed are not perfectly uniform. Second, in addition to these effects, which are discussed in Section II, there are also distributional repercussions of unwinding the structural changes outlined earlier. For example, if the real wage of labor has not risen with an expansion in domestic aggregate demand, the real wage need not decline with adjustment. Rather, the ratio of the nominal wage to the price of traded goods must fall, and whether or not this entails a decline in the real wage depends—as in an expansion—on the relative declines in wages and prices and the proportions of traded and nontraded goods in labor's consumption basket.¹⁶

II. Stabilization Programs and the Distribution of Income

The programs associated with the use of Fund resources in the upper credit tranches typically include limitations on aggregate demand as well as specific provisions for changing relative prices within the economy. As fiscal deficits are a principal source of external and internal balance, strong emphasis is placed on eliminating them. Although programs generally contain targets for budget deficits, performance criteria for meeting them are usually in the form of ceilings on net credit to government and on new external loans contracted by the government or the public sector. The private sector also contributes to the

¹⁵ For a discussion of the sustainability of a current account deficit, see Joanne Salop and Erich Spitaller, "Why Does the Current Account Matter?" *Staff Papers*, Vol. 27 (March 1980), pp. 101–34.

¹⁶ With perfect mobility of labor between industries, the nominal wage in the traded goods sector moves *pari passu* with the nominal wage in the nontraded goods sector. Hence, the ratio of the nominal wage to the price of nontraded goods and to that of traded goods rises and falls, respectively. With less than perfect labor mobility, nominal wages in the nontraded goods sector and the traded goods sector rise by less and more, respectively, but it is still true that adjustment entails a respective rise and fall in the ratio of the nominal wage to the price of nontraded and traded goods.

problem when the terms and availability of credit encourage the maintenance of unsustainable consumption levels and investment in projects that would not occur if the interest rate correctly reflected the true opportunity cost of borrowing in world markets. Accordingly, programs often specifically limit the extension of credit to the private sector in order to contain this source of excess demand. Programs also include measures that work directly on prices under the control of the authorities. Most prominent here are currency depreciation and the relaxation of foreign exchange restrictions, the lifting of price controls on the private sector, and the rationalization of prices of public enterprises.

It is worthwhile to consider a few methodological points before discussing the effect of specific policy instruments. To begin with, measuring the distributional consequences of a stabilization program is not straightforward. The ideal data set, which would provide the distribution of income both prior to and at some time after the implementation of a program, does not exist. Hence, one must rely on knowledge of the effects of the program on certain proxy variables that are correlated with the income of specific groups. In this context, it is useful to delineate four categories of income distribution: First, functional income distribution, that is, wage and salary earners, profit earners, landowners, and fixed-rent earners. Second, regional income distribution, particularly in terms of the distinction between rural and urban dwellers. Third, distributional effects across the various productive sectors that make up the gross national product. Finally, distributional effects from the viewpoint of the public sector versus the private sector.

The distributional effects of policy measures are relatively easy to trace when the measures are directed at particular groups or activities. Examples of such measures include changes in producer prices under public sector control, holding public sector wages constant in the face of general inflation, and selective credit policies in a climate of excess demand for loanable funds. The magnitude of the subsequent distributional effects will also be influenced by the extent to which nominal factor rewards are indexed or downwardly inflexible. At the same time, factor price rigidity also tends to cause unemployment and therefore may, on balance, either better or worsen the income share of the affected group.

Finally, the benchmark for considering the effects of a program is the distribution of income prevailing at the program's inception. However, since the initial point is not a sustainable equilibrium, it does not present a viable option for the economy to replicate in the future. Indeed, its very unsustainability implies that adjustment must be made, suggesting that the distribution of income is likely to change as well. Thus, while our focus is on the change in the distribution attributable to the program, it should be kept in mind that with or without the program the distribution of income would have changed, albeit differently, whether a different program were adopted or whether the authorities tried to maintain the prevailing situation through controls and restrictions.

CREDIT TO THE PRIVATE SECTOR

Stabilization programs often include provisions for reducing the rate of credit expansion to the private sector, either by limiting the infusion into the economy of high-powered money or by increasing the reserves of the commercial banks held against their liabilities to the private sector. Specifically, attempts are made to reduce direct and indirect commercial bank borrowing from the central bank, through raising the discount rate and reserve requirements. The authorities often supplement these aggregate credit measures with selective credit policies vis-à-vis the private sector, with the effect of restricting credit expansion less for priority than for nonpriority sectors. The selective measures can take the form of (1) portfolio-ceiling devices, which generally involve the setting of ceilings on loans directed at specific users or sectors; (2) policies tied to the discount mechanism, where the central bank charges differential rates in rediscounting paper originating in different sectors; (3) the linking of banks' reserve requirements to the composition of their portfolios; and (4) the creating, often within the central bank, of special credit lines for certain users.¹⁷ In Fund-supported stabilization programs, such selective credit policies must operate within a ceiling on overall credit.

¹⁷ For further discussion of these issues, see Omotunde E. G. Johnson, "Credit Controls as Instruments of Development Policy in the Light of Economic Theory," *Journal of Money, Credit and Banking* (February 1974), pp. 85-99, and "Direct Credit Controls in a Development Context: The Case of African Countries," Ch. 5 in *Government Credit Allocation: Where Do We Go From Here?* Institute for Contemporary Studies (San Francisco, 1975), pp. 151-80.

Economic agents in the private sector are affected by credit restraints according to: (1) their ability to generate foreign funds and, therefore, the extent to which controls on short-term foreign capital are in effect during the period of credit restraint; (2) their ability to generate funds in the light of their previous reliance on credit from now controlled financial institutions; (3) the extent to which they have access to curb markets for funds; and (4) the profitability to the banks of the funds extended to the different economic agents. These factors suggest that general credit restraint tends to bias access to available productive resources in favor of large, well-established (especially international) firms at the expense of small and medium-sized firms; in favor of consumers and producers in the urban sector as opposed to those in the rural sector; and in favor of medium-scale and large-scale commercial firms and those producing consumer goods as opposed to firms wishing to make investments in projects with longer than average gestation periods (e.g., in building and construction). Similarly, when, in addition to overall credit restraints, specific credit controls are instituted and implemented effectively, there is a further, perhaps counter-vailing, redistribution of income from financial institutions and the nonfavored sectors toward the favored sectors.¹⁸

Another form of redistribution accompanies credit restraint. Whenever the cost of borrowing domestically is artificially maintained below that prevailing abroad, the public sector implicitly subsidizes the recipients of the loans to the extent that the excessive credit results in a loss in international reserves. The program-induced decrease in the extension of credit reduces the overall magnitude of this subsidy and the redistribution that it entails. As indicated earlier, however, there tend to be biases associated with the restriction of credit, so that the implicit subsidy continues for certain groups but is terminated for others.

BUDGETARY POLICIES

Programs frequently include limitations on credit to the government and the acquisition of new foreign debt, thereby requiring the government to increase its revenue and/or decrease its outlays so as to reduce its overall deficit. The authorities are not totally free to determine how the burden of increased taxes and

¹⁸ *Ibid.*

decreased fiscal benefits is to be borne. Rather, the choice of policy instruments will be influenced by the political power of various income groups as well as the authorities' perceptions of the causes of the balance of payments problem and of the effects of different policy instruments.

An important factor influencing the incidence of additional taxes is the ease with which they can be collected. In the majority of developing countries, the immediate burden of increases in taxation tends to fall on producers of exported goods, consumers of imported goods, income earners in large firms in the modern private sector, and wage and salary earners in the public sector. Thus, the attempt to raise the ratio of government revenue to gross domestic product (GDP), by itself (i.e., neglecting accompanying changes in the pattern of government expenditure), tends to reduce the share of disposable income accruing to these groups and to increase the share accruing to producers of domestic foodcrops, small-scale self-employed individuals (especially in commerce and handicraft activities), and self-employed highly skilled professionals.

The distributional effects of an attempt to reduce government expenditure relative to GDP depends on where the specific reductions are made, the occupational and geographical mobility of different producing groups, and the adaptability of consumption patterns of different individuals. Some of the adjustment in expenditure tends to be borne by consumers of subsidized foodstuffs, particularly where such subsidies had been absorbing a significant portion of government expenditure. Similarly, wage and salary earners in the public sector as a whole generally experience some decline in their real rate of remuneration, so that their relative income position tends to deteriorate. Egalitarian considerations often result in especially steep cuts in the real salaries of higher-ranking civil servants. However, the brunt of any downward adjustment of government expenditure to GDP is most commonly borne by public sector employees engaged in projects that come to be postponed, together with the private domestic suppliers of services associated with such projects. These tend to be highly capital-intensive ventures in construction and public utilities.

EXCHANGE RATE DEPRECIATION

Stabilization programs often include exchange rate deprecia-

tion. Such action, when supported by the necessary monetary and fiscal policies, leads to an increase in the domestic prices of exports, imports, and import substitutes, relative to the general price level. Increased income per unit of productive resource utilized thereby accrues to producers in the export and import-competing sectors, relative to the average for the whole economy. The induced changes in consumption and production of traded goods bring about an adjustment of the current account in the required direction.

As argued in Section I, a necessary condition for this adjustment to occur is a decline in the ratio of the nominal wage to the price of traded goods. Currency depreciation can be a useful adjunct to restrictive monetary policies by raising the local currency price of exports, thereby allowing the critical ratio to fall even while nominal wages are rising. Thus, currency depreciation moderates the unemployment that would otherwise follow from a contraction in demand in an environment of downwardly rigid nominal wages. At the same time, the general increase in prices involves a tax on holders of financial assets that are denominated in domestic currency, and, because some people hold more financial assets than others, devaluation and the induced rise in prices affect them differently.

There are instances where the restraint-cum-depreciation mechanism does not operate as just outlined. When the necessary restraint is absent, the depreciation will only raise prices, and no adjustment will take place. Hence, the distributional effects are simply those of the ensuing inflation. In general, this will involve a tax on moneyholders and a loss to those whose nominal income does not keep pace with prices. Alternatively, the authorities may be able to contain demand, even while labor is successful in raising nominal wages *pari passu* with export and import prices. This is essentially the same as if restraint alone had been used, except that the accompanying inflation will imply additional distributional effects and there will be less unemployment in the nontraded goods industries, relative prices for these goods having been lowered by the depreciation.¹⁹

¹⁹ Without a depreciation, contraction in this kind of environment, which is really a "rigid-real-wage" world, produces unemployment on two counts. First, there is inadequate demand for nontraded goods at current prices. Hence, producers employ fewer workers than would be consistent with their equating labor's marginal revenue product with the wage. Second, because the real wage is too high, there is excess labor supply even if firms, not being

RELAXATION AND SIMPLIFICATION OF EXCHANGE RESTRICTIONS AND CONTROLS

The exchange controls that countries tend to impose in response to chronic external imbalance are usually simplified or relaxed in stabilization programs supported by Fund resources. Sometimes this process involves the unification of explicit multiple exchange rates or the reduction in the number of such rates; sometimes it entails the elimination of explicit differential taxes and subsidies that operate through the exchange system. In other cases, there is a liberalization and simplification of procedures, waiting periods, and maximum amounts of foreign exchange that are allowed to be transferred abroad.

In an economy where market transactions are dominant, relaxation and simplification of exchange controls reduce administrative and enforcement costs. There is, therefore, a freeing of resources for more productive uses. More important is that a complex, highly controlled exchange system introduces arbitrariness and uncertainty into the allocation of foreign exchange. This tends to induce demanders of foreign exchange to utilize resources to influence and to predict administrative decisions as well as to force suppliers and demanders of foreign exchange to deal in black markets. The ability and willingness of different economic agents to participate in such activities, as well as their comparative success in these activities, affect the ultimate allocation of foreign exchange. The efficiency and structure of the domestic production process are directly affected as are relative prices. With relaxation and simplification of exchange restrictions, therefore, the economy can be expected to approach a more rational allocation of its resources.

The benefits of the associated improvement in potential welfare will not be distributed equally. Indeed, the economic agents who had benefited from the exchange controls are likely to lose from reform, while those previously discriminated against will gain. Other general inferences about the distributional effects of the relaxation of controls are difficult to draw. These effects depend, first of all, on the nature of the specific controls and restrictions that are being relaxed and simplified. For instance,

constrained by sales, employ labor in accord with their marginal productivity conditions. Devaluation allows the prevailing price for nontraded goods to be consistent with the smaller demand by raising the domestic price of traded goods. See Salop and Spitller (cited in footnote 15).

pre-existing regulations may have subdivided imports into several categories, and subsidies on exchange earnings may have varied depending on the exports, causing the price of foreign exchange to vary widely across earners and users. Movement toward a uniform price will affect these groups in various ways, not only by the removal of the previous favorable or unfavorable discrimination but also by the subsequent effects of the changes on resource allocation and factor prices.

III. Findings and Conclusions

In most cases, the success of a stabilization program can be judged in terms of its effect on the ratio of the prices of non-traded goods to those of traded goods. Unlike the external terms of trade, which are largely beyond the control of the authorities, this ratio is a key variable that the authorities can influence in attempting to achieve internal and external balance. If the ratio is "too high," external balance achieved through restraint of demand entails unemployment, and internal balance entails an unsustainable balance of payments.

Given the conditions of production and the external market situation, movements toward the equilibrium ratio are generated by currency depreciation, which directly raises the domestic price of traded goods, and by monetary and fiscal restraint, which relieves the upward pressure on the prices of nontraded goods. Without a depreciation, the requisite decline in the ratio in question entails an absolute decrease in the nominal price of nontraded goods that is often not practicable. Without demand restraint, the devaluation-induced change in relative prices will be eroded by subsequent increases in the prices of nontraded goods. With regard to distributional effects, the reduced fiscal benefits implicit in restraint and the once-and-for-all inflationary impact of devaluation will inevitably affect economic agents differently, while the change in the internal terms of trade, if sustained, will lead to further distributional effects.

In comparing the specific countries examined in this study,²⁰ the distributional impact of a sustained reduction in the ratio of the prices of nontraded goods to those of traded goods and the associated change in relative factor returns would appear to dif-

²⁰ See footnote 4.

fer according to the underlying structure of the economy. Where, as in Ghana, the export sector is agricultural and dominated by small-scale operators and at the same time provides employment for a large segment of the population, the distributional effects would tend to be fairly egalitarian. Moreover, many of the unskilled workers in the urban sector retain strong working and family ties with the rural sector. The degree of mobility imparted by these connections allows this group to share in the gains accruing to the agricultural sector.

In the other countries under study, however, the distributional implications of a change in the internal terms of trade are more ambiguous. In Indonesia, for example, petroleum products accounted for some 35 per cent of export earnings in the early 1960s, and agriculture dominated the non-oil export sector. The agricultural sector, which employed about two thirds of the labor force, was composed of publicly owned estates and small producers farming family plots, generally of five acres or less. Almost three fourths of the tilled area was cultivated by the owner, rice being the most important commodity. Food prices comprised more than one half of the consumer price index, and import substitution measures favored certain manufactured goods. In this setting, a decline in the ratio of the prices of non-traded goods to those of traded goods would tend to shift real income away from farmers who specialize in foodcrops for the domestic market toward the urban sector and farmers who specialize in export crops. During this period, however, relatively rapid economic growth in the urban sector was taking place, inducing additional migration there. This situation would tend to temper somewhat the effect of any program-induced change in the rural/urban distribution on the overall distribution of income.

In Bolivia, 85 per cent of exports are mineral products, of which about 65 per cent are produced by public enterprises. Nontraded goods are largely agricultural products and simple manufactures, both produced principally by the poorer segments of the population. Hence, the movement in the internal terms of trade required by adjustment would tend to be to the disadvantage of the lower-income groups in Bolivia. Nevertheless, this worsening in their relative position could be offset by a coincident improvement in public sector operations—either passively, if the poor's share of fiscal benefits exceeds its share of national income, or actively, by an increase in the poor's share of public goods.

In the Philippines, the effect is even more complicated. About 65 per cent of exports are agricultural, and imports are overwhelmingly producer goods.

A movement in the internal terms of trade to achieve external balance would favor producers of agricultural exports at the expense of producers of goods for domestic consumption—such as corn, rice, and manufactured goods—whose prices were shielded from international markets. With the smallest farmholdings planted to corn, rice, and other staples, the internal terms-of-trade effect is likely to intensify inequality within the rural sector. At the same time, through a relative reduction in urban income, which tends to be twice as high per family as does rural income, an increase in the ratio of the prices of nontraded goods to those of traded goods would narrow the dispersion of income distribution.

Turning to the stabilization programs under study, one finds that in each of the countries a public sector deficit had been a major source of disequilibrium. Hence, the programs emphasized fiscal restraint. In Bolivia, the cornerstone of the program was to be restraint in government spending, augmented by various revenue-producing measures. The latter were associated mainly with the large currency depreciation that was included in the program, the most important of which was a 20 per cent *ad valorem* tax on exports. The devaluation was also expected to restore the profitability of operations in publicly owned tin and hydrocarbons, providing an additional source of revenue. As for distributional effects, to reduce the adverse effect of devaluation on real wages, a general increase of \$b 135 a month for public and private workers, regardless of salary level, accompanied the program.

In Ghana, the budget deficit was reduced to a level that could be financed out of domestic nonbank receipts and external loans and grants. This restraint facilitated a reduction in the rate of domestic credit expansion. Current expenditure was reorganized to reduce low-priority items, and efforts were made to rationalize the tax system in a way that would improve the collection of revenue. The ratio of government revenue to GDP rose between 1966 and 1970, and an increasing share of the tax burden was borne by the cocoa farmers (whose incomes are relatively easy to tax because they are received mainly in cash from a marketing board) even while their aftertax income was rising relative to GDP.

In Indonesia, a major objective of the program was to limit the overall budget deficit to the level of foreign aid and capital inflows. There was strict control over expenditure, and collection methods were considerably improved. During the period 1967-74, government revenue rose relative to GDP, and the burden of the increase was borne mainly by the oil sector. The individual income tax, export duties, and import duties all declined relative to total revenue.

In the Philippines, the program likewise emphasized fiscal restraint. Revenues were enhanced by the increase in customs receipts that accompanied the currency depreciation, a new tax on exports, and better fiscal administration. On the expenditure side, general development outlays were reduced, and overall spending was more closely monitored than before. While it is difficult to pinpoint the specific distributional impact of these measures, there was an apparent tendency to favor agricultural development. With 90 per cent of the poorest 40 per cent of the population living in rural areas and engaged primarily in farming, such an orientation would tend to have an egalitarian influence on the overall distribution of income.

In each case, a large exchange rate change was part of the program. In Bolivia, the peso value of the dollar was increased by 65 per cent in October 1972. As domestic costs had been rising faster than world prices for tin and other exports, public and private export enterprises had been increasingly squeezed financially, with unfavorable consequences for both employment there and government finances. Moreover, given the emerging structure of prices, the level of domestic demand required to attain full employment was not consistent with external balance, that is, the exchange rate had become overvalued.

In Ghana, a devaluation of 30 per cent was undertaken in the initial stage of the stabilization program. During the period 1961-65, when rates of domestic credit expansion had been much higher than real growth rates, domestic costs and prices were running well ahead of import prices. For example, in 1965 the ratio of the GDP deflator to the domestic price of imports was 36 per cent above its 1960 value. Meanwhile, cocoa prices were falling in world markets. While the producer price for cocoa could have been raised to bolster the profitability of the export sector, this was not a viable option in budgetary terms. Furthermore, in 1965 international reserves were less than half of what they had been in 1960.

In Indonesia, the rate of inflation had increased from 24 per cent in 1961 to 986 per cent in 1966, and the external effect of this acceleration led the authorities to intensify exchange and trade restrictions and to institute a complicated system of multiple exchange rates. A flexible exchange rate policy was instituted at the inception of the program in October 1966. The exchange rates in the two major markets depreciated until the rates were unified at Rp 315 = US\$1 in April 1970. In August 1971, following a further currency depreciation, the value of the rupiah was fixed at Rp 415 per US\$1.

In the Philippines, the program allowed for a flexible exchange rate policy. Following the exchange reform of February 20, 1970, the peso depreciated by 56 per cent vis-à-vis the dollar. While the motive force for the program was very high debt service payments, the exchange rate had been overvalued for some time. The viability of this rate had been maintained through an elaborate system of exchange controls, tariffs, and quotas, all of which favored the production of import substitutes. This kind of approach to development, that is, where few provisions are made to encourage exports, in the context of a rapidly growing labor force had created increasingly onerous unemployment. Currency depreciation was an important ingredient in implementing a strategy that would permit sustained growth through the simultaneous achievement of internal and external balance.

To the extent that restraint was maintained, the decrease in the ratio of the prices of nontraded goods to those of traded goods obtained by the respective devaluations was likewise maintained. To the extent that the planned restraint was relaxed, excess demand tended to pull up the prices of nontraded goods, reversing the change in the internal terms of trade and the associated movement in factor prices. Thus, in Bolivia the failure to maintain the demand restraint provided for in the program led to domestic price increases that by early 1974 eroded the decrease in the price ratio obtained by the devaluation of October 1972.

In Ghana, in contrast, the ratio of the GDP deflator to the domestic price index for imports fell with the devaluation in 1966 and remained below its predevaluation level at least until 1970. Similarly, in the Philippines, import prices rose much faster than did those for nontraded goods during 1970, the first year of the program. In 1971, while the trend was reversed, it reflected mainly increases in domestic food prices that resulted from unfavorable supply factors rather than from unrestrained demand. In

Indonesia, although the ratio of the domestic inflation rate to the world rate declined dramatically during the period of the program, the continued high level of this ratio meant that the price of purely domestic goods continued to rise relative to prices for traded goods. The improvement in the balance of payments that occurred was due largely to increased oil exports, capital inflows, and foreign aid.

It is also instructive to examine the effects of the program on wages. A decline in real wages is not a necessary precondition for a sustained movement toward external and internal balance in all cases, although it is in some. Nevertheless, where hired labor is an important factor of production in the export sector, a fall in the ratio of the nominal wage there to the price of exports is required for an improvement in the volume of exports. Moreover, movements in this ratio are apt to be good indicators of movements in the ratio of the prices of nontraded goods to those of traded goods, since the nominal wage in the export sector is likely to keep pace with prices there if the prices of nontraded goods rise as fast as export prices.

Again, the situation in Bolivia is illustrative of the effects of devaluation when restraint is not present. Nominal wages rose in the mining sector by more than 100 per cent between October 1972 and January 1974, when the average peso price for exports rose by just under 100 per cent. In contrast, in the Philippines, nominal wages for skilled and unskilled workers rose by 10 per cent and 15 per cent, respectively, from 1970 to 1972, when export prices rose by 20 per cent. The Indonesian program resulted in a substantial decline in the rate of inflation that was beneficial to wage earners, but there is insufficient data to deduce the movement of real wages relative to profits. In Ghana, real wages in medium-scale and large-scale establishments, for which data are available, rose in 1966 and 1967. Between 1967 and 1969, real wages rose marginally in the private sector but fell in the public sector. Only in construction in the private sector do real wages appear to have fallen significantly between 1967 and the end of 1969.

In contrast to the program-induced distributional effects that are transmitted through a change in the internal terms of trade and are largely structurally determined, the authorities possess considerable discretion over whose demand is reduced in the initial phase of the program. However, official decisions in this area are bound to be heavily influenced by political factors.

Often, for example, those with the most to lose from a program whose distributional objectives are egalitarian tend to be those with the most power. Moreover, if not provided for in the design of the program, these interests will tend to assert themselves and to interfere with the planned unfolding of the program.

Bolivia is a case in point. Exporters were able to secure a reduction in the tax to be levied on the inflated value of post-devaluation export receipts. This violated organized labor's conception of relative equity, and strike threats netted a sizable bonus to labor. As a result of these and other concessions, the relative price effects of the devaluation had been largely eroded by the end of 1973. Similarly, in the Philippines, the inability to get legislative authorization for tax increases initially hampered the pursuit of economic development with financial stability. By way of contrast, changes in government had preceded the programs in Ghana and Indonesia, and support for these changes was predicated to a large extent on dissatisfaction with the economic instability that had characterized the previous periods. Hence, there existed in these countries a firmer basis of support for the restrictive measures to be undertaken.

As a counterbalance to these political factors, there are some fairly important economic reasons for being sanguine about the equalizing effects of successful programs on the distribution of income. One of these is connected with the dismantling of controls. These and other institutional distortions of the price mechanism prevent the economy from organizing production in the most efficient manner. More important, controls and restrictions create artificial scarcities and bring a bonanza to those who gain access to the artificially scarce rights, who may not be the most efficient producers and are typically not the poorest groups.

Indonesia and the Philippines are examples of countries that had relied heavily on exchange controls to maintain their external positions in the face of overvalued exchange rates. In Indonesia, the complicated system of multiple exchange rates that evolved during the period of hyperinflation fostered a black market for foreign exchange in which U. S. dollars sold for 4 times the highest official rate and for more than 40 times the lowest official rate. On the other side of the market, the availability and cost of foreign exchange to purchase imported inputs was also highly variable. This tended to result in excess profits for firms or individuals acquiring import licenses and in an arbitrary distribution

of foreign exchange and profits. In the Philippines, major beneficiaries of the Government's development strategy in the 1950s and the 1960s were those who owned businesses in the industrial sector. Differential access to rationed credit at low interest rates enhanced the profitable opportunities created by exchange controls and other policies favoring import substitution. The removal of some of these distortions tended to reduce the gains of those who had enjoyed special privileges.

Perhaps of greatest importance for distribution is the impact of successful stabilization efforts on employment. Where the export sector has greater potential for growth than do the nonexport sectors, and where the lack of foreign exchange for imports and the general uncertainty produced by inflation, severe exchange controls, and overvalued exchange rates have constraining effects on investment, the employment effects of successful stabilization efforts can be particularly favorable. This was, for example, an important consideration at the time of the Bolivian devaluation, when many small tin mines had closed because production costs had been too high relative to the selling price and investment in mineral production had been too low to permit a sustained increase in output and employment.

Employment effects also figured largely in the aftermath of the Philippine and Indonesian programs. As part of the general movement away from a strategy of import substitution, the Philippine program stressed improved competitiveness for exports, with currency depreciation playing a critical role. This allowed for growth in employment opportunities from demand generated abroad, and tended to relieve the strain on the balance of payments that otherwise would accompany attempts to provide jobs for a labor force growing at 3 per cent annually. In Indonesia, real output and employment rose throughout the period of the program. Increased employment opportunities, especially in the Indonesian context with its rapidly expanding population, are favorable to enhancing equality.

In Ghana, there was evidence that excess capacity had existed in the cocoa sector, prices being so low that farmers simply had stopped tending some existing trees. Employment could, therefore, be quickly increased in the agricultural sector by a currency depreciation that would allow producer prices to be raised without endangering the financial status of the Marketing Board. At the same time, however, the low rate of growth in the initial stages of the program caused employment in the modern sector

to decline in 1966 and 1967; this employment picked up in 1968 and 1969.

In conclusion, this analysis supports the view that stabilization programs necessarily have distributional repercussions. That an economy is in a chronic state of external imbalance implies that the level and structure of domestic demand as well as the associated set of prices and factor rewards are unsustainable. Domestic political considerations will largely determine who bears the burden of reducing and restructuring aggregate demand in a manner consistent with the sustained achievement of external balance. Moreover, the associated reallocation of factors of production across sectors entails changes in the set of prices and factor payments that, from a short-run egalitarian perspective, may be undesirable and yet are necessary for the attainment of the economy's balance of payments and growth objectives. Thus, real wage rates may have to fall and real profit rates increase so as to encourage increased foreign capital inflow and private domestic capital formation. Similarly, because the mobility of labor and capital is limited, factor rewards in export industries will tend to rise at the expense of their counterparts in more domestically oriented industries in the process of moving toward a sustainable situation. Depending on the structure of the economy, these changes may constitute a movement toward or away from equality. Finally, perhaps the most important effect of a successful program on both the structure of the economy and the distribution of income operates only over time through the increased inflow of capital and the correspondingly increased rate of investment. Future research might profitably be directed to this topic.

A Supply Framework for Exchange Reform in Developing Countries: The Experience of Sudan

KARIM NASHASHIBI*

I. Exchange Rate Determination in Developing Countries

EXCHANGE RATE ADJUSTMENT in developing countries with pegged exchange rates has frequently been approached from a macroeconomic framework with special focus on the traditional export sectors as one major cause of the disequilibria, but with overall emphasis on the corrective fiscal and monetary policies needed to bring domestic output and absorption into sustainable balance. The underlying framework of such an approach is one of the price or cost structure in a particular country moving out of line with the price structure of its trading partners by some cost/push or demand/pull phenomenon leading to a chronic disequilibrium in the balance of payments. Exchange reform is then justified by the purchasing power parity (PPP) theory and is brought about to realign the domestic price structure with that of its trading partners, with the support of some deflation and readjustment in income shares. And while the theoretical shortcomings of the PPP theory have been widely recognized, it frequently lingers as a *modus operandi* with policymakers.

The formulation of the exchange rate adjustment policy in terms of price and cost developments in the economy implicitly takes the current productive structure and growth path as given. Allocational shifts stimulated by price effects would induce a

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greater supply of exports as well as a restraint on import demand that would be satisfied eventually by an increase in the production of domestic substitutes for imports. The underlying assumption is one of relatively free market forces that would direct resources via price signals to the most productive uses while restraining demand for imports. Appropriate fiscal and monetary policies would then ensure that incomes would rise less than the overall output, thus freeing real resources to be directed to exports.

In a number of developing countries, most of these assumptions may not be valid. For one thing, large sectors of the economy may be administered by the public sector in pursuit of goals other than efficient resource allocation, and they may not be responsive to price and cost signals. Price fixing, domestic trade monopolies, acreage prescriptions for various crops, in addition to the usual decisions on taxation and investment, are only some of the policy instruments wielded by governments—often without any systematic attempt at consistency either among the use of instruments or among the variety of goals pursued. Consequently, price and cost distortions emerge, resulting in a cleavage between private incentives and social goals with policy-induced or institutional rigidities preventing the movement of resources in the desired direction.

Under conditions of protracted exchange controls and quantitative restrictions on trade, the structure of imports ceases to be responsive to changes in prices or incomes. Apart from basic food items, private imports for consumption may be reduced to a small proportion of total imports and may become unresponsive to price changes as a result of the scarcity stemming from the quantitative restrictions. The derived demand for the bulk of imports—raw materials, spare parts, and capital goods—would be virtually price inelastic as they emerge as a major constraint to the growth of output—particularly exportables. Reliance on demand management policies, in conjunction with the price effects of a devaluation, to reduce the demand for imports and to shift resources toward exports then becomes ineffective, unless the adjustment mechanism is also directed at providing the price incentives for export expansion and at removing the price distortions and supply bottlenecks that have hampered the growth of exports and have encouraged the production of inefficient import substitutes.

The balance of payments disequilibrium may also be a reflec-

tion of a skewed export structure, with a fairly sluggish demand abroad coupled with the pursuit of a growth rate and social goals that cannot be sustained by the earnings of this export structure. The attempt to move the economy to a higher sustainable growth path will then require that the basic parameters of the economy (which tend to be stable in a developed country), such as the rate of savings, the input/output structure, the ratio of trade to gross national product (GNP), be changed by the use of appropriate instruments. Hence, an exchange reform aimed at correcting such a balance of payments disequilibrium may also have to be an instrument of structural change, vested primarily with an allocative function toward the fulfillment of a production and trade structure that can sustain the desired growth rate.

In this context, the very notion of an equilibrium exchange rate takes a different dimension. Equilibrium is commonly defined as the rate that would result in overall payments equilibrium when all import restrictions and export subsidies are removed and full employment prevails.¹ The time dimension implicit to the attainment of equilibrium is usually perceived as that which is necessary for the adjustment of the various price effects and output to be fully realized within the existing economic structure. The stringent requirement of moving an economy from a state of exchange controls and quantitative restrictions to a situation of free trade, apart from delivering a severe and possibly politically fatal shock to the system, has an unduly narrow time dimension of equilibrium. If a rate of exchange were predicated on the inducement of shifts in production and consumption, a balance of payments equilibrium might not result before such shifts fully materialize—a process that could take a number of years. Equilibrium could then be defined over a period of time that would allow for such shifts to occur and for the productive structure to acquire the capacity for earning foreign exchange that would sustain greater import liberalization.

To the extent that the exchange reform must be tailored specifically to the cost structure of the major export and import substitutes, to shift resources toward traded goods, and to foster structural change, the standard PPP diagnosis for such reform would tend to be inadequate in specifying the extent of the

¹ See, for instance, Edward Bacha and Lance Taylor, "Foreign Exchange Shadow Prices: A Critical Review of Current Theories," in *Analysis of Development Problems: Studies of the Chilean Economy*, ed. by Richard S. Eckhaus and P. N. Rosenstein-Rodan (New York, 1973).

exchange adjustment required and in revealing its incidence on the profitability of the various traded goods sectors. Under its several variants, this approach focuses on price and cost-trend differentials between the home country and its trading partners. After choosing a base period when both the domestic economy and that of its trading partners are deemed to be in equilibrium, relative price differentials are derived by means of some index to indicate the extent to which the cost or price structure of the country has fallen out of line with that of its partners. This approach is sometimes modified by adjusting the price movements in keeping with changes in the effective exchange rate.

Given the highly diversified import and export baskets of industrialized countries, where exports from the home country compete not only with the other imports of its trading partners but also with their own exports, this approach may be an effective shortcut to measuring the overall competitiveness of an economy. This is particularly so when resources move freely, markets are unrestrained, and there are no sudden changes in productivity that may affect its cost structure. Even then, the approach raises a number of conceptual problems as surveyed by Officer and that fall outside the scope of this paper.² It may be worthwhile, however, to point out some of these difficulties as well as practical problems that arise under some of the conditions characterizing developing countries. Suppose that the country experiencing disequilibrium has an export basket limited to a few primary or agricultural commodities and possibly a few standard manufactures. The country's exports do not compete with its imports nor with the commodities produced by its major trading partners—all of which are industrialized countries. Whether the traditional exports are raw materials or agricultural commodities, the rates of inflation incurred by the trading partners are only incidentally relevant to the competitiveness of these commodities, since the partners produce them only as substitutes. Of greater relevance would have been a comparison between price trends in the home country and price trends in costs of production in countries that produce competing commodities and that generally appear among developing countries as very marginal trading partners. For Sudan—a major exporter of groundnuts—this would imply a comparison of its price

² Lawrence H. Officer, "The Purchasing-Power-Parity Theory of Exchange Rates: A Review Article," *Staff Papers*, Vol. 23 (March 1976), pp. 1-60.

trends with those of Senegal, Nigeria, and South Africa, to name only the major competitors for these exports. If one were to include substitute oilseeds, the United States and Brazil would be added to the list. The multiplicity of competitors for each export, and even more so for substitutes, raises serious doubts as to the empirical feasibility of this approach. Moreover, price indicators in these countries are often limited to cost of living and wholesale price indices. The former usually reflects the price distortions introduced into the economy, as they are heavily weighted with such subsidized items as food staples or non-traded goods (housing, education, and health services). Wholesale price indices often include a substantial share of imports and do not reflect the suppressed inflation that results from the imposition of quantitative restrictions and is manifested by the emergence of shortages. Finally, in a number of developing countries, GNP deflators are simply weighted averages of the consumer and wholesale price indices that are used to deflate GNP series at current prices.

However, even if these price indices reflected broad movements of prices and costs, their relationships with costs of production in specific export sectors would be quite tenuous. For one thing, the commodity weights of the standard price indices would tend to differ markedly from the structure of these export sectors. Moreover, cost trends in long-established export sectors with their well-defined supply linkages and their own labor markets would tend to vary significantly from the changes in costs reflected by wage indices, and neither price trends nor wage indices tell us anything about developments in productivity in these export sectors, which may vary significantly among countries. There may be sudden shifts in productivity by the introduction of new technology, such as the gains reaped under the Green Revolution, or transitional decline in productivity resulting from labor migration and from the substitution of one factor of production for another. Moreover, the absolute levels of profitability may vary significantly among countries, as demonstrated by a number of empirical studies on manufacturing,³ and some exports with substantial quasi rents may remain competitive for a considerable period despite higher rates of inflation. At the other extreme, should the export sector face a down-

³ United Nations Industrial Development Organization, *Profiles of Manufacturing Establishments*, ID/SER.E/6 (New York, 1971).

ward-shifting demand curve because of the emergence of substitutes or a change in taste abroad, even low domestic rates of inflation relative to those of trading partners may call for a depreciation of the domestic currency to encourage alternative export sectors.

The PPP approach is more meaningful with respect to the production of import substitutes, since rates of inflation in major trading partners coupled with movements in their exchange rates do affect the costs of imports that are competing with domestic production. However, the limitation of the price indices as indicators of movements in costs remains, and in any case, the production of import substitutes is shielded from foreign competition by high tariff barriers and quantitative restrictions, which would ensure their profitability in the domestic market regardless of differences in rates of inflation between the home country and its trading partners.

Given the limitations that the PPP approach acquires under the conditions described earlier in determining an "appropriate" exchange rate and the need for the policymaker to address himself to the various price distortions and supply rigidities that hamper the movement of resources in the desired direction, this paper suggests a "supply" framework for exchange rate determination by drawing on Sudan's experience in focusing on the structure of the economy whereby the exchange rate—in conjunction with a number of corrective measures applied to the price and cost distortions—becomes a major instrument of export promotion and structural change. It is a partial approach insofar as it is not an optimizing exercise derived from a general equilibrium model that takes into account both demand and supply relationships. Limitations of data preclude the measurement of these relationships in Sudan as in most developing countries, and even, where feasible, a policy-oriented approach can ill afford to leave out certain complexities and information about the economy so as to conform to the simplifications prescribed by the current state of the art in model building. It is also partial to the extent that it does not take into account capital flows and the income effects of the supportive policies to an exchange rate adjustment that are left outside the scope of this paper. Its objective is to establish a broad operational framework with readily measurable quantities to assist policymakers in appraising their current exchange, trade, and investment policies and in formulating alternatives that would better correspond to their

expressed goals. The approach pursued here consists essentially in deriving the cost structure of the economy by focusing on the production costs of major productive activities, revealing its competitiveness vis-à-vis alternative exchange rates, its areas of comparative advantage, and the trade possibilities that emerge therefrom, as well as the supply constraints and the demand limitations that have been manifested.

After an exposition of Sudan's structural characteristics and imbalances in Section II, the main features of the approach pursued in this paper are discussed and Sudan's competitive position in 1972/73 and 1976/77 is developed in Section III. Section IV presents an appraisal of the domestic policies pursued in the aftermath of the 1972 devaluation, and Section V gives the formulation of an exchange rate policy in the light of the 1976/77 results. The paper concludes with a discussion, in Section VI, of the supportive policies necessary to sustain the 1978 devaluation.

II. Sudan's Structural Imbalance

The mainstay of Sudan's economy is its agricultural sector. It is the source of virtually all exports and domestic food consumption, and provides inputs for a large proportion of industrial activity.⁴ Structurally, the agricultural sector is composed of two distinct parts. The first is the irrigated areas concentrated mostly in publicly owned and administered schemes along the banks of the Nile River and its tributaries. The second is the rainfed areas, which for the most part are farmed by traditional methods but encompass a mechanized farm sector that is of growing importance. The irrigated agricultural schemes comprise large consolidated areas, such as the Gezira, which alone covers some two million feddans,⁵ and a number of smaller schemes along the Blue Nile and the White Nile relying on gravity, flood, and pump irrigation. Rotation requirements, the necessity to organize water distribution, and the economies associated with the consolidation of small plots under one crop into large areas led to the establishment of central management boards that

⁴ The industrial sector is relatively small, accounting for only 10 per cent of the gross domestic product (GDP), and is comprised mostly of agricultural processing activities.

⁵ One feddan equals 1.04 acres equals 0.42 hectare.

undertake the major production decisions, prescribe the cropping pattern, and provide the necessary inputs.

Cooperation between the boards, the farmers, and the Central Government involves a complex system of relationships, particularly with regard to the sharing of benefits. Historically, the Gezira and other public irrigation schemes were conceived for cultivating cotton as the only cash crop. Two other crops were cultivated for subsistence purposes, either complementing cotton in the rotation (a fodder crop) or using marginal land for the cultivation of sorghum—the basic food staple. The Government had a profit-sharing arrangement with the tenants whereby in return for land, irrigation, various services, and management, the Government and the Production Board would share roughly half of the net cotton proceeds, leaving the tenant the other half in addition to the full benefits of the subsistence crop. Incentives for tenants were concentrated on cotton cultivation as their sole source of cash and in line with the Government's objective of promoting the cultivation of its major export crop. Yet, when the other cash crops—wheat and groundnuts—were introduced, the Government and the Board did not include them in their profit-sharing arrangements, leaving their profits entirely to the tenant. Other distortions in the tax system further deflated the tenant's revenues from cotton, shifting his incentives to other crops. (See Chart 2.)⁶ Since the acreage distribution among crops is prescribed to the tenant by the Board, his incentives are manifested in his crop husbandry and allocation of inputs among crops, which is ultimately reflected in his crop yields.

Sudan's exports have been concentrated on a few commodities, with cotton accounting for about 63 per cent of the total, oilseeds 23 per cent, and the rest divided mostly between gum arabic and livestock products. The country is, therefore, extremely vulnerable to commodity-price fluctuations and adverse demand trends, particularly since Sudan commands, with Egypt, the position of a virtual duopolist in the world market for long-staple cotton. Therefore, there was a strong *prima facie* case for the diversification of Sudan's export basket and possibly for the expansion of import substitutes. Thus, oilseed production was expanded in the irrigated areas, and a number of sugar projects were launched. But the largest expansion

⁶ These issues were discussed in detail in Karim Nashashibi, "The Taxation of Agricultural Crops in the Gezira Scheme and the 'Land and Water Charge' Proposal" (mimeographed, 1976).

occurred in wheat and to a lesser extent in rice cultivation to promote "self-sufficiency," following a sharp rise in the price of cereals in 1974/75. (See Chart 1.) Consequently, cotton acreage was reduced by 20 per cent to 30 per cent with the expectation that average yields would rise, since marginal cotton lands were given up for cereal cultivation. Yet, average yields actually declined, thereby compounding the shortfall in output and pointing strongly to the emergence of distortions in the price and cost structure, resulting in a divergence between private incentives and social benefits.

The impact of these policies on Sudan's export performance was grave. A quantum index for exports shows a fall of 21 per cent in the volume of cotton exports (Table 1). The decline in exports between 1970 and 1977 did not result from the secular downward trend in demand for the long-staple variety of cotton. In fact, prices for Sudanese long-staple cotton rose rapidly over this period, partly because of the halving of cotton exports from Egypt and partly because of an overall strengthening of the cotton market. This can be seen from the export price index, which increased by more than 15 per cent a year during this period. The sharp increase in cotton prices afforded Sudan the opportunity of a substantial expansion in its cotton exports, rather than a retrenchment. Alternatively, had weakness in the long-staple cotton market been perceived, Sudan could have shifted its long-staple cotton acreage to a medium-staple variety, where, as a price taker, it could have expanded its exports considerably at

TABLE 1. SUDAN: EXPORT INDICES, 1970-78

(1970-71 = 100)

	1970	1971	1972	1973	1974	1975	1976	1977	1978
Volume index	96	104	96	101	49	70	90	87	71
Of which, cotton ¹	94	106	94	88	29	56	70	70	56
Value index ²	99	101	118	138	221	193	192	243	229
Export price index of industrial countries ³	97	103	112	133	163	183	185	203	234

Sources: Sudan export indices (Laspeyres) constructed from Bank of Sudan, Department of Statistics, *Foreign Trade Statistical Digest*. Export price index of industrial countries obtained from International Bank for Reconstruction and Development, *Commodity Trade and Price Trends* (IBRD EC-155).

¹ Cotton's weight in total exports is 62.5 per cent.

² Adjusted to exclude the effects of the depreciation on unit values during the second half of 1978.

³ C.i.f. index of U. S. dollar prices of manufactured exports, to all destinations. Imports of manufactures from developing countries account for three fourths of Sudan's total imports.

the going price. Nor was the decline in exports the result of a surge in the domestic consumption of its exportables following the inflationary policies pursued during this period. Only a small proportion of Sudanese cotton production was being consumed domestically. Rather, the decline in cotton exports resulted from the government decision to diversify the productive structure of the economy, and the various distortions in the incentive pattern that this entailed. Although other export crops were expanded, and import substitution in wheat was pursued, they did not significantly offset the decline in cotton exports. Consequently, Sudan's overall export performance, in volume terms, constituted a primary cause for the weakening of the balance of payments position during the 1970s.

While import price indices for Sudan are not as yet available, one can look at the index of manufactures in industrial countries, the source of most of Sudan's imports with the notable exception of petroleum products.⁷ This series, as a rough reflection of Sudan's import prices did not outpace the rise in export prices and therefore does not point to a deterioration in Sudan's terms of trade as a factor in the country's balance of payments problem. In value terms, while exports grew at an average annual rate of 8.1 per cent between 1970-72 and 1977-79, imports increased more than two and one-half times as rapidly—at the rate of 21.0 per cent a year (Table 2). Most of the expansion in imports was in food, raw materials, and capital goods, while imports of consumption items other than basic necessities declined as a proportion of total imports, falling from 14.1 per cent in 1970 to 9.8 per cent in 1978.⁸ Thus, while overall imports maintained their share in GDP at about 15 per cent, exports as a proportion of GDP fell from 14 per cent in 1970/71 to 7 per cent

⁷ Realized prices of petroleum products increased by about 800 per cent over this period, but the share of petroleum products in Sudan's total imports has hardly exceeded 10 per cent even in the most recent years. Consequently, a correction of the import-of-manufactures price index for Sudan would not significantly alter these results.

⁸ These are "luxury" consumption items that could be sharply reduced or substituted for by domestic production: all drinks and tobacco, perfume and cosmetics, footwear, sporting goods, refrigerators, air conditioners, ovens, passenger cars, spare parts for bicycles and automobiles, and ready-made textile articles. They amounted to LSd 14.1 million in 1970 and LSd 44.1 million in 1978. Part of this increase in imports was realized by means of the exchange that has been obtained by Sudanese residing abroad ("own exchange") who have been issued a "nil-value" import license. The implicit rates of exchange for these imports reflected a substantial depreciation of the Sudanese pound.

TABLE 2. SUDAN: TRADE, DEVELOPMENT EXPENDITURE, PUBLIC SECTOR DEFICITS,
AND CREDIT EXPANSION, 1970/71-1978/79¹

(In millions of Sudanese pounds)

	1970/71	1971/72	1972/73	1973/74	1974/75	1975/76	1976/77	1977/78	1978/79	Annual Rate of Growth
Exports	109.2	107.3	127.4	90.3	149.7	191.7	206.8	191.9	181.2	8.1
Imports	109.9	116.9	120.9	171.8	322.3	369.7	343.3	413.7	460.0	21.0
Balance of trade	-0.7	-9.6	6.5	-81.5	-172.6	-178.0	-136.5	-221.8	-278.8	
Net services	-9.3	-11.9	-16.0	-23.7	-34.9	-14.4	-18.8	-25.6	-24.4	
Current account	-10.0	-21.5	-9.5	-105.2	-207.5	-192.4	-155.3	-247.4	-303.2	
Development expenditure	26.6	29.8	29.6	50.7	102.4	117.2	159.4	185.0	198.0	
Government deficit	-22.2	-25.3	-29.3	-54.5	-128.7	-143.5	-199.2	-130.0	-245.0	
Net domestic assets (end of period)	152.2	180.4	206.1	301.1	399.7	562.5	721.7	887.1	1,093.7	32.5

Sources: Bank of Sudan, *Bulletin*, and Ministry of Finance.

¹ Fiscal years ended June 30; all trade values are based on customs records and are converted at the past official exchange rate of LSd 1 = US\$2.87. Growth rates for trade are evaluated for the averages of 1970/71-1971/72 and of 1977/78-1978/79. Net domestic assets are defined as credit extended to the Government, public corporations, and the private sector *minus* "Other Items (Net)" of the banking system.

in 1977/78. These trends give particular cause for concern, considering that under a normal development process, trade shares as a proportion of GDP would typically increase.⁹ Such a process would have been expected for Sudan where monetization of the economy increased rapidly during the 1970s, and where only a decade ago, infrastructure was at a rudimentary stage.

While a primary cause of the steady deterioration in Sudan's balance of payments during the 1970s was the weak export performance, the steady buildup of inflationary pressures during this period also contributed substantially to the external imbalance. Much of the inflationary pressures generated can be attributed to the pursuit of expansionary fiscal policies by the public sector. The public sector in Sudan holds a large share in productive activities. In addition to its usual role of providing the economic infrastructure and utilities, it manages all the modern agricultural schemes in the irrigated areas, owns the bulk of industrial enterprises, and—through its various trading companies—monopolizes internal and/or external trade in certain basic commodities, such as wheat, cotton, oilseeds, and petroleum products. The expansionary monetary and budgetary trends can be readily seen from the aggregates shown in Table 2. While there was a strong case for a buildup of the country's capital stock after a long period of stagnation of investment, too many project commitments were made within a short time, over-extending both the administrative and physical capacities of the country and leading to high costs in execution and long delays in completion. This development expenditure has been supported mostly by foreign borrowing, as the generation of domestic savings remained low and current expenditure grew virtually as rapidly as government revenues. The growing government deficits were financed increasingly by resort to domestic credit and have been the major factor behind the rapid expansion in the net domestic assests of the banking system.

To remedy the situation while the external imbalance was still manageable, a devaluation of 15 per cent was undertaken in March 1972 in conjunction with stabilization measures. This, coupled with the Government's decision to follow the U.S. dollar after its devaluation in December 1971 and the realignment of currency values in February 1973, resulted in an effective devaluation vis-à-vis most of its trading partners in excess of 20 per

⁹ Hollis Chenery and Moises Syrquin, *Patterns of Development, 1950-1970* (Oxford University Press, 1975), Figure 6, p. 37.

cent. However, as a result of a number of factors discussed later, the steady deterioration in the balance of payments continued and necessitated a second (25 per cent) devaluation in June 1978.¹⁰

While this paper does not examine in an exhaustive manner the causes of Sudan's weakening balance of payments position and the impact of the policies pursued during the 1970s, it is intended to present a systematic analysis of the competitiveness of Sudan's export sector and major agricultural import substitutes and their responses to changes in various policies. A critical shift in policy was the decision in 1974 to alter the cropping pattern and the shift of incentives away from cotton; this raises several questions. Can the decision be justified on the grounds of efficient import substitution whereby savings on imports more than offset earnings forgone on exports? Were the tenants' incentives consistent with the newly established cropping pattern? Should the shift in the cropping pattern prove to be detrimental to the maximization of net foreign exchange earnings, would not a correction of the incentive distortion, coupled with a reallocation of acreage among crops and a stabilization in aggregate demand, remedy the external imbalance? Or, to put it differently, were the two devaluations necessary? The answer to these questions lies primarily in an evaluation of the competitiveness of the Sudanese economy and its evolution over the period considered here. The questions cannot be answered satisfactorily by relating various price indices or by restricting the analysis to the movements of economic aggregates. Rather, they require a detailed analysis of the potentialities and the constraints affecting Sudan's major productive activities, and the overall allocation of resources.

¹⁰ Under the 1972 devaluation, the official exchange rate of LSd 1 = US\$2.87 was depreciated to an effective rate of exchange of LSd 1 = US\$2.50 by means of a tax subsidy scheme of 15 per cent on all external transactions except proceeds from exports of cotton lint and gum arabic. In 1978, the official exchange rate was set at LSd 1 = US\$2.50, while the effective exchange rate was depreciated to LSd 1 = US\$2.00 by means of taxes and subsidies for all external transactions except proceeds from exports of cotton lint. On September 16, 1979, the tax subsidy system was abolished and the official rate of exchange was set at the previous effective level, i.e., LSd 1 = US\$2.00. Additionally, a parallel rate of exchange was established at LSd 1 = US\$1.25 for non-traditional exports (about 8 per cent of the total) and for about 30 per cent of imports that were imported previously mostly under the nil-value license system, as well as some invisibles. Effectively, this amounted to a further depreciation of about 5 per cent.

III. Competitiveness of Sudan's Major Crops

The narrowness of the traded goods basket of developing countries, which considerably reduces the relevance of the PPP approach in evaluating their exchange rates, can be turned to an advantage by focusing directly on the costs of production of those goods and relating them to world prices. The latter, converted by the exchange rate into domestic c.i.f. import prices and f.o.b. export prices, can serve as benchmarks to determine whether domestic traded goods are competitive. Competitiveness would be evaluated along the lines initially developed by Bruno in his measurement of domestic resource costs and the various refinements that subsequently have been introduced by a number of authors.¹¹ The starting point of such an evaluation is to derive actual costs of production by adjusting domestic costs and import prices for taxes, subsidies, and various other price distortions that emerge from administering prices and the exercise of various forms of monopoly power. Once real costs of production are estimated, one can measure the net foreign exchange earned on an export or saved on an import substitute per unit of domestic resources (nontraded goods and factors of production) used up in producing a given commodity. In effect, for each product, an implicit exchange rate is derived for the foreign exchange obtained (or saved) per unit of domestic resources used. This allows for a ready comparison of the various products in terms of their net foreign exchange returns as well as a comparison of these returns to the current exchange rates.

A proper measurement of the competitiveness of an economy should cover the entire spectrum of productive activities, encompassing the marginal activities as well as traditional exports and import substitutes. An exchange rate adjustment would need to ensure that the traditional exports are competitive and should be set at the margin of profitability of some of the import-substitute and marginal-export activities. The extent to which the new exchange rate can "capture" these activities

¹¹ Michael Bruno, "The Optimal Selection of Export-Promoting and Import-Substituting Projects," Ch. III in United Nations, *Planning the External Sector: Techniques, Problems and Policies*, ST/TAO/SER.C/91, Sales No.: 67.II.B.5 (New York, 1967), pp. 88-135. See also Anne O. Krueger, "The Role of Home Goods and Money in Exchange Rate Adjustments" (University of Minnesota, 1969).

would depend on their position on the scale of competitiveness and their expected supply response. Such an approach is possible for a country like Sudan whose productive structure is concentrated on a limited number of commodities with well-defined characteristics (e.g., agricultural commodities and standard manufactures) and readily available international prices. A more complex industrial structure, as in Korea or the Republic of China, with a diversified output structure that is oriented toward the consumer market would run into difficult problems of estimation because of product heterogeneity, joint products, and the multiplicity of inputs. However, a large number of developing countries have a relatively simple structure of production where this approach might be used fruitfully.¹²

In addition to the "partial" characteristics mentioned in Section I, two limitations to this approach are worth pointing out. By setting the exchange rate at the edge of the marginal-export and import-substitute activities, one determines only the *maximum* exchange rate necessary to ensure the profitability of the "efficient" traded activities. While this exchange rate may be consistent with the objective of structural change and a reallocation of resources to those sectors found most competitive, additional information on the supply response would be needed to assess the impact of this rate on trade flows and to determine whether a lower rate might still be necessary to achieve a given balance of payments objective. Here, one must distinguish between the supply response of producers and the translation of this supply response into exports as discussed in Section V. Moreover, insofar as the desired supply response is contingent on expanding the infrastructure and the export-servicing capabilities, supply-elasticity estimates based on historical relationships would be of little help in determining the necessary price signals. Consequently, the determination of an exchange rate that would ensure the profitability of major exports and import substitutes as well as "infant" activities with a potential for expansion might be the best that could be done under conditions of structural change. Equilibrium would then be approached in discrete stages as supply capabilities unfold.

¹² Competitiveness was evaluated for 14 crops and 10 industries for Egypt in an assessment of the impact of the exchange regime on the allocation of resources. See Bent Hansen and Karim Nashashibi, *Foreign Trade Regimes and Economic Development: Egypt*, National Bureau of Economic Research (Columbia University Press, 1975).

The evaluation of competitiveness has normative implications on the allocation of resources. Policymakers should encourage an expansion in the most competitive activities and cause a retrenchment in the inefficient ones. The underlying assumption to the competitiveness coefficients based on average cost of production is one of constant costs. This should fairly approximate cropping changes in irrigated lands (but not expansion in the irrigated area) and possibly cropping expansion in rainfed lands. However, such implications of allocation must be approached cautiously, as there might be sharp changes in costs from one set of cost conditions to another. This is illustrated later for sugar and more generally in the differences between irrigated and rainfed agriculture.

The evaluation of competitiveness for Sudan encompasses ten productive activities, all of which are agricultural or, for sugar, involve the processing of an agricultural commodity. With minor exceptions this framework is fairly representative of Sudan's structure of production. In the irrigated areas, long-staple cotton is the traditional export crop and sorghum, the traditional food staple. Medium-staple cotton, wheat, groundnuts, rice, and, to some extent, sugar are all fairly recent attempts at diversifying production. In the rainfed areas, groundnuts and sesame can be considered as the traditional export crops, although partial mechanization of the latter has made possible a significant expansion in its cultivated area. Sorghum cultivation also benefited considerably from mechanization and was upgraded from its initial status as a subsistence staple to a cash crop with a significant export potential.

Competitiveness has been measured for two specific years—1972/73 and 1976/77. The former year was chosen because it preceded the commodity-price boom that followed the quadrupling of oil prices at end-1973. At the same time, it reflects the changes in the cost structure brought out by the realignment of currencies in December 1971 and the devaluation of the Sudanese pound in March 1972. It also preceded major changes in the cropping pattern in Gezira in favor of wheat and groundnuts and came at the end of a long period of stable crop distribution, when the position of cotton was unchallenged and tenants' incentives were directed toward its cultivation. The latter year was chosen partly because of the need to make use of the latest available data on production costs. By 1976/77, the commodity-price boom, which peaked in 1974/75, had subsided into a more stable

pattern of world prices—a necessary condition for the derivation of medium-term world prices that would serve as a basis for future price expectations. The choice of 1976/77 also offers the advantage of preceding the devaluation that took place in June 1978 and hence of being subjected to the same exchange rate regime as in 1972/73. While the discussion is centered on 1976/77, since it provides a reasonably current evaluation of competitiveness, a presentation of the cost structure and competitiveness in 1972/73 offers a valuable perspective on cost and productivity developments in various sectors and explains the causes that changed the absolute and the relative competitiveness of various crops. Further methodological aspects of the evaluation of competitiveness and the data coverage are discussed in Appendix I.

THE COMPETITIVE POSITION OF AGRICULTURE IN 1972/73

For 1972/73, data on costs of production have been obtained only for the six irrigated crops; the results are presented in Table 3. Of all the irrigated crops, and prior to any policy move at diversification, long-staple cotton emerges as the most competitive. With a net value added, measured at world prices of LSd 71 per feddan, long-staple cotton contributed US\$3.25 in export earnings per Sudanese pound of domestic resources used in its cultivation. This well exceeded the then official exchange rate of LSd 1 = US\$2.87, thereby contributing substantial excess profits to the tenants and confirming Sudan's strong comparative advantage in cotton production. Medium-staple cotton is second with a competitiveness measured at US\$2.75 per Sudanese pound, which is somewhat below the official rate of exchange but exceeds the effective rate of exchange of LSd 1 = US\$2.50 at which all output values and input costs are measured. Nevertheless, because medium-staple cotton did not benefit from the export subsidy, it was being taxed implicitly by the prevailing exchange regime, creating a disincentive to its cultivation. The ranking of medium-staple cotton below the long-staple variety is due essentially to lower world prices for this length of staple without being offset significantly by higher yields or lower costs of production.

Groundnut cultivation in Gezira with a competitiveness of US\$1.92 per Sudanese pound was clearly unprofitable in terms of the effective exchange rate set in March 1972. To a large

extent, this results from the relatively low yields prevailing at the time and from the large export-marketing costs, which exceed the material input costs of groundnut cultivation. Since the world prices of groundnuts are passed on to the tenant (*minus* transport and marketing margins), the noncompetitiveness of the crop resulting in negative excess profits of LSd 11 would have induced him to shift his labor and inputs to other crops and to neglect its cultivation. However, since he is not charged for the land and irrigation costs (LSd 7 per feddan) nor for the administrative costs (LSd 1.5 per feddan), he still derived a positive return of LSd 3 per feddan for his managerial function. Moreover, groundnut cultivation in irrigated areas cannot be evaluated independently from cotton cultivation, which it benefits by adding nitrogen to the soil prior to the planting of the cotton.¹³ The complementarity between cotton and groundnut cultivation can be taken into account by measuring the competitiveness of the crop rotation of groundnuts with the two varieties of cotton. For long-staple cotton in combination with groundnuts, the competitiveness would be US\$2.68 per Sudanese pound, while for medium-staple cotton it would fall to US\$2.38 per Sudanese pound.

Cereal cultivation in irrigated lands in 1972/73 appears to be noncompetitive. Wheat was the most inefficient crop, yielding only about US\$20 per feddan in value added at world prices, which is about one tenth of the average value added per feddan obtained from the cultivation of groundnuts and cotton taken in rotation. Despite the fact that wheat is protected by a high transport barrier, since it is treated as an import substitute, it saves only US\$1.05 per Sudanese pound of domestic resources used. Moreover, wheat may have an adverse effect on cotton and groundnut cultivation, since it uses stored water during the winter, possibly depriving these two crops of adequate irrigation in the spring when the water level is low in the Blue Nile. The major reasons for its inefficiency were the low yields obtained (about half a ton per feddan) and, as a relatively large user of water, the high costs of water delivery and land. However, its cultivation was encouraged by the Gezira Board on the grounds that as a winter crop it utilized land that otherwise would have been left fallow and machinery that would have been partly idle.

¹³ However, the opposite is not necessarily true, since in 1972/73 only 30 per cent of cotton acreage was preceded by groundnut cultivation.

TABLE 3. SUDAN: COST STRUCTURE AND COMPETITIVENESS OF MAJOR
AGRICULTURAL FIELD CROPS IN IRRIGATED LANDS, 1972/73

(In Sudanese pounds, except where indicated otherwise)

	Cotton			Wheat	Sorghum	Sugar
	Long- staple	Medium- staple	Ground- nuts			
1. Basic parameters						
Average yields (kilograms per feddan) ¹	681	703	700	509	474	4,400
World prices ²	55.9	41.0	85.7	36.0	29.7	70.5
2. Output value per feddan (at 1972/73 world prices) ³	93.0	80.3	44.8	21.1	18.0	356.7
3. Input costs per feddan	76.6	75.1	56.3	36.8	29.5	255.2 ⁴
a. Traded inputs at world prices	22.4	24.1	13.0	13.3	8.6	79.9
Fertilizers	2.5	2.7	—	2.6	1.6	6.3
Pesticides	4.2	4.6	—	0.8	—	14.2 ⁵
Seed	0.6	0.6	1.7	2.4	0.3	—
Sacks	2.5	2.7	2.0	1.5	0.8	10.6
Machinery usage ⁶	4.1	4.5	2.6	3.5	3.6	28.2
Transport	8.5	9.0	6.7	2.5	2.3	20.6
b. Nontraded inputs at domestic prices	16.4	16.4	19.7	6.7	4.7	33.9
Trade margins (commissions and interest) ⁷	6.0	5.8	13.2	2.2	1.9	9.3
Storage, clearing, and handling ⁷	7.4	7.6	4.5 ⁸	2.0	1.8	15.0
Irrigation ⁹	3.0	3.0	2.0	2.5	1.0	9.6
c. Factor remunerations	37.8	34.6	23.6	16.8	16.2	141.4
Labor	15.2 ¹⁰	12.0 ¹⁰	11.2	2.3	6.2	49.4
Land and water ¹¹	10.0	10.0	5.0	7.0	4.0	—
Management	3.6	3.6	1.5	1.5	1.5	27.3

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Administrative ¹²	2.5	2.5	1.5	1.5	1.0	22.0
Tenant ¹³	6.5	6.5	4.5	4.5	3.5	42.7
4. Joint products	—	—	-2.0	-5.0	-4.0	—
5. Excess profits (2 + 4 - 3)	16.4	5.2	-9.5	-10.7	-7.5	101.5
6. International value added (2 - 3a)						
a. In Sudanese pounds	70.6	56.2	31.8	7.8	9.4	276.8
b. In U. S. dollars at 1972/73 prices	176.5	140.5	79.5	19.5	23.5	692.0
7. Domestic resource costs (3b + 3d - 4)	54.2	51.0	41.3	18.5	16.9	175.3
8. Competitiveness in U. S. dollars at 1972/73 prices (6b ÷ 7)	3.25	2.75	1.92	1.05	1.39	3.95

Sources: Gezira Board, Oilseed Corporation, Sugar and Beverages Corporation, and Bank of Sudan, Department of Statistics, *Foreign Trade Statistical Digest*. Land and water charges were derived from Appendix II.

¹ Five-year weighted-average yields were centered on 1972.

² Converted at the official exchange rate, LSd 1 = US\$2.87. Prices for cotton are per bale of lint (420 lbs.); all other prices are per ton.

³ Converted at the effective exchange rate, LSd 1 = US\$2.50.

⁴ Input costs per ton of refined sugar.

⁵ Chemicals.

⁶ Includes depreciation costs.

⁷ Based on detailed cost breakdowns available for cotton and oilseeds; estimated for other crops.

⁸ Includes decortication.

⁹ Estimates of water delivery costs by Ministry of Irrigation including operational expenses, maintenance of irrigation facilities and of the sluice gates in the Sennar Dam, and operational expenses incurred by the Roseires Dam. All expenses scaled by the number of waterings for each crop.

¹⁰ Includes tenant's "individual" account.

¹¹ Estimated in Appendix II.

¹² Administrative operating costs of the Agricultural Board prorated at 50 per cent for cotton and 50 per cent for the remaining crops; for sugar, administrative costs incurred at Khashm el Girba plant.

¹³ For Gezira crops, tenant compensation for management estimated from historical income levels and checked against urban earnings of relatively skilled workers. For sugar and rainfed crops, based on a "normal" return to capital set at 10 per cent.

(See Appendix III.) Its cultivation was also valued by the tenants, despite losses amounting to half of its revenues at world prices, because of the high domestic producer prices (exceeding import price c.i.f. Khartoum by about 40 per cent in 1972/73) and, on the cost side, exemptions of any charges on land, water delivery, or administrative costs. Sorghum also emerges as non-competitive in irrigated lands even when treated as an import substitute. Since its prices in Sudan are determined by market forces, farmers are not subsidized on this account. Rather, they are subsidized indirectly through the omission of any land and water charges from their cost structure—a significant amount relative to sorghum's low output value per feddan, salvaging its profitability and accounting for the strong support its cultivation has among the tenants.¹⁴

Sugar production in 1972/73 at a world price equivalent to US\$0.08 a pound, which prevailed at that time, appears to have been quite competitive when evaluated in terms of the cost structure of the more efficient of the two existing sugar factories in Sudan.¹⁵ Its competitiveness, when treated as an import substitute, almost approaches US\$4 per Sudanese pound, substantially exceeding the competitiveness of long-staple cotton. If treated as an export, its competitiveness would be about US\$3.30 per Sudanese pound. However, world prices for sugar during that period were moving along a sharp upward trend. Moreover, if sugar competitiveness were to be compared with cotton, its *average* competitiveness must be derived taking into account the much higher cost in the operation of the second plant. In this case, its competitiveness drops to about US\$3.20 per Sudanese pound as an import substitute and to US\$2.22 per Sudanese pound as an export. Either way, these results were sufficiently positive to have justified (at the time) the decision to expand sugar production on the assumption that world sugar prices would keep pace with the rise in sugar production costs, particularly its imported inputs. In the event, that assumption did not hold; while world prices of sugar stabilized at about the same level after the commodity-price boom in 1974/75 subsided,

¹⁴ Sorghum stalks also provide fodder for the tenants' cattle and for those of migrant cotton pickers.

¹⁵ The lower efficiency of the other existing sugar operation at Guneid is attributed to much lower yields of cane and to lack of control by the sugar factory of the cane-growing lands, which are owned and cultivated by the area's farmers.

input prices more than doubled, thereby drastically reducing Sudan's sugar competitiveness.

Turning to the overall competitive position of irrigated agriculture in 1972/73, the average competitiveness of the six crops considered here, weighted by their relative shares of output value, is found to be US\$2.68 per Sudanese pound, or somewhat between the official and effective rates of exchange (Table 5). The degree of weighted-average competitiveness for agriculture as a whole could have been higher if data for rainfed crops had been available, since these have proven to be consistently more competitive than irrigated crops. On the other hand, it has been shown that the competitiveness of medium-staple cotton in rotation with groundnuts (US\$2.38 per LSd 1) was somewhat lower than the effective exchange rate. Since there was a convincing case for expanded cultivation of these two crops on grounds of relative comparative advantage and for the sake of attaining some diversification in the export basket, a depreciation of the Sudanese pound would have been necessary to ensure a profitable expansion of these crops. Thus, the 1972 devaluation was certainly justified on these grounds, although a larger devaluation would have been more effective in ensuring the competitiveness of irrigated groundnuts and in encouraging manufacturing activity, particularly with the presumption (discussed later) that manufacturing in Sudan tends to be less competitive than agriculture.

THE COMPETITIVE POSITION IN 1976/77

Competitiveness in 1976/77 is evaluated for ten crops for both irrigated and rainfed areas (Table 4). The results derived for both 1972/73 and 1976/77 are summarized in Table 5 together with the changes in the various cost components and the derivation of an initial position in the competitiveness of the various crops following the 1978 devaluation.

Long-staple cotton remained the most competitive irrigated crop at US\$2.69 per Sudanese pound; however, it could not compete at the official rate of exchange at which its export proceeds were converted. The competitiveness of sugar production at US\$2.57 per Sudanese pound in the more efficient of the two plants remained above the effective exchange rate, and sugar was able to compete effectively with imports at a landed cost in Khartoum of about US\$0.14 a pound. However, at an implicit export price of US\$0.10 a pound, its competitiveness fell well

TABLE 4. SUDAN: COST STRUCTURE AND COMPETITIVENESS OF MAJOR AGRICULTURAL FIELD CROPS, 1976/77

(In Sudanese pounds, except where indicated otherwise)

	Irrigated Crops							Rainfed Crops		
	Cotton		Ground-nuts	Wheat	Sorghum	Rice	Sugar	Ground-nuts	Sesame	Sorghum
	Long-staple	Medium-staple								
1. Basic parameters										
Average yields (kilograms per feddan) ¹	568	513	763	487	547	615	3,299	347	135	323
World prices ²	110	93	154	72	50	117	109	169	205	45
2. Output value per feddan (at 1975-77 world prices) ³	150.2	126.9	87.8	40.3	27.3	57.9	413.6	47.2	31.8	16.7
3. Input costs per feddan	142.1	137.8	91.4	64.4	46.6	112.6	406.2 ⁴	40.4	30.4	17.9
a. Traded inputs at world prices	35.1	41.7	23.3	26.9	11.5	54.4	135.8	12.5	10.9	10.7
Fertilizers	9.4	9.6	—	8.0	3.5	21.0	14.4	—	—	—
Pesticides	11.7	16.4	—	1.2	—	6.6	6.1 ⁵	—	—	—
Seed	0.8	0.8	2.7	3.8	0.5	8.1	—	2.3	0.5	0.3
Sacks	3.0	2.8	5.0	2.3	1.5	2.3	11.2	3.3	1.5	1.8
Machinery usage ⁶	5.0	6.6	7.2	7.3	2.0	12.2	71.1	—	5.8	5.4
Transport	5.2	4.5	8.4	4.3	4.0	4.2	33.0	6.9	3.1	3.2
b. Nontraded inputs at domestic prices	31.4	31.4	33.5	10.5	6.4	16.4	50.0	13.5	8.9	4.4
Trade margins (commission and interest) ⁷	13.7	13.7	23.3	3.0	2.4	4.0	14.4	10.6	7.0	3.4
Storage, clearing, and handling ⁷	12.2	12.2	6.5 ⁸	2.9	1.3	5.1	20.0	2.9	1.9	1.0
Irrigation ⁹	5.5	5.5	3.7	4.6	2.7	7.3	15.6	—	—	—

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c. Factor remuneration	75.6	64.7	34.6	27.0	28.7	41.8	220.4	14.4	10.6	2.8
Labor	37.6 ¹⁰	26.7 ¹⁰	12.6	3.0	11.2	15.8	87.3	9.1	6.9	0.1
Land and water ¹¹	18.0	18.0	10.0	12.0	8.0	14.0	—	0.3	0.3	0.3
Management										
Administrative ¹²	5.0	5.0	2.0	2.0	2.0	2.0	45.9	5.0	3.4	2.4
Tenant ¹³	15.0	15.0	10.0	10.0	7.5	10.0	87.2			
4. Joint products	—	—	-2.7	-7.0	-5.5	-2.0	—	-1.0	—	—
5. Excess profits (2 + 4 - 3)	8.1	-10.9	-0.9	-17.1	-13.8	-52.7	7.4	7.8	1.4	-1.2
6. International value added (2 - 3a)										
a. In Sudanese pounds	115.1	85.2	64.5	13.4	15.8	3.5	277.7	34.7	20.9	6.0
b. In U.S. dollars at 1975-77 prices	287.7	213.0	161.2	33.5	39.6	8.7	694.2	86.7	52.2	15.0
7. Domestic resource costs (3b + 3d - 4)	107.0	96.1	64.5	30.5	29.6	56.2	270.4	26.9	19.5	7.2
8. Competitiveness in U.S. dollars at 1975-77 prices (6b + 7)	2.69	2.22	2.46	1.10	1.34	0.15	2.57	3.22	2.68	2.08

Sources: Ministry of Agriculture, Gezira Board, Mechanized Farms Corporation, Oilseed Corporation, Sugar and Beverage Corporation, and Bank of Sudan, Department of Statistics, *Foreign Trade Statistical Digest*.

¹ Five-year weighted-average yields were centered on 1976.

² Average prices for 1976-77. Prices for cotton are per bale of lint (420 lbs.); all other prices are per ton. All prices are converted at the official exchange rate, LSd 1 = US\$2.87.

³ Converted at the effective exchange rate, LSd 1 = US\$2.50. Ginning outturn for long-staple cotton: 109 lbs. of lint, 206 lbs. of seed; for medium-staple: 120 lbs. of lint, 195 lbs. of seed. Shelling outturn for irrigated groundnuts, 65 per cent; for rainfed groundnuts, 70 per cent. Outturn for rice, 70 per cent.

⁴ Input costs per ton of refined sugar.

⁵ Chemicals.

⁶ Includes depreciation costs.

⁷ Based on detailed cost breakdowns available for cotton and oilseeds; estimated for other crops.

⁸ Includes decortication.

⁹ Estimates of water delivery costs by Ministry of Irrigation including operational expenses, maintenance of irrigation facilities and of the sluice gates in the Sennar Dam, and operational expenses incurred by the Roseires Dam. All expenses scaled by the number of waterings for each crop.

¹⁰ Includes tenant's "individual" account.

¹¹ Estimated in Appendix II.

¹² Administrative operating costs of the Agricultural Board prorated at 50 per cent for cotton and 50 per cent for the remaining crops; for sugar, administrative costs incurred at Khashm el Girba plant.

¹³ For Gezira cotton, tenant compensation for management estimated from historical income levels and checked against urban earnings of relatively skilled workers. For sugar and rainfed crops, based on a "normal" return to capital set at 10 per cent.

below the effective exchange rate (LSd 1 = US\$2.50). Groundnuts were third in irrigated areas at LSd 1 = US\$2.46, while medium-staple cotton emerged as significantly noncompetitive at that rate. Since the export proceeds of both medium-staple and long-staple cotton were converted at the official exchange rate, and, in addition, pay more than their share of land and water charges and administrative costs, their cultivation would not have taken place had the tenants been free to determine their own cropping pattern. Given the losses that the tenant is forced to incur on this crop, it is no wonder that he refers to cotton as "the Government's" crop. Wheat and sorghum cultivation appear again as high-cost operations as shown by their "savings" (as import substitutes) of US\$1.10 per Sudanese pound and US\$1.34 per Sudanese pound, respectively.

Crops cultivated in rainfed areas appear to be much more competitive than irrigated crops because they do not incur the heavy irrigation and administrative costs, nor most of the fertilizing costs. The competitiveness of oilseeds substantially exceeded the effective exchange rate with earnings of US\$3.22 per Sudanese pound for groundnuts and US\$2.68 per Sudanese pound for sesame. The competitiveness of sesame has been declining rapidly, however, because of particularly pronounced falls in yields—by as much as 30 per cent between 1971/72 and 1976/77. Here, labor shortages at harvesting time appear as the dominating factor and point toward mechanization as the only prospect for revitalizing this crop in the future. Sorghum, a lower-value crop, was found to be much less competitive at US\$2.08 per Sudanese pound. While it could not compete for exports at the effective rate of exchange, it remained an efficient import substitute, earning US\$2.74 per Sudanese pound when transport and marketing costs for exports were excluded.

The competitive position of agriculture in Sudan deteriorated between 1972/73 and 1976/77 (Table 5). The weighted-average competitiveness for the six irrigated crops considered in 1972/73 declined from US\$2.68 per Sudanese pound in that year to US\$2.26 per Sudanese pound in 1976/77. The overall weighted-average competitiveness of all the crops in 1976/77 was US\$2.44 per Sudanese pound, implying a substantial decline in the competitiveness of rainfed crops as well. Most crops incurred a decline in their competitiveness, mainly as a result of a fall in productivity (yields) coupled with a rapid increase in domestic costs of production and no significant gains in the output/input external terms of trade.

TABLE 5. SUDAN: SUMMARY OF RESULTS OF COMPETITIVENESS AND COST TRENDS, 1972/73-1976/77

	Irrigated Crops								Rainfed Crops			Weighted-Average Competitiveness ¹
	Cotton		Ground-nuts	Wheat	Sorghum	Sugar	Rice					
	Long-staple	Medium-staple										
Competitiveness in 1972/73 ²	3.25	2.75	1.92	1.05	1.39	3.96	—	—	—	—	2.68	
Increase in output prices ³	97	127	80	100	68	55	—	—	—	—	—	
Increase in productivity ³	-17	-27	9	-4	15	-25	—	—	—	—	—	
Increase in imported input costs ³	57	73	79	102	34	70	—	—	—	—	—	
Increase in domestic costs ³	97	88	58	51	75	54	—	—	—	—	—	
Competitiveness in 1976/77 ²	2.69	2.22	2.46	1.10	1.34	2.58	0.15	3.22	2.68	2.08	2.44	
Import coefficient ³	24.7	30.2	25.4	41.8	24.7	33.4	48.3	30.9	35.8	59.8	—	
Labor intensity ^{3, 4}	37.0	30.2	24.7	20.2	40.1	42.9	22.9	34.9	33.9	14.0	—	
Hypothetical competitiveness in the post-1978 devaluation ⁵	2.44	2.02	2.23	1.00	1.21	2.35	0.14	2.93	2.44	1.90	2.21	

Sources: Tables 3 and 4.

¹ Weighted by relative output value shares.² In U. S. dollars per Sudanese pound; evaluated at the effective exchange rate, LSd 1 = US\$2.50.³ In per cent.⁴ Labor intensity is defined here to include labor *plus* tenant remuneration *divided by* total input costs.⁵ In U. S. dollars per Sudanese pound; evaluated at the effective exchange rate, LSd 1 = US\$2.00, for output and imported input values with the assumption that domestic resource costs have increased by 10 per cent.

Long-staple cotton benefited from a virtual doubling of its world prices, partly as a result of a substantial decline in output in both Sudan and Egypt. Its imported input costs rose by much less than output prices, but this was more than offset by the 17 per cent decline in yields and a virtual doubling of its domestic costs. While lack of incentives was partly responsible for this decline in yields, competing demands for water from other crops and the deterioration in the water delivery systems also played a major role. The rate of increase in domestic costs is quite significant for cotton, since this is a labor-intensive crop that has undergone virtually no changes in its production techniques and factor proportions. Consequently, the increase in the costs of labor and nontraded goods at the same pace as the increase in cotton export prices is indicative of the inflationary pressures that have prevailed over this period and the rapid rise in labor costs.

The competitiveness of medium-staple cotton deteriorated from US\$2.75 per Sudanese pound to US\$2.22 per Sudanese pound as a result of a sharp fall in yield and despite a large increase in its output prices. It therefore ceased to be competitive at the rate of LSd 1 = US\$2.50 and fell into third place in irrigated areas behind long-staple cotton and groundnuts, whose relative positions improved. Medium-staple cotton was affected adversely by a sharp rise in both domestic costs and imported input costs. As with long-staple cotton, its labor costs increased rapidly while its imported input costs bore the brunt of the rise in oil prices, since cotton is a heavy user of pesticides and fertilizers. In contrast, neither of these two inputs is used in the cultivation of groundnuts, whose overall costs of production rose only moderately. The substantial increase in the imported input costs of cultivating groundnuts resulted simply from an upward shift in the capital/labor coefficient with the introduction of mechanical harvesting. But overall efficiency in groundnut cultivation increased with both a slower rise in costs relative to other crops and an increase in productivity. Consequently, its competitive position improved, rising from US\$1.92 per Sudanese pound in 1972/73 to US\$2.46 per Sudanese pound in 1976/77 (marginally below the effective exchange rate). Sugar production suffered a sharp fall in competitiveness as a result of lower productivity and increases in production costs, which exceeded the rise in its world price.

The positions of wheat and sorghum in irrigated areas remained virtually the same as in 1972/73, with a very low level

of competitiveness. The increase in the world price of wheat was offset by a rise in its imported input costs as a result of the mechanization of its cultivation and the rise in the price of fertilizers. Since it is one of the most import-intensive field crops, its cultivation benefited least (together with sugar) from the 1972 devaluation. For irrigated sorghum, which is grown using traditional techniques with little mechanization, the rise in its domestic production costs outstripped the increases in its world price. This precluded an improvement in its competitiveness that would otherwise have resulted from the higher yields. Rice, grown on a limited scale in Gezira since 1974 in compliance with "self-sufficiency," emerged as the most inefficient crop, primarily because of its low yields and high imported input costs. These are almost as high as its output value measured at world prices, verging on the possibility of a negative value added.

Generally, the evaluation of competitiveness for 1976/77 confirms the results obtained for 1972/73, as there was little change in the relative rankings of the crops considered. In the irrigated areas, Sudan preserved its strong comparative advantage in the cultivation of cotton and groundnuts. Nevertheless, the much stronger performance of groundnuts in rainfed than in irrigated areas strengthened the position of cotton and cast some doubt on the relative efficiency of cultivating groundnuts in irrigated areas. However, irrigated groundnuts have been as profitable as medium-staple cotton, and until a more efficient crop is found it will remain the second-best alternative to cotton. The cultivation of cereals on expensive irrigated land remained highly inefficient and resulted in substantial foreign exchange earnings forgone. Had cotton, instead of wheat and sorghum, been planted on half a million feddans in public entities, net foreign exchange earnings between 1975/76 and 1978/79 could have increased by about US\$250 million.¹⁶ (See Appendix III.) Sugar would not have been competitive as an export, since its export prices remained mostly below US\$0.14 a pound (up to the end of 1979) and production costs must have increased. Nevertheless, it has been competitive as an import substitute, and it did save the country substantial amounts of foreign exchange during this period. In rainfed areas, Sudan has a strong comparative advantage in oil-

¹⁶ At 1976/77 prices, which did not depart significantly from average prices over this period.

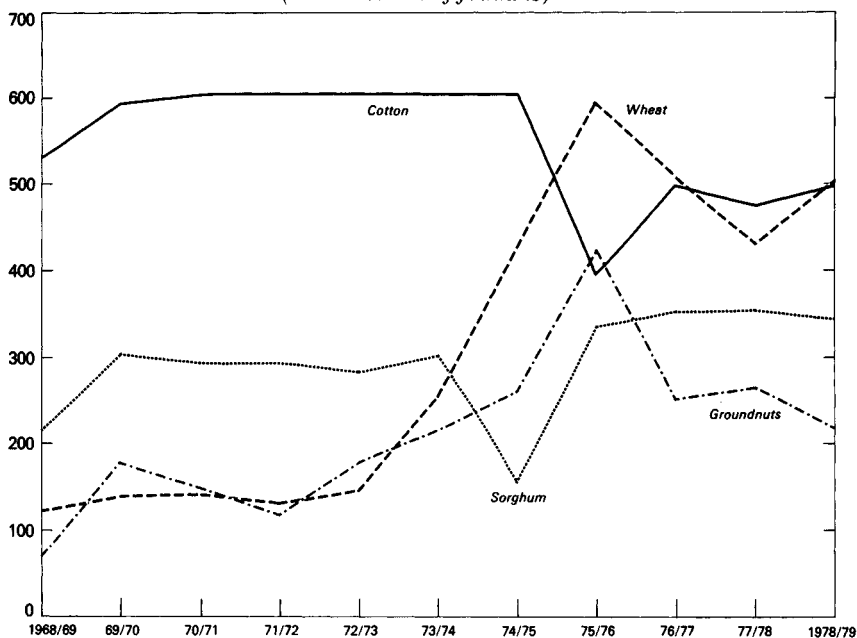
seeds, while sorghum (the largest crop in Sudan, grown on more than six million feddans) has been able to compete only as an efficient import substitute.

IV. Domestic Policies in the Wake of the 1972 Devaluation

The results obtained for 1972/73 and later confirmed with the broader coverage of activities for 1976/77 have several allocational implications. In the irrigated areas, the cultivation of cotton and groundnuts should have been expanded to the limit afforded by the water capacity of the irrigation canals. Likewise, at the prices prevailing in 1972/73 sugar would have been a good prospect for expansion, given the cost structure of the more efficient sugar estate. Wheat and sorghum should both have been cut back—the former to the point where its water requirement did not infringe upon the water demands of groundnut sowing in the late spring and cotton cultivation in the winter, and the latter to the point where it used only marginal lands after groundnuts had reached their maximum attainable area. Actual developments in the cropping pattern, however, were entirely different. Cotton cultivation was cut back by 20–30 per cent while wheat acreage was trebled to a point where it exceeded cotton acreage, and, even though there was subsequently some retrenchment in its cultivation, its average in 1976/77 remained over two and one-half times greater than in 1972/73 (Chart 1). This expansion was undertaken in the name of self-sufficiency in food staples, even though Sudan produces a large surplus of sorghum, and was stimulated by the historically high prices attained in 1973/74 and 1975/76. Sugar production was also expanded considerably by the development of several sugar estates, but it was not until 1977/78—long after the peak sugar prices of 1974/75 had fallen to about US\$0.08 a pound—that the first consignment of sugar was produced from the first newly completed factory at Sennar.

In the rainfed areas where crop distribution and expansion responds solely to market forces and supply constraints, the export-price stimulus provided by the 1972 devaluation coupled with the implicit depreciation of the Sudanese currency through its peg to the U.S. dollar had a considerable impact on acreage and output. Between 1971/72 and 1977/78, sorghum acreage expanded by 57 per cent, from 3.3 million feddans to 5.2 million feddans. Groundnut acreage showed the greatest relative expan-

CHART 1. SUDAN: CROPPING PATTERN IN THE GEZIRA ¹
 SCHEME, 1968/69-1978/79
 (In thousands of feddans)



¹ Including the Managil extension and Guneid.

sion, from 1.3 million feddans to 2.2 million feddans. Only for sesame was the increase in acreage small (8 per cent), because of particular problems that limit a rapid expansion of this crop. ¹⁷

While the availability of data and technological shifts brought about by mechanization do not allow for a rigorous derivation of supply elasticities for the rainfed crops, the acreage response to higher prices and profits exhibited so far by private mechanized farms provides evidence of a substantial supply response in Sudan. This is made possible by the availability of large tracts of fertile but uncultivated lands in the rainfed areas, as well as opportunities for reclaiming land along Sudan's rivers by expanding their irrigation networks. Additionally, since Sudan's yields are generally low, much higher returns could be obtained from acreage presently under cultivation by relatively small increments of input.

¹⁷ Rapid shedding of the sesame seeds at maturity limits the harvest time to about two weeks, placing great demand on timely availability of labor.

The dramatic supply response to price incentives in rainfed areas was not matched by the provision of ancillary services necessary for a rapid marketing of relatively perishable crops and ultimately acted as a binding constraint on export growth. Railroad facilities, which are the core of the transportation network in Sudan (given the long distances and the bulkiness of Sudan's exports), proved to be inadequate in meeting freight demand despite a number of rehabilitation programs undertaken over the past two decades. Indeed, the rail network may have suffered a deterioration in its capital stock relative to its state in the late 1960s as a result of poor maintenance and lack of spare parts. This was dramatically illustrated during the winter of 1977/78 when a record groundnut crop harvested in the west of the country could not be shipped to Port Sudan—in response to strong export demand—over a period of an entire year, with the result that more than 80,000 tons were left to spoil. Consequently, the groundnut crop fell in the subsequent year to the point where a ban on new export contracts was enacted in March 1979. Exports of sorghum have likewise been constrained to a maximum of 150,000 tons a year by inadequate transportation and lack of processing equipment. Large sorghum crops without significant outlet to foreign markets have driven domestic prices down, acting as a disincentive to further output expansion. Additional services—such as storage, grading, and packing facilities—are mostly lacking, and oilseed-crushing mills are often antiquated, resulting in lower-quality oils.

While farmers who work in irrigated schemes have no control over their cropping pattern, since it is prescribed to them by their production boards, they do face a set of material incentives determined by the relative returns that accrue to them from the various crops. These returns result from the domestic set of prices as well as the taxes and subsidies that they face, and both influence their overall allocation of resources among crops. Although it was shown that the prescribed cropping pattern took the wrong direction, this could have been offset to some extent by a set of incentives that would have strengthened the position of the efficient crops.¹⁸

However, the opposite was true. The incentive pattern that

¹⁸ The inconsistency between the cropping and incentive patterns would have been entirely possible, since incentives in Sudan have resulted from a series of price and tax policies enacted on an ad hoc basis with different, and often conflicting, objectives in mind.

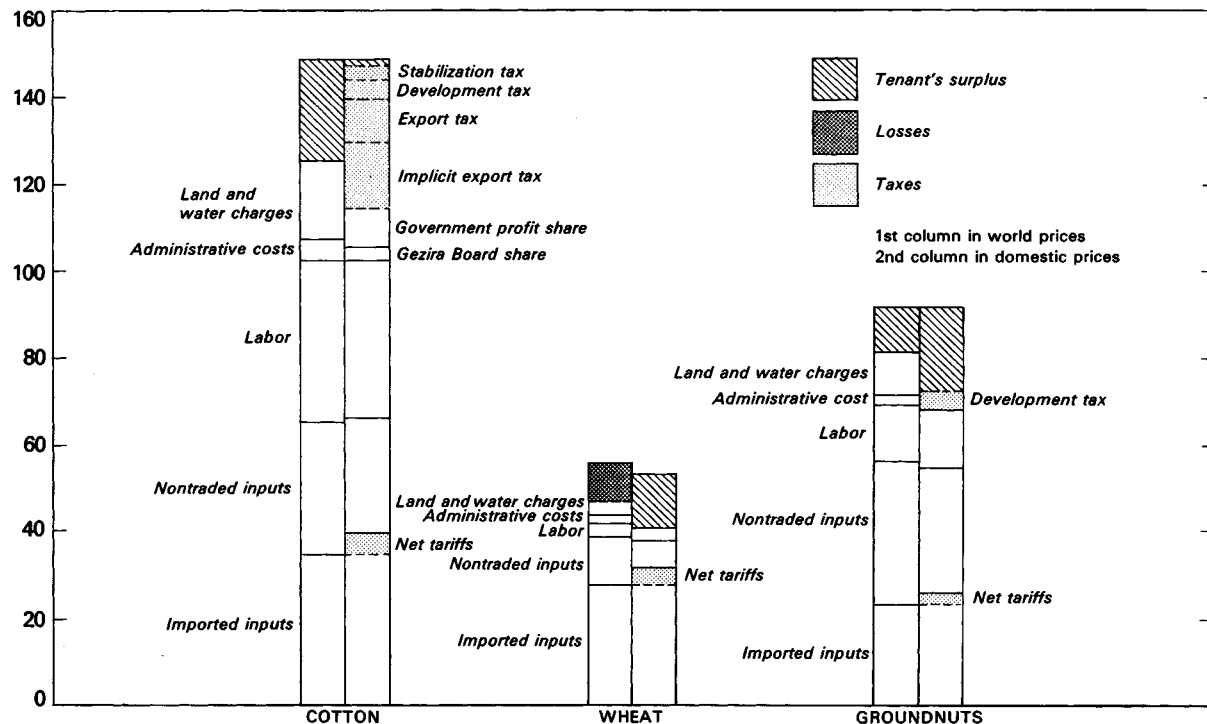
emerged from the domestic cost and price distortions has been broadly consistent with the wrong cropping pattern. Cultivation of cotton has been heavily taxed by the discriminatory exchange rate applied to it, export taxes, and substantial customs duties imposed on its imported inputs. In addition, cotton has been bearing the full burden of costs incurred by the production boards as well as the water delivery costs, which can be imputed to the profit shares of the Government and the boards. Consequently, the producers received only about 70 per cent of the export value of cotton as is clearly demonstrated by Chart 2, which contrasts costs and tenant income for cotton, wheat, and groundnuts at domestic and world prices.¹⁹ At domestic prices, the present profit shares of the Government and the Gezira Board amount to less than the land and water charges that should have been imposed on cotton. Yet, various layers of taxes make up the difference and siphon off the entire surplus, which otherwise would have accrued to the tenant. The effective government share of the surplus, which is the sum of the taxes levied *plus* the Government's profit share, amounts to 31 per cent of the output value, while the tenant's profit share is negligible (1.3 per cent). In contrast, the tenant derives a substantial income from wheat (24 per cent of its output value), which is subsidized by minimum delivery prices that are set by the Ministry of Agriculture substantially in excess of world prices. Tenants have also been able to extract an indirect subsidy from the production boards by incurring debts for the cultivation of wheat through the use of Board machinery and other inputs, and later evading repayment by marketing their crops to private traders. On the cost side, wheat was being subsidized by not charging any of the land, water delivery, or Board management costs. Had these price and cost distortions been corrected, tenants would have suffered substantial losses on the cultivation of wheat.

Groundnut cultivation also resulted in greater income to the farmer than did cotton, even though it was less profitable at world prices. Groundnut cultivators were benefiting from the effective exchange rate, and, with the exception of an export tax, they were in effect obtaining the export price for their output (*minus* transport and marketing costs). Additionally, their

¹⁹ While for cotton and groundnuts, producer prices do reflect actual export prices obtained, they are distorted by implicit and explicit taxes and subsidies.

CHART 2. SUDAN: DISTRIBUTION OF COSTS AND SURPLUSES FOR MAJOR CROPS IN GEZIRA, IN WORLD AND DOMESTIC PRICES ¹

(In Sudanese pounds per feddan)



¹ Based on costs for 1976/77 (Table 4). Tariffs, taxes, and subsidies obtained from the Ministry of Finance.

costs were subsidized by the lack of land and water charges or Board management costs. Consequently, at domestic prices, tenants' incentives would favor primarily groundnuts followed by wheat, while they would have little, if any, incentives in cultivating cotton. Without these price and cost distortions, cotton would be the most profitable crop to the tenants, followed by groundnuts. At current yield levels, wheat cultivation could have been sustained only if the domestic price were raised to about LSd 110 per feddan.

With respect to the overall financial management, subsequent to the 1972 devaluation, stabilization of aggregate demand became progressively weaker. While the Government launched an ambitious development program, fueled by expectations of considerable foreign aid in the aftermath of the oil boom, it was unable to mobilize domestic resources either through its budgetary operations or through surpluses from its public enterprises. Nor were there meaningful attempts at channeling private savings into development investments. Both current and development expenditure increased rapidly after 1972, while revenues lagged, resulting in a growing overall deficit and increase in the government recourse to the banking system (Table 2). The public enterprise system as a whole was incurring yearly losses, which were also financed from the banking system, resulting in high rates of monetary expansion. These contributed to the sharp rise in domestic costs of production shown earlier and the erosion in the competitiveness of agriculture.

To summarize, while the 1972 devaluation was necessary to ensure the competitiveness of potential export crops, it had little effect on moving exports from their stagnation and correcting the structural imbalance in the economy. To a large extent, the price effects of the devaluation were undermined by a number of policies and distortions introduced into the economy:

(1) Acreage allocation in the irrigated areas did not move in favor of the two export crops that would be responsive to the price effects of a devaluation and would contribute most to a correction of the external imbalance. In fact, the opposite happened, as cotton production was actually cut back in favor of wheat, and the large sorghum acreage in irrigated areas limited groundnut expansion. Likewise, the distortions introduced into the tenants' incentives through the use of dual exchange rates, the profit-sharing system in irrigated public schemes, and the taxation mechanism resulted in disincentives to cotton cultivation.

(2) While the price effects of the devaluation did contribute to substantial increases in acreage in rainfed areas and in output, lack of supportive transportation and marketing facilities created a disincentive to output expansion and hindered exportability, resulting in depressed domestic prices.

(3) Aggregate demand was expanded rapidly by the pursuit of expansionary policies, resulting in a much faster increase in domestic resource costs than in export prices.

V. Exchange Rate Determination

The deterioration in the competitive position of agriculture by 1976/77 once again raised the issue of the appropriateness of the exchange rate structure. To correct for this deterioration, a 25 per cent depreciation of the Sudanese pound was undertaken in June 1978. The analysis of the policies that accompanied the 1972 devaluation demonstrated the critical importance of enacting a number of supportive policies that would unlock supplies and lead to the desired export response. These policies, which may include substantial investments in ancillary services, must in turn be taken into account in the formulation of the necessary demand stabilization measures and also determine the adjustment period.

Two competitiveness distributions of ten activities in 1976/77 are shown in Table 5. The first distribution shows results of competitiveness prior to the 1978 devaluation. The second distribution assumes a certain "slippage" by the devaluation-induced rise in the prices of traded goods to the cost of domestic resources, resulting initially in some erosion of the competitiveness gained from the devaluation. Theoretically, the slippage would vary across sectors according to their relative demands for different labor skills, the extent of their labor organization, and, indirectly, through their demand for nontraded goods. In Sudan, since the activities considered here are mostly agricultural with unorganized rural labor, there are no empirical grounds to differentiate the impact of the devaluation on the domestic resource costs of various crops, other than a general presumption that the slippage would tend to be greater in the irrigated sector than in the rainfed areas.²⁰ Consequently, in

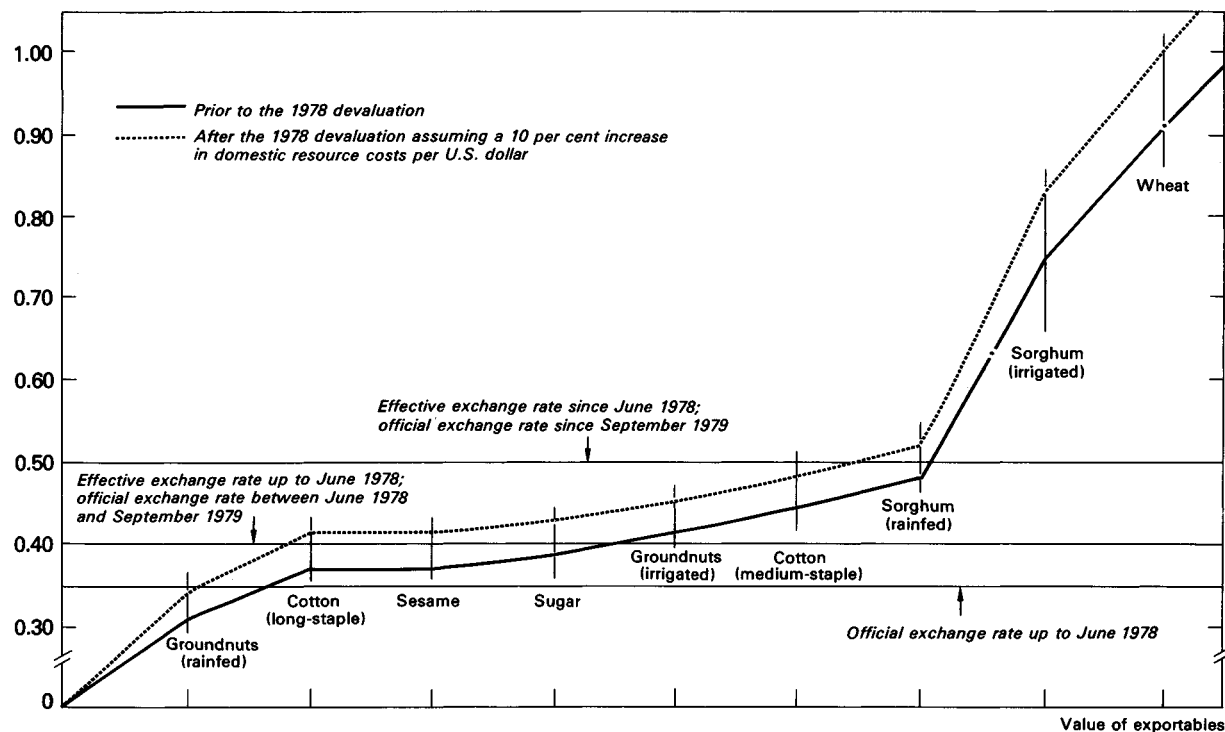
²⁰ Tenants in Gezira are strongly organized in a powerful union that negotiates with the Board and the Government on its real profit share (after taxes). However, the labor that they hire for most of the field work is unorganized.

response to the depreciation that was put into effect in 1978, the slippage was hypothetically set at 10 per cent across the board for all crops, which would reduce the competitiveness of all crops by the same percentage. Thus, a substantial degree of money illusion is expected to prevail, resulting in a relative decline in the real wage and in the prices of nontraded goods.

As a shift in domestic demand from traded to nontraded goods takes place and as the expansion in output of exportables materializes, prices of domestic resources will tend to rise. The extent of this increase depends on the elasticity of supply of the various categories of labor. Sudan does have a shortage of skilled labor, which has been drained away by the remunerative wages in the Gulf region following the oil boom. Additionally, seasonal shortages of unskilled labor have appeared, particularly in the harvesting of cotton and sesame, which has been increasingly reliant on the migration of seasonal workers from neighboring countries. Consequently, any expansion in demand for exportables or nontraded goods is bound to result in higher wages. Insofar as the export crops would be actively promoted in conjunction with their servicing sectors and infrastructure, demand management policies can have only a limited impact on their wage levels, short of jeopardizing the structural change pursued. In a second phase, substitution would take place from traded into the relatively cheaper nontraded inputs and from capital-intensive to labor-intensive techniques, resulting in different input coefficients from those shown in Table 4. Such substitution would mitigate the cost effect of the devaluation and would tend to strengthen the relative competitiveness of those products that offer the greatest opportunity for input substitution.

The ranking of traded goods according to their competitiveness can be visualized as a supply curve of exportables as a function of the exchange rate. Competitiveness and the exchange rate may be drawn along the vertical axis, while the value of exports offered would be drawn along the horizontal axis. To obtain a decrease in competitiveness along an ascending axis, one would plot the inverse of competitiveness (domestic resource costs) and express the exchange rate in units of the domestic currency per U. S. dollar (Chart 3). The shape of the curve itself would depend on the estimated or expected supply response to increases in the domestic prices of the traded goods that would result from successive depreciations of the domestic currency. The appropriate exchange rate level could then be

CHART 3. SUDAN: HYPOTHETICAL SUPPLY CURVES OF EXPORTABLES, WITH DOMESTIC RESOURCE COSTS SHOWN IN UNITS OF THE SUDANESE POUND PER U. S. DOLLAR ¹



¹ Costs of crops plotted for 1976/77; sugar, irrigated sorghum, and wheat treated as import substitutes.

determined at a point in the curve that indicates the maximum supply response that can be induced and beyond which diminishing returns and supply rigidities would emerge, at least in the medium run.

In practice, discrete intervals separate the competitiveness of various activities, and their distribution becomes in itself suggestive of the point at which the exchange rate line should be drawn. For Sudan, two clusters of activities emerge—one where competitiveness ranges between US\$2.69 for long-staple cotton and US\$2.08 for rainfed sorghum, and another for wheat and irrigated sorghum at about US\$1.10. At the tail ends of the distribution, there are rainfed groundnuts at US\$3.22 and rice at US\$0.15. The interval between the two clusters is large enough to categorize wheat and irrigated sorghum as inefficient in the sense that there was no attainable exchange rate, that is, through incremental change in the current exchange rate, that would make these two crops competitive. Therefore, the exchange rate line can be drawn in the upper range of the first cluster, or at about LSd 1 = US\$2.10. This would ensure the competitiveness of two major crops—medium-staple cotton and irrigated groundnuts—for which large expansion plans have already been implemented and that could not be sustained at the previous effective exchange rate (LSd 1 = US\$2.50). It also strengthens the position of sugar, the expansion of which is certain to raise average capital costs.²¹ And, finally, it affords rainfed sorghum, for which a large potential export market exists, the necessary stimulus for expansion.

Cereal production in irrigated areas may become competitive during short periods when its world prices are at high levels, as in 1974/75. Its cultivation could then be justified over a broad range of exchange rates. However, the determination of a cropping pattern cannot be made on transitory price phenomena but must be determined on historical averages that take the full commodity-price cycle into account. In any case, insofar as there is substitutability between sorghum and wheat, on the one hand, and cotton and groundnuts, on the other hand, and historical price trends move in the same direction, the question does not

²¹ New productive capacity of 600,000 tons will gradually be attained over the next few years, with about one half destined for export. This, however, is not expected to materialize before 1982. Capital costs per ton of sugar produced at the Kenana plant would be about US\$2,000. In contrast, at the estimated replacement costs of the Girba plant, the capital cost per ton of capacity would be US\$850.

arise, since the opportunity cost of cultivating the latter (cotton and groundnuts) will remain substantially higher than the benefits derived from cultivating the former at any exchange rate. It is only in those areas where substitutability in production has been substantially reduced, say, by the availability of water or by land fertility, and at substantially higher levels of yield ²² that it may become profitable to cultivate cereals at a depreciated rate.

With the assumed increase in domestic resource costs following the June 1978 devaluation, an erosion of competitiveness along the lines shown by the hypothetical postdevaluation distribution is unavoidable. To discount such an erosion, the depreciation of LSd 1 = US\$2.00 was put into effect in June 1978 to maintain the profitability of the various export crops. However, should such an erosion actually occur, long-staple cotton would require a smaller implicit export tax than the present exchange rate structure implies, while medium-staple cotton would just attain competitiveness at the rate of LSd 1 = US\$2.00 without any export tax. Rainfed sorghum would fall below this exchange rate at US\$1.90; however, as sorghum exports are expected to remain a small proportion of total sorghum output and would stem from the most efficient producers whose competitiveness would be larger than the average, they could be sustained for some time at the rate LSd 1 = US\$2.00.

An area of concern, however, pertains to the cotton textile industry, which is almost totally reliant on medium-staple cotton as its raw material and which could not be analyzed here for lack of data. Should the competitiveness of medium-staple cotton decline to the exchange rate LSd 1 = US\$2.00 when account is taken of the increase in domestic costs of production, there would be no margin for any inefficiency in the production of textiles to be "absorbed" by the competitiveness of the raw material. Despite Sudan's position as a major producer of cotton, several factors may cast doubt on the competitiveness of the textile industry as an import substitute:

- (1) The protective barrier resulting from transport costs is very small for textiles.
- (2) Sudan does not have abundant labor with low wage costs

²² Even in the northern provinces where traditional wheat farmers obtain yields that are 50 per cent higher than in Gezira, it has become profitable over the past three years to cut back on wheat acreage in favor of growing vegetables and fruit.

nor does it have the skills required to operate capital-intensive technology in textile manufacturing, and hence does not at present have a factor-based comparative advantage in producing cotton textiles.

(3) Sudanese medium-staple cotton may be too fine and expensive to serve as a raw material for basic cotton cloth, which is the major consumption item among textiles in Sudan.

These factors may partly explain the losses incurred by domestic textile mills despite their subsidization, for a number of years, through the purchase of domestic cotton lint. They may also explain the large inroads made into the domestic market by imported textiles from Asian countries despite their subjection to a depreciated exchange rate through their imports under own exchange and high tariff duties. More generally, since manufacturing in Sudan does not benefit from a "natural" advantage as does agriculture, or from favorable factor-cost conditions, there is a presumption that it would tend to be less competitive than agriculture.

The preceding considerations indicate that unless the rise in domestic costs of production is effectively restrained within the assumed increase, the rise in domestic resource costs would jeopardize the competitiveness of medium-staple cotton, sorghum, and possibly textiles. Such circumstances would reduce the effectiveness of the 1978 devaluation and would underscore the importance of pursuing strict demand management policies and containing inflationary pressures.

It should be stressed that while the suggested exchange rate adjustment ensures the competitiveness of the major crops in Sudan—a *sine qua non* for their expansion—it also provides all agricultural production with a greater incentive for output expansion through the intensification of cultivation in irrigated areas and the further possibility for acreage expansion (as well as intensification) in rainfed areas. However, by drawing the exchange rate line at the margin of competitiveness for sorghum and medium-staple cotton, one implicitly makes a judgment that a lower exchange rate would not result in a significantly greater supply response. In the absence of estimates of supply elasticities,²³ it is a judgment based not on the farmers' responses to

²³ Even if one were to estimate supply elasticities on the basis of historical data, these would be derived as a function of entirely different levels of output, type of technology, transportation facilities, and input availabilities from those that are expected to prevail over the next few years. Consequently, such coefficients would have little predictive value.

price signals, which in the rainfed areas have appeared to be quite elastic, but on the capability of the transportation, distribution, and servicing systems to deliver the increase in exportables to foreign markets. The limitations in this capability, discussed at length in the following section, suggest that an exchange rate adjustment under conditions of severe supply constraints must be approached cautiously and, if needed, in stages until the necessary infrastructure expands sufficiently to absorb increases in supply.

The determination of the exchange rate in terms of the cost structure of the economy's major products also helps to assess the impact of the depreciation on the cost of their inputs and, by extension, on income distribution. Because the depreciation favors those commodities that are intensive in their use of domestic resources, it would further strengthen those crops that were found to be the most efficient (Table 5). Thus, rainfed areas would reap a relative advantage over irrigated areas. Rainfed groundnuts, which are cultivated by traditional methods and utilize hardly any imported inputs, would benefit most, followed by sesame, while sorghum cultivation, which has a large import content (57 per cent), would benefit least. In the irrigated areas, the position of groundnuts and long-staple cotton would improve relative to that of medium-staple cotton or sugar, while wheat, with the lowest domestic resource content (27 per cent), would benefit least. The depreciation would have a desirable income-distribution effect among producers, since it favors those commodities cultivated by the poorest producers—the tribesmen in the rainfed areas. Moreover, since the consumption basket of the lower-income groups in Sudan has a high proportion of non-traded goods and native food staples, while that of the higher-income groups is more import intensive, the burden of the adjustment would be relatively lighter on the lower-income groups. Nevertheless, even though there may be a relative improvement in the position of those groups, any reduction in their real income would represent a greater hardship than that sustained by the upper-income groups. This raises the often-neglected equity considerations in the adjustment process, a worthy subject for further research. Suffice it to say that historically, and particularly under present conditions characterized by labor scarcity, the subsistence level of the lower-income groups in Sudan, as measured by their intake of calories and protein as well as their access to housing and education, would compare

favorably to the subsistence level in most of the neighboring countries.²⁴

VI. Supportive Policies

To break away from the export stagnation that has characterized Sudan's economy over the past decade, it has been suggested that the exchange rate should be specifically tailored to the cost structure of the economy. The correction of price distortions and the reorientation of the cropping pattern toward exportables would not have been sufficient to promote exports, because a number of exports would have been unprofitable at the previous exchange rate. Conversely, given that large sectors of the Sudanese economy are administered by the public sector, changes in relative prices brought about by a devaluation would not in themselves result in the desired supply responses and reallocation of resources. A series of policy decisions that would be consistent with the objectives of the devaluation must be taken jointly to ensure that resources move in the desired direction and to preclude the policy inconsistencies that were followed subsequent to the 1972 devaluation.

Since the crop distribution in irrigated public schemes is prescribed to the tenant independently of relative prices and incentives, a reorientation of the cropping pattern toward the most competitive crops must be carried out jointly with the exchange rate adjustment. In the Gezira scheme, this would imply an expansion of cotton cultivation, the maintenance of present groundnut acreage, a considerable reduction in wheat acreage, and the phasing out of sorghum cultivation. The expansion of cotton cultivation in Gezira by 300,000 feddans coupled with a reduction in sorghum and wheat acreage would increase net foreign exchange earnings by US\$55 million a year. (See Appendix III.) The reorientation of cropping must also be coordinated with a change in tenants' incentives, so that their allocation of inputs among crops results in the highest attainable yields under the overall constraints of the availability of water and labor. Much progress has already been achieved in this respect. The domestic producer prices of exportable crops (cotton, groundnuts, and sorghum) in irrigated areas did increase by

²⁴ Food and Agriculture Organization, "Perspective Study of Agricultural Development for the Sudan," ESP/AGS/PD/SUD/73.

at least 25 per cent following the devaluation. In June 1979, the exchange rate applicable to cotton export proceeds was changed from LSd 1 = US\$2.50 to LSd 1 = US\$2.00, which placed cotton on a par with all other exports. At the same time, its export tax was abolished and the subsidization of cotton lint to domestic mills was ended. Land and water charges have also been imposed on wheat and groundnuts in the Gezira scheme. The profit-sharing formula on cotton has not been replaced by a flat land and water charge but has been amended to yield progressively larger profit shares to tenants with higher productivity. Despite these adjustments to the incentive pattern, charges on wheat and groundnuts are quite low relative to the imputed charges on cotton, and, in absolute terms, well below charges that would cover water delivery and utilization costs as well as provide the Government with an adequate return on its investment (Appendix II). Moreover, irrigated sorghum has been exempted from any charges that, when combined with the rapid rise in sorghum prices, would strengthen the tenants' resistance to phasing out its cultivation. Nevertheless, the combination of price increases and the imposition of land and water charges will reorient tenants' incentives in the desired direction and should result in higher yields for the exportable crops. Over time, the land and water charges will need to be adjusted upward and should be extended to other schemes and to all crops.

A third area of government policy in support of the devaluation pertains to the reordering of investment priorities. The decline in productivity during the 1970s, which undermined the 1972 devaluation, would have to be reversed if the current competitiveness of various crops is to be maintained in the face of rapidly rising costs. While this decline can be partly attributed to distortion in incentives and possible shortages of imported inputs, the deterioration of the infrastructure (e.g., water delivery, transportation), the lack of research and development of higher-yielding strains, and labor shortages also appear as major contributing factors. Raising yields and expanding the production of exportables will depend to a large extent on the timely provision of imported inputs, particularly fertilizers, pesticides, agricultural machinery, and packing material. Water delivery systems in New Halfa and the large number of pump schemes along the Blue and White Niles would have to be restored to their normal levels of operation. Growing labor shortages may need to be alleviated through the introduction of mechanization

for harvesting medium-staple cotton and the expansion of mechanization for sorghum and oilseeds in the rainfed areas. Shortages of basic commodities, such as fuel, sugar, coffee, tea, and clothing, in rural areas owing to transportation difficulties or lack of foreign exchange may undermine the improved incentives that are being extended to the producers. One of the major reasons for the decline in gum arabic exports stems from the acute shortages of these commodities in the entire Savannah belt where tribesmen tap the gum trees. Consequently, the tribesmen have tended to flock to the populated areas, turning to less productive occupations but ensuring themselves of better access to consumer goods. Unless higher incomes can be translated into greater availability of basic consumer goods in the producing areas, the incentive for higher output will recede.

Increased production of exportables in response to better incentives and a reallocation of resources would be transformed into foreign exchange proceeds only if these exports are actually processed and transported to Port Sudan for shipment abroad. Lack of adequate transport and other export-servicing facilities in the past has acted as an effective constraint on export trade and has become one of the most potent arguments against the manipulation of relative prices, including the exchange rate, to increase trade flows. Unless development expenditure is concentrated on the rehabilitation and expansion of the transportation network, the increase in exports will not materialize. This is a major undertaking, given the deterioration that the railroads have suffered in their capital stock and the shortage of spare parts and fuel, which has reduced the capacity utilization of road transport. A diversification of exports toward oilseeds, cereals, and livestock has substantially increased the perishability and the bulkiness of the country's exports, adding a further measure of urgency to the provision of adequate transport facilities. Likewise, export-servicing facilities, such as ginning plants, oilseed-crushing mills, decortication sheds, storage, and grading, would need to be developed to ensure the marketing of exports. Finally, adequate power must also be provided on a steady and reliable basis. Over the past few years, power cuts and fuel shortages have resulted in large losses of output.

The strengthening of Sudan's infrastructure and the provision of export-servicing facilities to ensure shipment and marketing of exports abroad will require considerable investment and much larger operating costs. No estimate has been made for the

increase in imports that would stem from a full implementation of the structural changes in the agricultural and transportation sectors, or from the alleviation of most of the current shortages. Nevertheless, such an increase may result in a quantum jump over past trends, unless there is a reallocation of foreign exchange resources from consumption items imported under own exchange to imports of production inputs.²⁵ A reduction in the launching of new development projects under the reordering of investment priorities will affect imports only after a considerable lag, while expanded production of exportables will require, *ex ante*, increases in imports. Since the reorientation of the cropping patterns toward exportables and the translation of a new incentive pattern into higher yields will take time to gain momentum, the supply of exports is not expected to increase significantly over the next two years. Moreover, an increase in export shipments is contingent upon the rehabilitation of the relevant infrastructure and the provision of the necessary imported inputs. This points to the conclusion that the viability of the exchange rate adjustments in Sudan will require large external financial assistance for balance of payments support. The adjustment period would have to accommodate the structural changes in the economy that are necessary for the full realization of the export potential.

It was pointed out earlier that the June 1978 devaluation would allow for an increase of only 10 per cent in domestic resource costs per unit of foreign exchange earned or saved before profitability begins to fall below the assumed level and acts as a disincentive on output expansion.²⁶ This would imply relatively stringent, but selective, demand management policies, particularly vis-à-vis urban consumption. A substantial increase in the generation of domestic savings would need to be actively pursued in support of the large investments envisaged in the restructuring of the economy and in view of the external debt burden. While there is some evidence of growing private investment, there has been little self-financing of investments by public sector firms. Whatever surplus has been generated by financially successful public enterprises, such as the Gezira Board, trading corporations, or banking institutions, has been more than offset

²⁵ The recent abolition of importation under the "nil-value" license system may contribute appreciably to this shift.

²⁶ This constraint may be relaxed either by a gain in the terms of trade or by increased factor productivity.

by losses incurred by some agricultural and industrial enterprises. While the performance of these enterprises may improve with adequate supplies of raw materials and power, the challenge facing the Government is in reorganizing public sector enterprises to bring them to profitability and to generate a steady flow of public savings.

A full implementation of the export promoting measures outlined earlier is bound to increase the overall level of current government expenditure, particularly in areas governed by the Ministries of Agriculture, Irrigation, and Transportation. Yet government revenues, mostly from indirect taxes, have been found relatively inelastic with respect to income.²⁷ Thus, the burden of reducing the extent of deficit financing, which has fueled inflationary pressures in the past, must fall upon a broadening of the tax base and the generation of greater government revenues. A number of sources of potential government taxation have been left largely untapped, particularly in the rainfed agricultural estates and trade and construction sectors. In the long run, the generation of greater domestic savings becomes a necessary condition to sustain the development momentum of the past six years, which hitherto has been financed almost entirely from foreign savings.

The devaluation introduced in Sudan in June 1978 was carried out under difficult circumstances. In a situation of acute foreign exchange scarcity, which has acted as a binding constraint on output growth, a devaluation aimed at the expansion of the external sector would have to be backed by the availability of considerable foreign exchange to alleviate existing shortages and to generate a supply momentum in the economy. The infusion of imports, which such a foreign exchange cushion could finance, would also limit price increases to the direct effects of the devaluation, at least in the short run. However, in the absence of such foreign exchange or large external assistance, the price effects of the devaluation were compounded by widespread shortages throughout the production structure of the economy. This was further aggravated by the heavy rains that flooded large areas in the Gezira and other irrigated schemes. The losses caused by

²⁷ Sudan has one of the lowest sources of government revenues from direct taxes, as it ranks thirty-fourth among 35 developing countries for the period 1973-75. See Alan A. Tait, Wilfrid L. M. Grätz, and Barry J. Eichengreen, "International Comparisons of Taxation for Selected Developing Countries, 1972-76," *Staff Papers*, Vol. 26 (March 1979), pp. 123-56.

these floods contributed largely to a substantial decline in the production of Sudan's major crops and to an expected overall decline in GDP. The export capacity of the country fell to its lowest level in a number of years in terms of both its primary factors (acreage distribution among crops and input availabilities, including labor) and the entire export delivery capability, particularly transportation. The phasing of the restructuring of tenants' incentives by postponement of the imposition of land and water charges by a year, coupled with a gradual shift envisaged for the crop distribution in irrigated areas, will lengthen the adjustment period necessary for a major turnaround in the balance of payments, when exports begin to grow faster than imports. Nevertheless, much progress has been achieved in the past two years with the initiation of fundamental changes in demand management, agriculture, investment, and pricing. The ground has been laid for an economic expansion propelled by the export sector. It remains for domestic management and external financial assistance to bring it to fruition.

APPENDICES

I. Methodological Aspects of the Evaluation of Competitiveness for Sudan's Major Crops

Since transport costs are considerable in Sudan and offer natural trade protection, a commodity may be competitive if treated as an import substitute and noncompetitive if treated as an export. In this paper, sugar, wheat, irrigated sorghum, and rice are all treated as import substitutes by adding to their c.i.f. import price the sizable cost of transportation from Port Sudan to the largest consuming center (i.e., Khartoum). In comparison, the domestic costs of production of these commodities incorporate only minor transport costs (e.g., from Gezira to Khartoum) and do not include all the marketing and handling expenses that exportability entails. However, since both sugar and sorghum have a major export potential, their competitiveness as exports has also been appraised.

Some notable omissions to the activities studied here are caused by lack of data. In agriculture, gum arabic is the most traditional of Sudan's exports, accounting for 75 per cent of total exports at the turn of the century and reduced to 16 per cent in the 1970s. Its tapping is mostly a tribal activity, with labor as its sole input and virtually no information on its cost of production. Under its labor-intensive traditional structure, it is bound to decline further as an export activity because of strong competition from alternative occupations. Livestock breeding is another tribal activity for which little information is

available. However, as with gum arabic, a significant expansion in its export is possible only under modernization of its techniques with a completely different cost structure. But such modernization is only in its incipient stages and would not enter as a factor in determining the exchange rate. Textiles and cement are major omissions in manufacturing. The former is a rapidly expanding industry, and its evaluation would have to await the full-capacity utilization of its newly erected integrated textile mills and the detailed cost records when they become available. Over the past few years, the two cement plants have been plagued by power cuts and low-capacity utilization, which preclude a meaningful derivation of the production costs for cement.

Since the evaluation of competitiveness in any single year is quite sensitive to the prevailing world prices and crop yields, it is important to derive representative world prices and yields that are not subject to erratic yearly disturbances. Five-year average yields were derived for 1972/73 and 1976/77, but for world prices, two-year averages were used at the tail ends of the time series to minimize the effects of the commodity-price boom in 1974/75. Adjustments to the data consisted mostly of netting out excise taxes, local taxes, and import duties from the input costs. Should an input be produced domestically at a higher cost than the c.i.f. price of the equivalent imported input, the latter would be used, sparing the output the penalty incurred in the utilization of an inefficient input. And while nontraded inputs are evaluated at domestic prices (*minus* taxes), in cases where such an input is a heavy user of an imported material (such as transport, the cost of which can be attributed mostly to the imported rolling stock and fuel), it is treated as a traded commodity evaluated at world prices. This provides a closer approximation of the direct and indirect import contents of an activity and minimizes the inclusion of import duties levied on the secondary inputs.

With respect to costs of factors of production, a set of land and water charges were imputed for all the irrigated crops in relation to the recurrent and capital replacement costs of the irrigation facilities and the watering requirements of each crop. (See Appendix II.) Because Sudan does not have a labor surplus and wages do respond to market forces, labor costs were taken at their market value. As for capital costs, a "normal" rate of return of 10 per cent was imputed to invested capital in mechanized farms and in the sugar industry. This is certainly low in relation to the rates of return expected by private entrepreneurs who venture their own capital and in relation to the rates of inflation that have prevailed in Sudan, particularly over the past three years. Nevertheless, it is above the actual costs of borrowing the capital invested in these projects, as it stems mostly from development project loans at low interest rates. Since Sudan will continue to rely heavily on foreign project loans at concessionary terms, for much of its investment in modern agricultural projects and industry, a 10 per cent rate of return on capital may be considered appropriate.

Returns to management consist of administrative expenses, mostly those incurred in operating the Gezira Board and mechanized farms and an imputed tenant income. While the former can be readily obtained from the enterprise's balance sheet, there is no solid basis for estimating the latter. Tenant income derives partly from his labor in the fields, already accounted for under "labor" costs, and partly from the net profits derived from the selling of his crops. These cannot be taken as a return to his managerial function, as they are a residual distorted by the price and taxation systems. Instead, one can proceed

on the assumption that the tenant should derive at least as much income as a relatively skilled worker would in an urban area. For a small tenancy of 20 feddans, he should derive about LSd 200 a year for his managerial functions. With the addition of his labor income—from LSd 140 to LSd 250—he would be earning the equivalent of a low-salaried employee in an urban center. Since the evaluation of competitiveness involves considerable adjustments to the raw data and requires the imputation of implicit costs, errors in estimations are bound to emerge. While most of these tend to offset one another, all estimates of competitiveness should be viewed within a good 10 per cent margin of error.

II. Land and Water Charges for the Gezira Scheme

The provision of perennial irrigation over large areas has always been expensive, and the irrigation schemes along the Blue Nile River in Sudan are no exception. Extensive work was required in infrastructure, first in the construction of the Sennar Dam (1925), then in the construction of the Roseires Dam (in the 1960s), the excavation of canals, the construction of water regulators and drains, and the provision of administrative quarters. The historical costs of these works amounted to LSd 125 million for the Gezira scheme but are of little significance because of the secular rise in prices and because of the difficulty of allocating cost from major hydroelectric works, such as dams, which produce a number of joint products (irrigation, flood prevention, and hydroelectricity) in addition to the ecological impact and social benefits, such as the dissemination of agricultural skills.

Nevertheless, it is useful to attain some order of magnitude of the capital costs that would have been required to develop the scheme at current prices. In 1966, the Rist Report estimated the costs of the Gezira scheme on a replacement basis, adjusted for building the Roseires Dam, at LSd 190 million.²⁸ To update these costs to the end of 1978, the export-price index of industrial countries was chosen for lack of a better index, since much of the equipment needed for developing such a scheme would have been imported from them.²⁹ Over the period 1966–78, an annual rate of price increase of 9.4 per cent was derived, which brings the cost of the Gezira scheme by the end of 1978 to LSd 512 million, or LSd 320 per cropped feddan.³⁰ This estimate of the current value of the assets of the scheme (on a replacement basis) is below that for the recently developed Rahad scheme, whose cost of at least LSd 150 million would amount to LSd 500 per feddan but whose potential yields are significantly higher than in Gezira.

Since the Government levies heavy taxes on agricultural crops, the issue of land and water charges cannot be separated from government taxation. Instead, it should be related solely to the value of the government-owned

²⁸ International Bank for Reconstruction and Development, "Gezira Study Mission," Annex VI (October 1966); Ministry of Irrigation and Hydroelectric Power.

²⁹ See Table 1.

³⁰ Of the 2.1 million feddans in the scheme, about 1.6 million are cropped. (See Appendix III.)

assets and the agricultural surplus obtained. Once the government share of the surplus is determined, it then becomes a matter of policy as to how this share should be apportioned between land and water charges and taxes. The question then arises as to the rate of return that the Government should expect to obtain from these assets. Had the Government operated the Gezira scheme as a state farm with hired labor, its return for the scheme would amount to its true rental value, namely, the residual to capital and management from the output value after deduction of costs of production and depreciation. But the Gezira scheme is cultivated by tenants who are in fact sharecroppers in partnership with the Government and the Gezira Board. While part of their income is derived from their labor, they also get a share of the residual in compensation for their management.

With a full detail of costs of production and output values (Table 4), the derivation of a residual to capital and management is a straightforward matter. However, to each cropping pattern will correspond a different residual. The derivation of an expected profit share accruing to the Government must be carried out in terms of an efficient utilization of its fixed assets, that is, in terms of an "optimum" cropping pattern as derived in Appendix III. Under such a cropping pattern, and with output measured at world prices, the gross output value of the Gezira scheme would have amounted in 1976/77 to about LSd 160 million, while input costs would have been roughly LSd 120 million. This would leave about LSd 40 million to be divided between tenants and the Government. Returns to tenants have been estimated at LSd 19 million (returns to tenant management in Table 4), leaving about LSd 21 million for the Government to collect as land and water charges or under any form of indirect taxation. However, unless indirect taxes are distributed among crops in line with their use of resources, it would be more efficient to apportion the government share among crops as land and water charges, rather than to distort farmers' incentives through indirect taxation. It is therefore suggested that the entire LSd 21 million be distributed in land and water charges.³¹ This distribution of the residual between tenants and the Government is in line with the cotton profit-sharing formulations in effect in the scheme over the past two decades and, hence, with what the Government visualized the tenants' profit share to be. Looking at it from another angle, this return to the Government would amount to 5 per cent of the estimated asset value in 1976/77. Considering that this rate of return is obtained over and above a built-in 9 per cent rate of appreciation of the scheme's assets (owing to inflation), it appears to be quite adequate. However, with the 1978 devaluation, the potential surplus available from the Gezira agricultural product would rise by about LSd 9 million, raising the opportunity for some indirect taxation as well as for an improvement in tenants' incentives through higher income.

³¹ Under the actual cropping pattern in 1976/77, the residual would amount to only about LSd 30 million. If the Government were to siphon off LSd 21 million as its profit share, it would leave only LSd 9 million to the tenants. But the corollary of nonoptimum cropping patterns in Gezira is a set of domestic crop prices that ensures that the residual is sufficiently large to keep tenants in production. Thus, subsidization of wheat production is a transfer of income from other government revenue sources to the Gezira tenants. Under practices that preceded the imposition of land and water charges, the residual was

The distribution of the Government's profit share among crops must take into account the watering requirement of each crop and the time during which it occupies the land. As cotton requires the largest number of waterings and occupies the land the longest, its land and water charges for 1976/77 may be set at LSd 18 per feddan. Charges per feddan for other crops would be as follows: wheat LSd 12, groundnuts LSd 10, sorghum LSd 8, and rice and vegetables LSd 14.³² To these charges must be added depreciation costs, water delivery operating costs, and the administrative costs of the Gezira Board. Present depreciation costs are quite difficult to determine for Gezira, given the age structure of its assets. Depreciation of the agricultural machinery used is included in its rental charges imposed on the tenants, while the depreciation of other durable assets (dwellings, roads, lighting systems, and railways) is included in the administrative costs of the Gezira Board. Similarly, the Ministry of Irrigation does include depreciation costs in its budgeted expenditure. Whether these depreciation provisions have been adequate cannot be ascertained without detailed information on the age profile of the fixed assets and their replacement costs. Consequently, they are taken here at face value and are included in the administrative and irrigation costs shown for 1976/77 in Table 4. In that year, the administrative expenses of the Gezira Board amounted to about LSd 4.7 million. Since cotton assumes a disproportionate share of these costs—requiring much greater supervision and more services than the other crops—it has been assigned an administrative cost of LSd 5 per feddan versus LSd 2 per feddan for the other crops.

After protracted discussions on the desirability of imposing land and water charges on the Gezira scheme, the Government announced in March 1979 that land and water charges are to be imposed on Gezira crops other than cotton and sorghum beginning with the 1979/80 season. The profit-sharing formula on cotton is to be maintained with the addition of an incentive formula whereby the tenants would reap progressively higher shares of profits with higher yields. Previously, the joint profit sharing by the three partners rewarded the inefficient tenants at the expense of the efficient tenants. While the major costs of production (plowing, ridging, fertilizing, pest control, and uprooting) are basically the same across tenancies of equal size, the costs are charged *per kantar of cotton produced*. Thus, low-yield tenancies were bearing lower shares of costs. Moreover, the profit-sharing formula, akin to a uniform income tax, deprived the tenant from the full benefits of higher productivity and yield. This arrangement was being justified on grounds of income distribution, since it was argued that land fertility varied widely across tenancies. The introduction

divided as follows: *Government share*: Profit share from cotton revenues (36 per cent) *plus* indirect taxation of agricultural products (e.g., explicit and implicit export taxes on cotton), development taxes on export crops and imported inputs, and customs tariffs on agricultural imports *minus* the subsidization of the production of wheat and rice, the writing off of some tenants' debts, the financing of the annual deficits of the Gezira Board, and the financing of the water delivery costs via the Ministry of Irrigation. *Tenants' share*: Profit share from cotton (49 per cent) after government taxation. Full profits from the cultivation of wheat, rice, sorghum, and vegetables (including subsidies) *minus* the taxation of agricultural inputs and export crops.

³² Cotton requires 12–16 waterings, wheat 10 waterings, groundnuts 8 waterings, sorghum 6–7 waterings, and vegetables and rice 16 waterings.

of a progressive formula attempts to protect the low-yielding farmer by ensuring him a minimum profit share of 49 per cent while giving the efficient farmer additional incentives to raise his yields. However, the new formula is quite complex, and it remains to be seen whether it can be implemented effectively. Sorghum was being exempted, as it is intended to phase out its cultivation in Gezira; however, given the tenants' past resistance to any reduction in sorghum acreage, its exemption from land and water charges is only expected to strengthen their resolve.

The announced Gezira charges are shown in column 5 of Table 6, together with the 1976/77 charges updated to 1979/80 (column 4) as suggested in this

TABLE 6. SUDAN: ESTIMATED AND ANNOUNCED LAND AND WATER CHARGES
(In Sudanese pounds per feddan)

Crop	Return on Capital and Management (1)	Water Delivery Costs ¹ (2)	Adminis- trative Costs ² (3)	Suggested Land and Water Charges, 1979/80 ³ (1 + 2 + 3) (4)	Announced Land and Water Charges for 1979/80 (5)	Suggested Rates for the Rahad Scheme (1977) ⁴ (6)
Cotton	21.5	6.5	6.0	34.0	30.3 ⁵	34.2
Wheat	14.5	5.5	2.4	22.5	6.5	28.5 ⁶
Groundnuts	12.0	4.4	2.4	19.0	5.5	22.8
Sorghum	9.5	3.2	2.4	15.0	—	—
Rice	17.0	8.7	2.4	28.0	9.0	—
Vegetables	17.0	8.7	2.4	28.0	9.0	—

Sources: Gezira Board, Ministry of Agriculture, and the Rahad Corporation.

¹ Based on estimates by the Ministry of Irrigation of LSd 0.451 per watering in 1977.

² Estimated from the Gezira administrative budget.

³ Updated from charges for 1976/77 shown in Table 4 by applying the increase in the export price index given in Table 2.

⁴ Rates derived in study commissioned by the Rahad Corporation.

⁵ Imputed as follows: Government's profit share, LSd 11.5 per feddan (actual payment by the Gezira Board to the Government in 1977/78 of LSd 6 million divided by 530,000 feddans; Gezira Board's administrative costs, LSd 5.3 per feddan; LSd 26 per feddan as the implicit export tax on cotton lint; LSd 9 per feddan from a 5 per cent development tax; LSd 4.5 per feddan from the 2 per cent tax for the National Support Fund; and a price support fund tax of 1/2 of 1 per cent. Taxes on imported production inputs not included. Prior to July 1979, imputed land and water charges were LSd 56.3 per feddan, as cotton was subject to the official exchange rate, equivalent to an implicit export tax of LSd 26 per feddan. The addition of indirect taxes to the charges of the other crops would raise them only marginally.

⁶ The Rahad Scheme is not supposed to grow wheat; hence, this rate was imputed on the basis of its water requirements. Actual charges for 1979/80 are LSd 1.50 per watering. Assuming 12 waterings for cotton and 8 waterings for groundnuts, these charges would amount to LSd 18 per feddan and LSd 12 per feddan, respectively.

paper. For purposes of comparison, land and water charges estimated for the Rahad Corporation have also been included (column 6). The charges enacted for the Gezira scheme have been derived by the Ministry of Agriculture by estimating water delivery and administrative costs and distributing them among crops. They do not include any return on capital and management, leaving the profits of crops other than cotton almost entirely to the tenants. Prior to July 1979, a large tax load was also imposed on cotton cultivation, with the result that its total charges were much larger than the rate suggested here and than those proposed in the Rahad scheme. This approach tended to burden cotton with a disproportionate share of the agricultural surplus siphoned off by the Government instead of apportioning the Government's profit share among crops strictly in terms of land and water use. And, while the imposition of land and water charges in Gezira can be seen as a major step in recognizing that cultivators must bear the full costs of cultivating all crops, the Government's share from the Gezira's agricultural surplus continues to stem almost exclusively from the cultivation of cotton, thus maintaining a substantial disincentive against its cultivation. While the tax load on cotton has been greatly reduced by applying to it the same exchange rate as to other crops and by abolishing its export tax, the next step would be to reapportion the Government's surplus share among all crops in terms of their actual use of land and water resources.

III. Toward an Optimum Cropping Pattern in the Gezira Scheme

The Gezira scheme, comprising 2.1 million feddans (possibly the largest centrally managed agricultural farm in the world), is the center of Sudan's agricultural activity and accounts for the bulk of its cotton production. It is important not only because of the magnitudes involved but also because it has served historically as a model for the remaining schemes under irrigation. A major yardstick in its performance would be its net foreign exchange benefits, either as revenues earned from its export crops or as savings reaped by the cultivation of import substitutes. Given the costs of production of the various crops, their world prices, and various constraints on production, their foreign exchange benefits as shown in line 6.b of Table 4 can be maximized by the choice of an optimum cropping pattern.

Crop distribution in the Gezira is constrained by the water delivery capacity of the canals. Of the total area of the scheme, no more than 1.2 million feddans can be irrigated at any one time. The seasonality of crop distribution shown in Chart 4 reveals the constraints governing land utilization. From it, one can surmise several facts:

(1) Because cotton occupies the land almost twice as long as other crops, it competes with all of them. Should its acreage attain the limit of 1.2 million feddans, no other crop could be cultivated in the Gezira. Any acreage below this limit that is not used for cotton can be planted to either sorghum or groundnuts in the summer or wheat in the winter. Conversely, at full-capacity utilization, the expansion in cotton cultivation by one acre would entail the reduction in sorghum (or groundnuts) and wheat cultivation by one acre each.

(2) Under present sowing and harvesting practices, all crops overlap in October; during this period, all of them compete for water. This puts great

strains on the water delivery capacity and adversely affects the yields of those crops that are denied their water requirements.

(3) The overlapping of crops in October notwithstanding, sorghum and groundnuts compete directly. Any reduction in sorghum acreage can be filled in by groundnut cultivation; wheat competes only with cotton. This seasonality provided a case for wheat cultivation. It was argued that any land planted to sorghum and groundnuts during the summer would have a counterpart during the winter, which would be either left fallow or planted to a winter crop. Cultivation of wheat would make use of fallow land and machinery that would otherwise be idle at that time of year.

With no overlapping among crops and under assumptions of constant returns to scale and of abundant labor, the relative benefits of the various crops for 1976/77 (Table 4) would have prescribed that cotton be cultivated in Gezira up to the limit provided by the availability of water (1.2 million feddans), while the remaining land would be kept fallow.³³ However, such assumptions would not do justice to the problem, since land in Gezira is quite heterogeneous, causing yields to vary significantly with the scale of production and the availability of labor. Hence, cotton cultivation would have to expand up to the point where its marginal revenue product would fall below the combined marginal revenues of wheat and groundnuts. Moreover, the overlapping of crops in October has also caused major variations in yield. The expansion of wheat in 1974/75 and 1975/76 from 150,000 feddans to 600,000 feddans (with a concomitant decline in cotton acreage) was accompanied by a sharp drop in the yield of both wheat and cotton. With the subsequent retrenchment of wheat acreage over the following two years and an expansion in cotton acreage, the yield of both cotton and wheat improved substantially. It is not suggested here that distribution of acreage between wheat and cotton is the only factor affecting their yields. Acreage variations of groundnuts and sorghum also have their effect, as well as such exogenous factors as weather (which may affect some crops more than others), the incidence of pests, or the timely provision of inputs. Nevertheless, a striking correlation between yields and acreage variations for these two crops appears to have emerged since these sharp variations in acreage were introduced. As wheat is ecologically ill-suited to Sudan (partly because the winter season is so short), it becomes very sensitive to sowing dates and to the availability of water. Its cultivation beyond 400,000 feddans seems to affect its own yield adversely and that of cotton. On the other hand, it is capital (and therefore import) intensive and does not run into the labor constraint that is manifesting itself increasingly in Sudan.

From the preceding discussion, the major lines of a cropping configuration that would be consistent with the relative crop benefits and the constraints governing their cultivation emerge as follows:

(1) There is no economic justification for sorghum cultivation in Gezira, since groundnuts, which compete with it directly, are a much more profitable

³³ As the benefits of groundnuts exceed those of sorghum, the choice is essentially between growing cotton over 1.2 million feddans and growing a combination of groundnuts and wheat over 1.2 million feddans each (or a combination of the two possibilities). However, since the net foreign exchange benefits of the former (US\$213 per feddan in Table 4) exceed the sum of the latter (US\$192 per feddan), a monoculture of cotton would be prescribed.

crop. Thus, about 300,000 feddans of the 344,000 feddans presently under sorghum cultivation should be released for either cotton or groundnut cultivation. The remaining 44,000 feddans of sorghum would be cultivated on marginal lands not suited to other crops.

(2) It would be more profitable to expand cotton cultivation on the 300,000 feddans released by sorghum than to expand groundnut cultivation, which is more efficient in rainfed lands. But an expansion in cotton would entail a reduction in both a summer crop (sorghum) and a winter crop (wheat). Thus, should cotton acreage increase from 500,000 feddans to 800,000 feddans, wheat would be reduced from its 450,000 feddans to 300,000 feddans, in addition to the reduction of sorghum. Nevertheless, net foreign exchange earnings would increase. The configuration suggested here and the resulting change in net foreign exchange earnings would be as follows:

Crop	Cropping Pattern, 1978/79	Suggested Cropping Pattern		Changes in Total Acreage	Changes in Net Foreign Exchange Earnings <i>Million U.S. dollars</i>
		(Summer)	(Winter)		
Sorghum	350,000	50,000	—	-300,000	-11.9
Groundnuts	260,000	260,000	—	—	—
Wheat	450,000	—	300,000	-150,000	-4.6 ³⁴
Cotton	500,000	800,000	800,000	300,000	+71.4 ³⁵
Total cropped area (in feddans)	1,560,000	1,110,000	1,100,000	-150,000	54.9

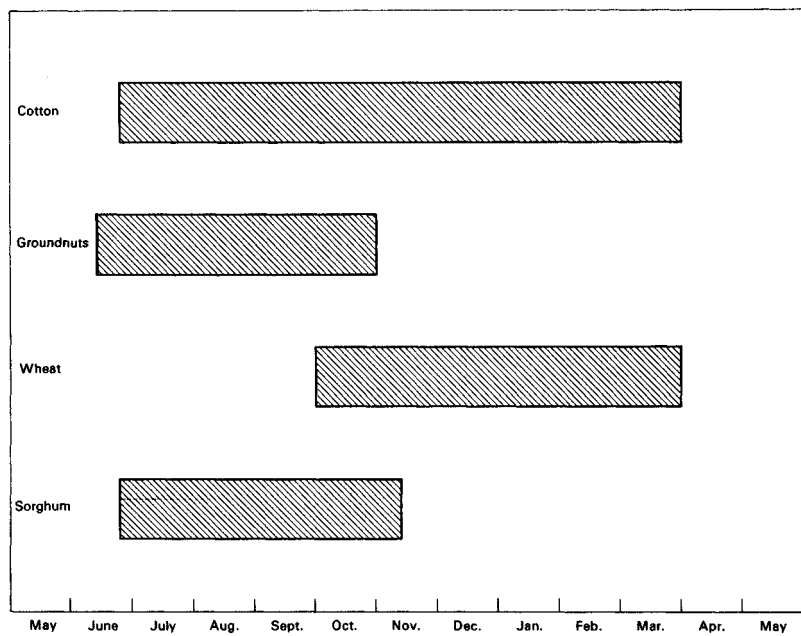
A shift from the 1978/79 cropping pattern to the one proposed here would increase net foreign exchange earnings by US\$55 million a year.³⁵ By keeping the cropped area below the theoretical maximum of 1.2 million feddans, the strain on the water delivery capacity in October would be reduced and would provide the authorities with greater freedom for marginal adjustments.³⁶ The envisaged expansion in cotton acreage would be mostly in the medium-staple variety (in which Sudan is a price taker), which is suitable for mechanical harvesting, given the existing labor constraints.

³⁴ Assuming that foreign exchange is paid for wheat imports at going world prices. Imports through concessionary terms (e.g., U.S. Public Law 480) would reduce this amount and raise the opportunity cost of growing wheat.

³⁵ Assuming an expansion of 100,000 feddans in long-staple cotton and of 200,000 feddans in medium-staple cotton.

³⁶ In the summer of 1975/76, the total cropped area reached 1.156 million feddans, the closest the Gezira scheme had come to the limit of 1.2 million feddans.

CHART 4. SUDAN: CROP SEASONALITY IN THE GEZIRA SCHEME



The Optimal Basket in a World of Generalized Floating

LESLIE LIPSCHITZ and V. SUNDARARAJAN *

IN A WORLD of generalized floating exchange rates, many countries have sought to peg their currencies to some relatively stable standard; some of these have chosen to peg to a weighted currency composite.¹ This paper provides an operational definition for the optimal weighted currency composite and sets up criteria for selecting such a composite. It argues that the real exchange rate rather than the nominal exchange rate is the important variable for policymakers to monitor and that, although exchange rate data are available daily, price data are available only after some delay. Consequently, continuous discretionary management of the real exchange rate is impossible, and a rule is needed for fixing the nominal exchange rate so that the real exchange rate is stabilized. The optimal weighted currency basket (or composite) provides such a rule. A method is developed for assigning weights to the currencies in the composite, in order to minimize variations of the real exchange rate around its equilibrium level over some reference period, and to ensure that the mean value of the real exchange rate remains close to its equilibrium level over the same period.² The optimal basket weights differ, in general, from the predetermined weights used in the construction of the real exchange rate index, and the differences are related primarily to the amplitude of

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¹ On June 30, 1979, of 138 Fund members, 92 were classified as having pegged rates: 18 were pegged to a currency composite, 13 to the special drawing right, and 61 to a single currency.

² Lipschitz (1979) discusses the allocation, distribution, and balance of payments implications of various types of currency composite, and suggests the criterion of minimizing real exchange rate fluctuations.

deviations from purchasing power parity (PPP) among the trading partner countries. Based on the formulas for optimal weights, the conditions are described under which a single currency peg is optimal.

Section I discusses the background to the problem. In Section II the formulas for the optimal selection of the currency composite are discussed and numerically illustrated. In addition, the results of stability tests on some of the important constituent parameters of the formulas are presented and discussed in this section. Section III presents some concluding comments. The full algebraic derivation of the formulas is given in the Appendix.

I. Background

In a world of generalized floating, there are various reasons why a country might wish to peg the value of its currency in terms of some standard. Exchange rates are determined in an asset market—a market for different monies—and, even in a relatively stable world, asset market prices tend to fluctuate sharply.³ It is widely believed that real economic costs are associated with such fluctuations; they inhibit trade, increase uncertainty, and serve generally to frustrate economic decision making. If the market for a particular currency is thin, the exchange rate fluctuations are likely to be even more volatile, and, for a country without a well-developed financial market, the hedging costs for transactors may be prohibitively high. These factors are sufficient to induce many countries to peg their exchange rates. An additional, although less often discussed, argument for fixing the exchange rate is that a fixed rate system has a built-in reserve-cushioning effect that tends to reduce the impact of short-term real (as opposed to financial) shocks.⁴ This is particularly important for some developing countries in which the whole economy is extremely sensitive to output and market conditions for a few primary commodities.

While it is apparent that for many countries there is a good case for fixing the value of the currency, for most of them the appropriate standard against which to fix is not immediately

³ For various reasons, exchange rate changes have tended to overshoot equilibrium values. See Dornbusch (1976) and Schadler (1977).

⁴ See Laffer (1973), Mundell (1973), Black (1976), Fischer (1977), and Lipschitz (1978).

apparent. In a world of generalized floating, a fixed exchange rate with any particular currency implies a joint float with that currency against all others. For this reason, many countries have chosen to fix their exchange rates in terms of baskets of currencies, with the composition of the basket determined for each country by the relative importance of the various component currencies in the external transactions of the country concerned.

The composition of the basket is generally related to the stabilization objective of minimizing the effects of exchange rate fluctuations on the economy. It ought therefore to be chosen to minimize the real exchange rate changes that occur as a result of nominal exchange rate fluctuations among trading partners. The appropriate real exchange rate index will reflect the fact that a country is more sensitive to certain bilateral real exchange rates than to others. The elasticities necessary for a proper weighting scheme may be derived from a model of trade; they are real world parameters that must be estimated and cannot be known *a priori*.⁵

In the following section, an optimal basket is constructed and compared with the alternative of using the known elasticities as weights in the currency basket. It is optimal only in the sense of the specific objective of the peg—in this case to minimize variations in the real exchange rate index that are due to transitory deviations from PPP among trading partners. The construction of the real exchange rate index is based on a set of pre-determined bilateral elasticities that are assumed given and are assumed to be appropriate to the objectives of the authorities.

II. The Optimal Basket

FORMULATION OF THE PROBLEM

The objective of the authorities is to minimize the variance of

⁵ For developed countries, the multilateral exchange rate model developed in Artus and Rhomberg (1973) provides some elasticities. For developing countries, Bélanger (1976) and Feltenstein and others (1979) use a commodity-by-commodity approach to developing elasticities for primary producing countries.

The analysis in this paper begs the question of the appropriate price index to use in computing the real exchange rate index. Sundararajan (1976) discusses a method of combining import and export prices, and comparing the resultant index with a nontraded goods price index, when the objective is maintaining equilibrium in the trade balance.

the real exchange rate index over some reference period or time horizon. It is assumed that the authorities are given an appropriate set of elasticities (η_i), that is, they have full knowledge of the contributions of changes in each bilateral real exchange rate to the overall index.

Assume that the small country with which we are concerned trades with n partner countries, $i = 1, \dots, n$. For convenience, let the pound sterling ($i = 1$) be treated as the numeraire currency and the domestic currency be called the rupee.

e'_{it} = pounds per unit of the i th currency

e'_t = pounds per rupee

$e_{it} = \frac{e'_t}{e'_{it}}$ = i th currency units per rupee

P = the price level, for the home country, if no subscript is given, or for the subscripted partner country

The subscript t refers to the time period, and the subscript 0 refers to the base date for indices, that is, $t = 0$. Two indices are defined, a relative price index,

$$RP_i = \left(\frac{P_t}{P_{it}} \right) \left(\frac{P_{i0}}{P_0} \right)$$

and an exchange rate index;

$$Q_i = \left(\frac{e'_{it}}{e'_{i0}} \right)$$

The authorities have decided to fix the value of the rupee to some (as yet undetermined) weighted combination of partner countries' currencies. In the limit, of course, a single currency peg might be chosen, in which case one weight will be set at unity and all others at zero. This, however, is a special case, and in the general formulation the only initial constraint should be that the weights are all nonnegative and that they sum to unity.

If the rupee is pegged to a log-linear basket of n currencies, with weights w_i , $i = 1, \dots, n$, one can write

$$\ln \left(\frac{e'_t}{e'_0} \right) = \sum w_i \ln \left(\frac{e'_{it}}{e'_{i0}} \right) \quad (1)$$

The elasticity-weighted real exchange rate index can be expressed as

$$rer = \ln(RER) = \sum_1^n \eta_i \ln(RP_i) + \sum_1^n \eta_i \ln \left[\frac{e'_t}{e'_0} \cdot \frac{e'_{i0}}{e'_{it}} \right] \quad (2)$$

Substituting equation (1) into equation (2), and noting that $\sum \eta_i = 1$, one can write

$$\begin{aligned} rer &= \sum_1^n \eta_i \ln(RP_i) + \sum_1^n (w_i - \eta_i) \ln(Q_i) \\ &= rp_1 + \sum_2^n \eta_i rp'_i + \sum_2^n (w_i - \eta_i) q_i \end{aligned} \quad (3)$$

where lowercase letters indicate logarithms of the corresponding uppercase letters, and $rp'_i = rp_i - rp_1$.

The task of the authorities is to choose a set of weights (w_i) that minimizes the variance of the expression in equation (3) over the reference period. In defining this variance, covariances among the relative prices of the partner countries, as well as those among their exchange rates, may be ignored, because the concern is only with the set of bilateral relations between the rupee and the currency of each partner country. However, the covariance of each bilateral exchange rate and the corresponding bilateral relative price is an important component of the PPP relationship between the rupee and each of the other currencies and cannot be ignored. With this in mind, the relevant variance may be written as

$$\begin{aligned} \text{Var}(rer) &= \text{Var}(rp_1) + \sum_2^n \eta_i^2 \text{Var}(rp'_i) + \sum_2^n (w_i - \eta_i)^2 \text{Var}(q_i) \\ &\quad + 2 \sum_2^n (w_i - \eta_i) \eta_i \text{Cov}(rp'_i, q_i) \\ &\quad + 2 \sum_2^n (w_i - \eta_i) \text{Cov}(rp_1, q_i) \end{aligned} \quad (4)$$

The variance with which we are concerned is not the variance about any mean value, but the variance about the equilibrium. For this reason, the indices are constructed about unit values in some "normal" year, that is, a year during which the purchasing power of the rupee was in a sustainable relationship with that of the aggregate of external currencies.

While the objective of the peg is to minimize the variance of the real exchange rate about this equilibrium, in the absence of real changes in the structure of the economies involved, the authorities are also concerned that the level of the real exchange

rate should not move too far from the equilibrium level. There are good reasons not to alter the nominal exchange rate for every transitory deviation from PPP; indeed, if the deviation occurs because of some real shock, maintaining the real exchange rate could exacerbate the impact of the shock.⁶ Sustained deviations, however, are likely to produce balance of payments effects that will require adjustment. Consequently, a constraint on the minimization of the variance in equation (4) is that the expected value of the real exchange rate index should be within some acceptable range around unity (that is, its logarithm should be in the range $-\alpha$ to $+\alpha$) over the reference period. This constraint may be characterized as

$$-\alpha \leq \sum \eta_i \overline{\ln(RP_i)} + \sum (w_i - \eta_i) \overline{\ln(Q_i)} \leq \alpha$$

where the middle term of the inequality is the real exchange rate defined in equation (3), and $(\bar{})$ denotes the expected value over the reference period. The preceding inequality may alternatively be expressed as

$$B - \alpha \leq \sum w_i \bar{q}_i \leq B + \alpha \quad (5)$$

where

$$B = \sum \eta_i \bar{q}_i - \sum \eta_i \bar{r} \bar{p}_i$$

$$\bar{q}_i = \overline{\ln(Q_i)}$$

and

$$\bar{r} \bar{p}_i = \overline{\ln(RP_i)}$$

It will always be technically possible to find a set of nonnegative weights that minimizes the variance in equation (4) subject to the foregoing constraint and the condition that the weights sum to unity,

$$\sum_1^n w_i = 1, \quad \text{where } w_i \geq 0 \quad i = 1, \dots, n \quad (6)$$

provided that a sufficiently broad range of acceptability is specified for the constraint in equation (5). However, if the authorities seek to maintain the average real exchange rate over the reference period fairly close to its equilibrium value (that is, if α is small), for various sets of expected future exchange rates and

⁶ See Fischer (1977) and Lipschitz (1978). The discussion of real and nominal wage policies in Gray (1978) provides an interesting analogy.

relative price movements, it might not be feasible to fix the exchange rate to any basket. In such a case, it will be necessary to change the exchange rate vis-à-vis any basket in order to offset a sustained deviation of the real exchange rate from equilibrium.

The problem of minimizing the expression in equation (4) subject to the constraints (5) and (6) may be solved by standard quadratic programming techniques. Details of the general solution are provided in the Appendix; some particular solutions that are amenable to verbal description and are of likely practical importance are discussed in the next section.

IMPLICATIONS OF THE SOLUTION

Consider the case in which the optimal solution falls within the range specified in constraint (5)—that is, the expected real exchange rate over the reference period is acceptably close to equilibrium—and all the weights are positive. In this case, the optimal weights are

$$w_i = \eta_i(1 - x_i y_i) - z_i y_i \quad i = 2, \dots, n$$

$$w_1 = 1 - \sum_2^n w_i \quad (7)$$

where

$$x_i = \text{Cov}(rp'_i, q_i), y_i = 1/\text{Var}(q_i), z_i = \text{Cov}(rp_1, q_i)$$

If, however, the expected real exchange rate over the reference period falls at either limit of the acceptable range,

$$w_i = \eta_i(1 - x_i y_i) - z_i y_i + \frac{\lambda}{2} \bar{q}_i y_i \quad i = 2, \dots, n$$

$$w_1 = 1 - \sum_2^n w_i \quad (7')$$

where

$$\lambda = \frac{2 \left[B \pm \alpha - \sum_1^n \eta_i(1 - x_i y_i) \bar{q}_i + \sum_1^n z_i y_i \bar{q}_i \right]}{\sum_1^n \bar{q}_i^2 y_i} \quad (8)$$

It is clear from equations (7) and (7') that the use of the elasticity-weighted basket (i.e., $w_i = \eta_i$) is not generally optimal. Equation (4) helps to clarify this point. In the case where both

covariance terms are zero, elasticity weights will be optimal. While it is not unlikely that the second covariance term (z_i)—that is, the covariance between the relative price of the home country vis-à-vis the numeraire currency country and the exchange rates of each of the other partner country currencies vis-à-vis the numeraire currency—will be close to zero, it is unlikely that the first covariance term (x_i)—that is, the covariance between partner countries' prices and exchange rates vis-à-vis the numeraire currency—will be that small. If, however, these covariances are zero, the best result possible is to limit the variance of the real exchange rate to that of relative prices; as may be seen from equation (4), this is achieved by adopting simple elasticity weights. In general, as is clear from either equation (4) or equation (7), if the variance of other countries' currencies against the numeraire currency is large relative to the covariance terms, a simple elasticity-weighted basket is optimal. Larger covariances lead to weights different from the elasticity weights, even if they indicate that exchange rates have tended to exacerbate rather than to offset relative price movements.

The question of whether the optimal basket, in terms of the specified criterion, is a single currency peg or a broader weighted basket can be examined in terms of equations (5) and (7). A necessary condition for a single currency peg emerges directly from the constraint (5), which may be written

$$-\alpha \leq -B + \sum_2^n w_i \bar{q}_i \leq \alpha$$

Clearly, if all the weights from 2 to n are zero, B must fall within the range $-\alpha$ to $+\alpha$ or, in the strictest case, B must equal zero. This condition is quite intuitive. B is nothing more than the domestic price relative to the weighted average of partner country prices expressed in sterling. Thus, a necessary condition for a single currency peg is that the weighted average of partner country prices in terms of that currency does not deviate, on average, beyond narrowly prescribed limits from the domestic price index. This is not, however, a sufficient condition.

Various sufficient conditions may be described with reference to equation (7). For a single currency peg to be optimal, all the other weights derived must be zero. In our programming framework, it is easy to compute each of the weights for $i = 2, \dots, n$ from equation (7). Where inclusion of the currency (i) in the basket reduces the variance of the real exchange rate, its weight will

be positive; where it does not, the relevant weight will be negative or zero. Where the computed weight is negative, it should simply be set equal to zero and the currency excluded from the basket.⁷ On this basis, several situations can be described in which a single currency peg is optimal.

First, consider the (not unlikely) case in which the covariance between the relative price of the home country and the United Kingdom and the exchange rate of the United Kingdom vis-à-vis all other partner countries is zero—that is, $z_i = \text{Cov}(rp_i, q_i) = 0$. If, in addition, PPP holds continuously among all the trading partners, so that $x_i y_i = 1$, all the weights, from 2 to n , in equation (7) are zero and a single currency peg is optimal. In this case, all partner country currencies may be aggregated and considered as a single currency—in the Hicksian composite commodity sense. As long as price inflation in the domestic currency does not deviate on average by more than an acceptable limit from that in the numeraire currency, it is optimal to peg to the numeraire currency. While sterling has thus far been used as the numeraire currency, where PPP holds among partner countries it would be optimal to peg to whichever currency of the partner countries that inflates at about the same rate as the home country.

Second, consider the case in which, as before, $z_i = 0$ but $x_i y_i > 1$. Thus, the computed weight from equation (7) is negative, and hence the optimal weight for the i th currency is set at zero. If this is so for all the currencies, from 2 to n , then a single currency peg is optimal. In this case, the relative prices of other partner countries and the numeraire currency country are much more variable than are the corresponding exchange rates.⁸ While the exchange rates do move in the right direction to offset the relative price movements, the amplitude of their movement is insufficient. Given the necessary condition that domestic

⁷ In principle, in deriving a rule for setting the exchange rate so that the real exchange rate is stabilized, there is no reason for not including negative weights. However, negative weights cannot be readily interpreted in the context of the currency composition of an optimal basket.

⁸ It can be easily shown that

$$-\left[\frac{\sqrt{\text{Var}(rp_i)}}{\sqrt{\text{Var}(q_i)}} \right] \leq x_i y_i \leq \left[\frac{\sqrt{\text{Var}(rp_i)}}{\sqrt{\text{Var}(q_i)}} \right]$$

so that for $|x_i y_i| > 1$ the variance of the relative price must be larger than that of the corresponding exchange rate.

prices are expected to move in line with the weighted average of partner country prices expressed in terms of the numeraire currency, the optimal basket would be one for which the average exchange rate movement between the domestic currency and the other partner country currencies was no smaller than the movement between the numeraire currency vis-à-vis the average of other partner country currencies. Clearly, to the extent that any of these currencies were included in the basket, the amplitude of the former would be lower than that of the latter. Consequently, the optimal basket is a single currency peg.

This result is made most accessible by considering equation (4), from which it can be seen that if $\text{Cov}(rp'_i, q_i)$ is large relative to $\text{Var}(q_i)$ —that is, $x_i y_i > 1$ —a zero weight for the particular currency concerned will serve best to reduce the variance of the real exchange rate. As the weight of a particular currency in the basket is reduced, the variance of the nominal exchange rate of the home currency vis-à-vis that currency is increased, thereby adding to the variance of the bilateral real exchange rate. However, insofar as these nominal exchange rate fluctuations offset the corresponding bilateral relative price movements—that is, there is a positive covariance between them—the nominal exchange rate fluctuations reduce the variance of the real exchange rate. Where the covariance term is large relative to the variance term, a maximum exchange rate variance (so as to offset the large relative price variance) and therefore a minimum weight (of zero) is optimal.

A third example of an optimal single currency peg arises when $z_i y_i > 0$, and, as a result, w_i from equation (7) is negative. In the easiest case, PPP holds between the trading partner currency concerned and the numeraire currency, so that $x_i y_i = 1$. In such a situation, the currency (i) will have to be excluded from the basket—that is, assigned a zero weight. If this is true for each of the currencies $i = 2, \dots, n$, a single currency peg is optimal.

This case is best described by reference to an example. Suppose that the currency under consideration for inclusion in the basket is the U. S. dollar and that the U. S. inflation rate is 20 per cent. Suppose further that the inflation rate in the United Kingdom is 5 per cent and that, since PPP holds, the dollar is depreciating by 15 per cent per annum against sterling. If domestic prices relative to U. K. prices have a positive covariance with the price of dollars in terms of sterling, dollars are best excluded from the basket. In our example, a domestic inflation

rate of less than 5 per cent would make the covariance positive. In such circumstances, the dollar should be excluded from the basket. If the domestic inflation rate is close to 5 per cent, then a sterling peg would result in a low variance of the real exchange rate. However, if the domestic inflation rate is only 2 per cent, then the best available option is to peg to the currency of the partner with the slowest rate of inflation—in this example, sterling. Of course, eventually the PPP constraint will be violated (unless α is very large), and an exchange rate adjustment will be required.

It is possible to describe a few simplified cases at a general level, but to fully understand the operational significance of the formulas, it is best to proceed to an example of an actual computation.

A NUMERICAL ILLUSTRATION

Consider a hypothetical country that chose to peg its currency to a composite of currencies of its major trading partners—the United Kingdom, the United States, the Federal Republic of Germany, and Japan—from the third quarter of 1976 until the third quarter of 1978, at which time the authorities planned to review their exchange rate policy. The authorities considered the relative prices that prevailed in the third quarter of 1976 to be consistent with balance of payments equilibrium. Moreover, they were expecting a steady domestic price inflation of 2.3 per cent per quarter.⁹ Their objective was to choose a currency basket for the reference period that would minimize the deviations of the country's real exchange rate from equilibrium. They also wanted to ensure that the real exchange rate remained in equilibrium with respect to the average prices and exchange rates that they expected to prevail during the reference period. The relative importance of movements in each of the bilateral relative prices was known to the authorities and was reflected in the weighting scheme used in the computation of the real exchange rate index. Table 1 shows these elasticity weights—arbitrarily chosen for illustrative purposes—and the relevant statistics on exchange rates and relative prices.

This table illustrates the computation of the optimal basket weights. The parameters—variances and covariances—required

⁹ This was the elasticity-weighted average of inflation rates in the trading partner countries during the period 1974–76.

TABLE 1. OPTIMAL BASKET CALCULATIONS

Trading Partners	Elasticity Weights η_i (1)	Ratio of Covariance to Variance $x_i y_i = \frac{\text{Cov}(rp'_i, q_i)}{\text{Var}(q_i)}$	Optimal Weights w_i (3)
		(2)	
United States	0.50	0.70 (5.0)	0.15
Japan	0.25	0.96 (3.4)	0
Germany, Fed. Rep.	0.20	1.05 (6.8)	0
United Kingdom	0.05	—	0.85

to compute the optimal basket are estimated from historical data for the two-year period preceding the third quarter of 1976 when the basket peg is assumed to begin.

Column (2) shows the ratios of covariance to variance ($x_i y_i$), relating relative prices (rp'_i) and exchange rates (q_i) for each country during the historical period. These ratios were obtained as the coefficients of the regressions of relative prices on exchange rates, and the corresponding t -values are shown in parentheses.¹⁰ All the coefficients are significantly different from zero. The coefficients for Japan and the Federal Republic of Germany are not significantly different from unity at the 90 per cent level of confidence.¹¹ Therefore, in computing the optimal weights (from equation (7')), $x_i y_i$ were set equal to 1 for Japan and the Federal Republic of Germany. As the coefficient for the United States (0.70) is significantly different from unity, it was used in the calculation of optimal weights. Economic theory offers no a priori guidance on the sign or magnitude of z_i , that is,

¹⁰ All relative prices used in the regressions were ratios of wholesale price indices. The exchange rates and relative prices were expressed in sterling per i th currency unit and converted into indices with the third quarter of 1976 as the base period. The logarithms of these indices were used to estimate the variances, covariances, and the regression coefficients. The regression equations were estimated with an intercept term. Strictly, to measure deviations from base period values, the intercept should have been constrained to zero. However, the inclusion of the intercept is justified in that the condition that the real exchange rate should be close to the base period equilibrium is imposed separately. Notably, none of the conclusions would require alteration if regressions without intercept terms were used.

¹¹ The t -statistics on the significance of deviations from unity of the estimated $x_i y_i$ are as follows:

<u>United States</u>	<u>Japan</u>	<u>Germany, Fed. Rep.</u>
-2.13	-0.16	0.35

$\text{Cov}(rp_1, q_i)$; nor is there any reason to expect a stable parameter $z_i y_i$. Consequently, in the absence of any *ex ante* expectations as to the size of this parameter over the period for which the basket peg was to be adopted, it was simply set at zero.

Evaluation of the last term in equation (7') $\left(\frac{\lambda}{2} \bar{q}_i y_i\right)$ requires the setting of a tolerance level (α) and some foreknowledge about average exchange rates and relative prices.¹² For the purpose of this computation, the tolerance level was set at 0.025, so that the maximum tolerable average deviation from PPP would be 2.5 per cent on either side (or an average deviation within a 5 per cent band around equilibrium). In the computation of the optimal weights, the full term was initially set at zero—since there was no reason to expect deviations from PPP on the average over time—with the proviso that it would be re-evaluated at the end of the first year of the basket peg, on the basis of average deviations from PPP during that year, to check whether the weights would have to be recomputed. As it turned out, no change in the weights was required, as, based on the experience of the first year, deviations from PPP were, on average, within the specified tolerance level and λ could be set at zero.¹³ Consequently, the weights given in column (3) were applicable to the entire reference period from the third quarter of 1976 to the third quarter of 1978.

Since the optimal basket was derived on the basis of historical correlations, and since those parameters for which there was no reason to expect a stable value over the reference period were simply omitted, it is of interest to compare the performance of the estimated “optimal” basket with the elasticity-weighted basket over the reference period.¹⁴ Chart 1 shows the time paths of the real exchange rate under the two different weighting schemes, and Table 2 presents some comparative measures of stability of the two baskets.

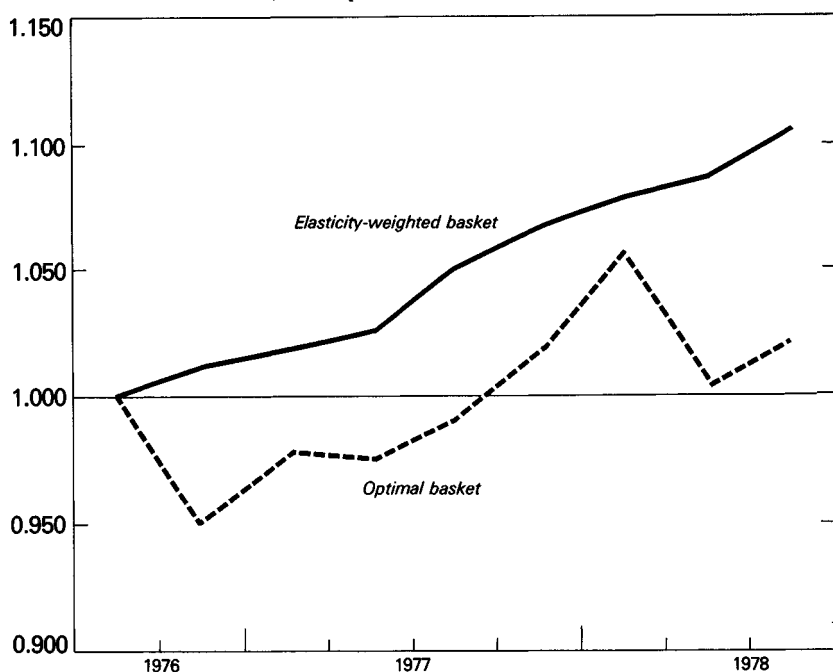
¹² In addition, separate estimates of variances of the exchange rates will be required to compute λ .

¹³ The average deviation was only 0.023 in the first year. Had this not been the case, it would have been necessary to re-estimate optimal weights to include the last term in equation (7'). As it turned out, the average deviation was close to zero over the entire reference period.

¹⁴ The word “optimal” is used loosely here. Clearly, it is possible that the elasticity-weighted basket may outperform the “optimal” basket in terms of the specified criterion. In this case, the “optimal” basket would obviously be suboptimal.

CHART 1. THE REAL EXCHANGE RATE INDEX, THIRD QUARTER 1976-THIRD QUARTER 1978¹

(Third quarter 1976 = 1.000)



¹ Home country price level relative to trading partner price level, adjusted for exchange rate changes.

It is clear from Chart 1 that during most of the reference period, the real exchange rate index based on the optimal basket remained closer to unity than did the index based on the elasticity-

TABLE 2. THE OPTIMAL BASKET COMPARED WITH THE ELASTICITY-WEIGHTED BASKET

Some Statistics Relating to the Real Exchange Rate ¹				
	Mean	Mean absolute deviation from unity	Mean squared deviation from unity	Variance around the mean
Elasticity-weighted basket	1.05	0.05	0.0040	0.0014
Optimal-weighted basket	1.00	0.02	0.0009	0.0009

¹ The real exchange rate was computed from the expression in equation (3).

weighted basket. The real exchange rate index based on the elasticity-weighted basket increased (appreciated) steadily during most of the reference period, while the index based on the optimal basket fluctuated around the base period value. As shown in Table 2, use of the optimal basket resulted in a substantially lower mean squared deviation from unity than did use of the elasticity-weighted basket; this measure of stability was lower by nearly 80 per cent.

The stability of the estimated parameters is critical to the usefulness of such estimates based on past data for computing optimal weights for a future period. Table 3 provides some tests of stability.

TABLE 3. STABILITY TESTS

	Regression Equations ¹				F-Statistics (with Degrees of Freedom (2, 14)) ²
	2d quarter 1974– 2d quarter 1976		3d quarter 1976– 3d quarter 1978		
	Constant	$x_i y_i$	Constant	$x_i y_i$	
United Kingdom– Germany, Fed. Rep.	–0.144 (–10.6)	1.05 (6.8)	–0.318 (–2.8)	1.38 (3.4)	0.717
United Kingdom– Japan	–0.144 (–5.76)	0.96 (3.5)	–0.125 (–2.2)	0.85 (4.8)	0.060
United Kingdom– United States	–0.010 (–0.6)	0.70 (5.0)	0.400 (9.9)	–0.48 (–1.7)	17.999

¹ Figures in parentheses are *t*-statistics.

² To test whether the regression coefficients are stable over the two sub-periods, the critical value of *F* at a 5 per cent level of significance is 3.74 and at a 10 per cent level, 2.73.

The PPP relationship between the United Kingdom and the Federal Republic of Germany and between the United Kingdom and Japan remained stable, while the relationship between the United Kingdom and the United States was extremely unstable. The optimal basket, based on past data, outperformed the elasticity-weighted basket because of the stability of the coefficients for Japan and the Federal Republic of Germany. Thus, insofar as it is reasonable to expect stable relationships of this sort, the derivation of useful optimal basket weights is feasible.

III. Summary and Conclusion

During the past few years there has been a great deal of discussion at the policy-making level of the best, or optimal, basket peg for a country seeking relative stability in a world of generalized floating. This paper has sought to define the term "optimal peg" by specifying precise criteria for optimality. It has been argued that the *real* rather than the *nominal* exchange rate is the variable deserving of policymakers' attention. Although exchange rate data are available daily, price data are usually available only after a lag of some months. Continuous, discretionary fine tuning of the real exchange rate is, therefore, impossible. Consequently, what is sought is a rule for fixing the nominal exchange rate so that the real exchange rate is stabilized. Fundamental to the proposed methodology is the idea that this rule, or optimal basket, should employ all the available information, including any systematic relationships between bilateral exchange rates and the corresponding relative prices. The optimal basket, as defined in this paper, is one that minimizes the variance of the real exchange rate about its equilibrium, while maintaining the average value of the real exchange rate close to its equilibrium level over the reference period. Besides its basis in economic theory, an advantage of this definition is that it is amenable to quantification, so that the optimal basket weights for trading partners' currencies can be established by standard quadratic programming techniques.

A solution for the optimal basket is derived. It is found that, in general, the optimal weight of the currency in the basket will differ from the preassigned elasticity weight that denotes the importance of the currency in the real exchange rate index. The reason is that the variances and covariances of exchange rates and relative prices have an important effect on the real exchange rate index, and weights in the optimal basket are chosen to maximize the contribution of this effect to stability. A number of interesting specific cases of the general solution are discussed, and particular emphasis is given to the conditions under which a single currency peg is optimal.

A numerical illustration of the solution is provided, and a comparison, in terms of relative stability, is made between an optimal basket peg and a basket peg in which simple elasticity weights are used. The question remains as to whether the vari-

ances and covariances required to derive the optimal weights are stable over time and therefore useful in setting an exchange rate rule for the future. It turns out that these parameters are of the nature of regression coefficients, so that their stability can be tested. The results of such tests are presented in the paper. It is argued that insofar as the parameters required to calculate the optimal basket weights may be estimated from historical data, and may reasonably be expected to be stable, the derivation of useful optimal basket weights is feasible.

APPENDIX

Variance Minimization

The problem is to choose a set of weights w_1, \dots, w_n that minimizes the variance of the real exchange rate.

$$F \equiv \text{Var}(rp_1) + \sum_2^n \eta_i^2 \text{Var}(rp'_i) + \sum_2^n (w_i - \eta_i)^2 \text{Var}(q_i) \\ + 2 \sum_2^n (w_i - \eta_i) \eta_i \text{Cov}(rp'_i, q_i) + 2 \sum_2^n (w_i - \eta_i) \text{Cov}(rp_1, q_i)$$

Subject to the constraints,

$$B - \alpha \leq \sum w_i \bar{q}_i \leq B + \alpha \quad (9)$$

$$\sum w_i = 1$$

and

$$w_i \geq 0, \quad i = 1, \dots, n$$

This is a quadratic programming problem that can be solved using a variety of computational algorithms.¹⁵ However, to highlight the nature of the optimal solution, the Kuhn-Tucker conditions characterizing the solution are examined.

The Lagrangian expression for this problem can be written as

$$L = F + \lambda_1 \left(\sum_2^n w_i \bar{q}_i - B + \alpha \right) + \lambda_2 \left(- \sum_2^n w_i \bar{q}_i + B + \alpha \right) + \lambda_3 \left(\sum w_i - 1 \right)$$

where $\lambda_i, i = 1, 2, 3$ are the Lagrangian multipliers. The multiplier λ_1 relates to the lower bound of the range for the real exchange rate specified in equa-

¹⁵ For a description of the available algorithms, see Simmons (1975).

tion (9); λ_2 relates to the upper bound; λ_3 relates to the condition that the weights sum to unity.

The Kuhn-Tucker conditions are as follows:

$$\frac{\partial L}{\partial w_1} = \lambda_3 \geq 0 \quad (10)$$

$$\begin{aligned} \frac{\partial L}{\partial w_i} = & 2(w_i - \eta_i)\text{Var}(q_i) + 2\eta_i \text{Cov}(rp'_i, q_i) + 2 \text{Cov}(rp_1, q_i) \\ & + \lambda_1 \bar{q}_i - \lambda_2 \bar{q}_i + \lambda_3 \geq 0, \quad i = 2, \dots, n \end{aligned} \quad (11)$$

$$w_i \geq 0, \quad i = 1, \dots, n \quad (12)$$

$$\frac{\partial L}{\partial w_i} \cdot w_i = 0 \quad (13)$$

$$\left(\sum w_i \bar{q}_i - B + \alpha \right) \geq 0 \text{ and } \left(B + \alpha - \sum w_i \bar{q}_i \right) \geq 0 \quad (14)$$

$$\left(\sum w_i - 1 \right) = 0 \quad (15)$$

$$\lambda_i \geq 0, \quad i = 1, 2, 3 \quad (16)$$

$$\lambda_1 \left(\sum w_i \bar{q}_i - B + \alpha \right) = 0 \text{ and } \lambda_2 \left(B + \alpha - \sum w_i \bar{q}_i \right) = 0 \quad (17)$$

The conditions (10) to (13) state that the first derivative either vanishes at an interior solution where the optimal weights are positive or remains positive at a corner solution where the optimal weight is zero. The inequalities in equation (14) represent the lower and upper limits specified for the mean real exchange rate over the reference period. Equation (15) states that the weights sum to unity. Equation (16) states that the multipliers are nonnegative. The equations in (17) state that if either of the multipliers, λ_1 or λ_2 , is positive, then the mean real exchange rate over the reference period attains its lower or upper bound, and if the mean real exchange rate is within the bounds, then the multipliers are zero.

Using these conditions, solutions to some useful special cases can be derived and rules of thumb can be evolved for deciding when a currency should be excluded from the optimal basket. In all that follows, it is assumed that the optimal weight of the numeraire currency is positive, so that $\lambda_3 = 0$ (from equations (10) and (13)).

Case I

First, consider the situation when the optimal weights lead to an average real exchange rate falling within the bounds specified in equation (9). In this case, the conditions in inequalities (9) (and (14)) hold strictly; therefore, the multipliers λ_1 and λ_2 become zero and the inequality (11) becomes

$$\frac{\partial L}{\partial w_i} = (w_i - \eta_i) + \eta_i x_i y_i + z_i y_i \geq 0$$

where

$$x_i = \text{Cov}(rp'_i, q_i), y_i = 1/\text{Var}(q_i), \text{ and } z_i = \text{Cov}(rp_1, q_i)$$

Moreover, from equation (13) we note that if

$$(w_i - \eta_i) + \eta_i x_i y_i + z_i y_i > 0 \quad (18)$$

then $w_i = 0$. Thus, the inequality (18) provides a sufficient condition for the optimal weight of the i th currency to be zero. Using $w_i = 0$, one can rewrite (18)

$$\eta_i(x_i y_i - 1) + z_i y_i > 0$$

The interpretation of this condition is contained in the text.

If, however, it is assumed that all the weights w_i are positive (i.e., an interior solution), one has, from equations (11) and (13)

$$(w_i - \eta_i) + \eta_i x_i y_i + z_i y_i = 0$$

Therefore,

$$w_i = \eta_i(1 - x_i y_i) - z_i y_i \quad i = 2, \dots, n$$

and

$$w_1 = 1 - \sum_2^n w_i$$

These are the optimal weights shown in equation (7) and constitute an interior solution that can also be derived by the classical optimization methods.

Case II

Consider the case when the optimal weights lead to an average real exchange rate that falls on the boundary of the range specified in equation (9). For definiteness, let us first assume that the upper limit is reached, so that λ_2 is non-negative, and $\lambda_1 = 0$. In this case, the inequality (11) becomes

$$(w_i - \eta_i) + \eta_i x_i y_i + z_i y_i - \frac{\lambda_2}{2} \bar{q}_i y_i \geq 0$$

If the preceding expression holds as a strict inequality, then from equation (13), $w_i = 0$. Thus, a sufficient condition for the exclusion of currency i from the optimal basket is

$$\eta_i(x_i y_i - 1) + z_i y_i - \frac{\lambda_2 \bar{q}_i y_i}{2} > 0$$

This condition is either more or less restrictive than the corresponding condition in case I, depending on whether \bar{q}_i is positive or negative. If all the weights w_i are positive (i.e., an interior solution), we have

$$w_i = \eta_i(1 - x_i y_i) - z_i y_i + \frac{\lambda_2}{2} \bar{q}_i y_i, \quad i = 2, \dots, n \quad (19)$$

and

$$w_1 = 1 - \sum_2^n w_i$$

An expression for λ_2 can be derived by substituting from equation (19) in the constraint, $B + \alpha = \sum w_i \bar{q}_i$

$$B + \alpha = \sum_2^n w_i \bar{q}_i = \lambda_2 \frac{\sum_2^n \bar{q}_i^2 y_i}{2} + \sum_2^n \eta_i (1 - x_i y_i) \bar{q}_i - \sum_2^n z_i y_i \bar{q}_i$$

Therefore,

$$\lambda_2 = \frac{2 \left[B + \alpha - \sum_2^n \eta_i (1 - x_i y_i) \bar{q}_i + \sum_2^n z_i y_i \bar{q}_i \right]}{\sum_2^n \bar{q}_i^2 y_i}$$

These are the solutions presented in equation (7'). If $\alpha = 0$, then the foregoing solution applies on substituting $\alpha = 0$. However, if the lower limit specified in (9) is reached, then we have $-\lambda_1$ in place of λ_2 in equation (19), with

$$\lambda_1 = - \frac{2 \left[B - \alpha - \sum_2^n \eta_i (1 - x_i y_i) \bar{q}_i + \sum_2^n z_i y_i \bar{q}_i \right]}{\sum_2^n \bar{q}_i^2 y_i}$$

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Why Does the Current Account Matter?

JOANNE SALOP and ERICH SPITÄLLER *

SINCE THE ONSET of generalized floating in 1973, the current account has largely replaced the balance of payments as a barometer of the need for adjustment in a country's macroeconomic policies. But while there is a fairly natural presumption that the cumulative balance of payments should equal zero over some specified period, the appropriate analogue for the current account is less obvious. In view of the significance accorded to the current account within official circles and the financial community, it would appear useful to know more about what constitutes its equilibrium level and distribution across countries.

Two criteria—sustainability and optimality—readily suggest themselves as suitable equilibrium concepts for the current account and standards for determining the appropriateness of adjustment action in any instance. Sustainability is ultimately imposed as a condition by external forces: The drying up of sources for financing a deficit presents a clear signal that a particular current account has become unsustainable and that a change in policies is required. More discretion over the timing of adjustment is associated with deviations from optimality, since this objective is motivated by a purely internal consideration, viz., the presumed desire to maximize social welfare, somehow

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defined. At the same time, departures from the social optimum are less easy to read than the more visible indications from the financial community and involve the exercise of considerably more judgment on the part of those who make policy.

Fundamentally, it is a country's overall level of savings relative to investment that determines its current account. Hence, any assessment of a particular current account turns on the sustainability or optimality of the magnitudes of these underlying variables. For example, a sustainable current account deficit is one that is consistent with continued financial solvency and economic viability. Even though there is a deficit, the country is not living beyond its means. Rather, it is borrowing abroad to invest and, in so doing, to enhance its future earning power. In different circumstances the same deficit would be unsustainable if the country were borrowing abroad to finance current consumption. Similarly, the optimal current account can be deduced, at least conceptually, from the levels of optimal savings and efficient investment.

While sustainability is of immediate concern to a country's creditors, it is also important to the country's trading partners, since departures from it signal the urgency of adjustment measures that will directly affect them. From this perspective the optimal current account is similarly relevant, since a country may elect to change policies to achieve it. Focusing on the external effects of a country's policies raises the surveillance-related question of the potential for conflict over the international distribution of current accounts. And, although some scope for conflict is possible over countries' long-run optima, it is more likely to arise in the pursuit of their shorter-run macroeconomic policy objectives. To be specific, one long-run effect of a country's increased savings is a fall in the worldwide real interest rate. This is likely to produce a decline in the collective current account balance of the rest of the world, but in a benign manner—through an induced reduction in optimal savings and an increase in efficient investment. In the short run to medium run, however, as the world economy proceeds to this new long-run equilibrium, there may be unemployed resources because global investment adjusts only slowly to a level commensurate with the higher rate of global savings. In addition to shortfalls in world demand precipitated by one country's desire or need to adjust, exogenous forces frequently cause significant departures of investment, in particular, from its long-run efficient level. In

both cases, a country's medium-term current account target may exceed the optimal, long-run level, if its employment objectives would be served by channeling its excess savings into net exports, which, like investment, provide a medium for the productive deferral of consumption. The efficacy of using the current account in this way and—by extension—the scope for mutual inconsistencies in countries' current account targets, however, depend rather critically on the operative connection between the current account and the level of employment.

Two different views of this connection are prevalent. One is Keynesian. Accordingly, an increase in net exports, prompted either by an exogenous shift in tastes or by a decrease in their relative price through currency devaluation, tends to increase aggregate demand and the level of output if the initial situation is characterized by unemployment. Because the magnitude of the devaluation is subject to discretion, virtually any current account becomes feasible. The desired current account, then, is that which, in combination with actual investment and the desired levels of private and public consumption, yields full employment. Note that under this rubric the current account and the level of employment are related positively. Hence, in a period of widespread stagnation there is clearly the potential for conflict among countries: witness the competitive depreciations and other "beggar-my-neighbor" policies of the 1930s. The alternative view concentrates on labor's concern about purchasing power. While it would concede that an exogenous increase in export demand could improve simultaneously the current account and employment, it would question the ability of devaluation to achieve this same result because of the ensuing wage/price spiral. This model suggests that only the existence and persistence of slack in the economy will facilitate the requisite decline in relative export prices. Hence, changes in the current account and the level of employment, which policy has the power to effect, tend to be related negatively.

These two competing explanations of the way that devaluation works have decidedly different implications for a country's desired current account and the degree of potential conflict among nations over the international distribution of current accounts. Yet, to try to determine to what degree each of the alternative theories is operative at present is beyond the scope of this paper. Rather, the purpose is the more limited one of identifying the different facets of the current account, reconciling

them analytically, and, in general, developing a fairly broad view of the current account with particular emphasis on its dual role in the adjustment process, that is, as an indicator of the appropriateness of initiating adjustment and as an influence on the selection of specific measures to effect adjustment. Accordingly, the body of the paper elaborates on the analysis outlined here in its rudiments, while reserving one section for a survey of official statements on the current account.

I. Theory

THE LONG RUN

This section provides a simple theoretical framework that places the current account in a macroeconomic context. It is interesting to see whether or not a particular value of the current account is necessary for the attainment of some long-run goal and is, for that reason, desirable. To this end, the underlying determinants of the actual current account balance are presented first. Because these reduce to the difference between the economy's savings and investment, the next question concerns their preferred levels. Two criteria are suggested for the former—sustainability of the implied consumption stream and optimality of the implied consumption stream. World savings and efficiency in the international allocation thereof will determine the level of investment in any country. Finally, the nature of worldwide equilibrium and the associated distribution of current balances are indicated.

Determinants

A convenient starting place is the relationship between aggregate output and the components of demand. Equation (1) indicates that net domestic product (*NDP*) is divided among private consumption (C_p); public and private net investment (I); government spending for consumption-type goods (C_g); and net exports ($X - M$).

$$NDP = C_p + I + C_g + X - M \quad (1)$$

Net domestic product can differ from net national product (*NNP*) if assets are owned abroad and generate a stream of

returns. Noting this, we substitute for *NDP NNP minus* net foreign receipts (*F*). Hence,

$$NNP - F = C_p + I + C_g + X - M \quad (2)$$

Substituting net savings (*S*)¹ for *NNP minus* private consumption *minus* taxes (*T*) and rearranging, we have

$$X - M + F = S - I - G \quad (3)$$

where *G* is the government deficit for consumption-type purposes, that is, $G = C_g - T$. In words, the current account surplus equals the excess of private net savings over the sum of net investment and public (deficit) consumption. From this it may be inferred that the current account surplus will be higher the greater is the accumulation of private wealth, the smaller is the accumulation of capital, and the larger is the budget surplus of the government. Any positive judgment about the long-run sustainability, or normative judgment about the optimality, of the level of the current account derives from corresponding judgments about these variables.²

¹ Net savings are equal to gross national product *minus* consumption *minus* depreciation.

² Accumulation of private wealth and capital reflects attitudes toward thrift, on the one hand, and the productivity of capital, on the other hand. A high propensity to save and a low productivity of capital relative to the values of the corresponding parameters abroad will tend to make a country a structural surplus country. If, for some reason, the authorities wanted to reduce the current account surplus, they could do so by increasing the government deficit. They would have to realize, however, that unless they were prepared to do so on a permanent basis, the surplus could be reduced only if either private attitudes toward thrift or the productivity of capital, or both, were made to change. See Charles P. Kindleberger, "Germany's Persistent Balance-of-Payments Disequilibrium Revisited," Banca Nazionale del Lavoro, *Quarterly Review*, No. 117 (June 1976), pp. 118-50. See also Ronald I. McKinnon, "America's Role in Stabilizing the World's Monetary System," *Daedalus: Journal of the American Academy of Arts and Sciences* (Winter 1978), pp. 305-24. McKinnon points out that Japan's surplus reflects a high propensity to save relative to the current flow of investment opportunities.

It is also possible to argue, although difficult to take seriously, that in the long run the government cannot affect the current account. Rather, private savings would offset any public dissavings as the private sector perceived the course of national wealth straying from its desired path. Accordingly, there would be a "natural" current account, which would be beyond the powers of government to alter. While such counterbalancing behavior of the private sector may be operative to some extent, the conditions under which it functions as a perfect offset are very limiting.

Sustainability

Inspection of equation (3) indicates that the same current account is consistent with a number of variations in the composition of aggregate demand. For example, a current account deficit can result from a high level of either investment or the government deficit relative to savings. In the first case, total savings ($S - G$) may be positive, while in the second it may be negative—yet both exhibit the same current account. Moreover, the former conforms to a pattern of consumption that is within the country's budget and is, for that reason, "sustainable"—even though part or all of its investment is financed by foreign borrowing.³ In the latter, the country is borrowing abroad or liquidating assets to pay for the excess of its consumption over its income. As the country's associated external debt rises without a commensurate increase in its assets, risk of devaluation and to some extent actual default rises, and with it the cost of borrowing. That the same current account deficit is sustainable in one instance and not sustainable in the other suggests that the current account per se is not a good indicator of the need for adjustment. Rather, it is the relationship between an economy's income and consumption, that is, its savings, that matters.

While we have some basic understanding of what is generally meant by sustainability in the context of discussions about the current account, there is clearly some merit in trying to make the concept both more precise and more operational. Underlying the notion of a sustainable current account is an assessment of the sustainability of the consumption pattern. As noted earlier, a country cannot continue borrowing indefinitely to consume, nor can it continuously spend out of wealth. Hence, a deficit resulting from too much consumption is not sustainable in the long run, although it may be sustainable over a variety of short periods. For a consumption level to be sustainable over the long run, the economy must be saving enough to maintain its wealth and income at its present level. That is, the economy must be in some kind of steady state or on a positive trajectory away from a steady state. With constant population, this simply translates into the stipulation that neither net savings nor the expected return on investments, net of debt service and principal repay-

³ As long as the expected real rate of return on capital does not fall short of the cost of borrowing, future debt service and repayment of principal will be generated by the projects so financed.

ment, is negative. Otherwise, part of the funds earmarked for these investments must be logically construed as consumption expenditure.⁴ In an economy with a growing population, net savings have to be positive⁵ if per capita levels of wealth, income, and consumption are to be maintained. Savings rates below these respective lower limits imply that the economy will ultimately have to alter its consumption pattern, regardless of whether the present "excess" of consumption is being financed by incurring debt or by running down wealth.⁶

The implications of this analysis for assessing the sustainability of a particular current account deficit or determining a country's maximum sustainable current account deficit are rather straightforward. If the economy has positive net savings,⁷ then the actual deficit will tend to be sustainable. Conversely, if net savings are negative, the deficit will be unsustainable over any prolonged period. Hence, the maximum sustainable deficit corresponds to the economy's zero savings position, which, according to equation (3), is given by the level of investment.⁸ Because the sum of the economy's profitable investment opportunities⁹ establishes the upper limit on the amount of external financing that tends to be available, it becomes meaningful to speak of sustainability in terms of both the current account and the capi-

⁴ This is particularly relevant to developing countries where, according to Tun Wai, "government investment is a large component of total investment and government decisions on the level of investment are not usually made on the profitability of the project in the short run." See U Tun Wai, "The Optimal Size and Ideal Structure of Financial Markets in Developing Countries" (unpublished, International Monetary Fund, August 4, 1978), p. 16.

⁵ In specific terms, total savings must not fall short of the rate of growth of population *times* wealth.

⁶ Such savings behavior may constitute the adjustment to a new lower desired stock of wealth and should not necessarily signal the need for a policy response.

⁷ As before, if population is growing, savings must be at least equal to wealth *times* the rate of growth of population for the consumption stream to be sustainable.

⁸ Clearly, many caveats apply here. Most important is the always implicit *ceteris paribus* and the condition set out earlier—that the expected real rate of return on capital does not fall short of the cost of borrowing.

⁹ If capital is fairly immobile internationally, the level of net investment in any instance offers a poor guide to the maximum sustainable deficit. As the deficit rises, foreign borrowing costs will likewise rise and will choke off investment. In such an environment, the principle outlined in the text applies, that is, that investment sets the limit for the deficit, but the appropriate investment figure is not current investment. Rather, a maximum investment level would have to be calculated, based on the interest sensitivities of financing, that is, both domestic savings and foreign inflows, and investment.

tal account; it also confirms the intuitively plausible notion that the maximum sustainable current account deficit and the maximum sustainable capital account surplus should be mirror images of each other.¹⁰ Accordingly, as a practical matter, the market's appraisal of a particular current account deficit as expressed in the magnitude and terms of private financing readily forthcoming is a reasonable gauge of its sustainability. At the same time, historical observations on the magnitude of private capital inflows over some period tend to be inconclusive about the limits of the potentially sustainable deficit, since a much larger deficit may also evoke a counterbalancing capital inflow.

So far, the discussion has neglected the effect of cyclical influences on the current account and, correspondingly, on the usefulness of the concept of long-run sustainability developed earlier for signaling the appropriateness of adjustment action. For example, because of clearly temporary factors a larger than usual current account deficit might evoke an equally unusual capital inflow, neither being sustainable over an indefinite period. Nevertheless, adjustment measures would not necessarily be required, particularly if the market makes the additional financing available at the country's normal borrowing rate. The availability of funds not only allows a country to maintain its consumption pattern but also suggests that the market views the disturbance as a temporary one. Thus, judgments about the sustainability of a country's position during a particular period should draw on information about its borrowing costs relative to other periods as well as its cyclically adjusted levels of savings and investment.¹¹

¹⁰ In an economy with a growing population, the current account deficit associated with a zero savings position could elicit the requisite foreign financing, even though the underlying consumption level would not be sustainable. In such cases, the maximum sustainable deficit is smaller than net investment. In keeping with the requirement that savings must be such as to maintain the per capita level of wealth, the maximum sustainable deficit is investment *minus* the rate of growth of population *times* wealth.

¹¹ For the computation of cyclically adjusted, underlying trade balances, see Jacques R. Artus, "The Cyclical Adjustment of Foreign Trade Flows and the Estimation of Underlying Trade Balances" (unpublished, International Monetary Fund, November 12, 1973). While valuable, this work does not provide the information required by the criterion of sustainability. In keeping with the argument developed in the text that the magnitude of net savings is the key variable in determining sustainability, the cyclically adjusted level of net savings is paramount in making such a determination in an environment that is subject to fluctuation.

Optimality

The question of sustainability leads directly to a consideration of optimality. Specifically, one wants to know whether there is an optimal level for the current account. The literature on economic growth has dealt with the question of optimality by deriving the consumption stream that maximizes the present discounted value of utility of present and future generations.¹² This analysis usually assumes that current consumption is preferred to future consumption and that there is a diminishing marginal rate of substitution between consumption in any two periods. The optimal consumption path is that which equates the marginal rate of substitution with one *plus* the rate of return on capital.¹³

For our purposes, several features of this analysis are noteworthy. First, optimality is sought with respect to consumption, a variable that enters the individual's utility function. Second, for every rate of return on capital there exists an optimal consumption stream and an implied optimal savings stream. Third, in the closed economy, the alternative to consumption is investment, and in that analysis, whatever is not consumed is added to the capital stock. In the open economy, of course, exports provide an additional outlet for savings.¹⁴ Recalling the earlier dis-

¹² For an individual, the optimal consumption stream is that which maximizes his utility over time. While the concept of a utility function is admittedly somewhat artificial, it nevertheless makes some sense at this level. For an economy, however, there is an additional complication, viz., whose utility is referred to. If it is the sum of the individuals, then the private sector should save in accord with its individually determined optimal consumption stream, and the public sector should provide public goods and assign property rights to avoid inefficiencies resulting from externalities. The only areas of discretion, and therefore a matter of public choice, are (a) who pays for the public goods and (b) to whom are property rights assigned. Once these questions are resolved, optimization is a private matter. In most countries, however, the role of the state is larger and includes the overall management of the level of economic activity. Conceptually, we can think of some social welfare function that incorporates interpersonal and intergenerational trade-offs into a single ranking, although it would be difficult to make this concept operational.

¹³ For the approach of maximizing the present discounted utility of the future stream of consumption that is followed in the literature on optimal growth, see David Cass, "Optimal Growth in an Aggregative Model of Capital Accumulation," *Review of Economic Studies*, Vol. 32 (July 1965), pp. 233-40.

¹⁴ See J. H. Williamson, "On the Normative Theory of Balance-of-Payments Adjustment," Ch. 7 in *Monetary Theory and Monetary Policy in the 1970s: Proceedings of the 1970 Sheffield Money Seminar*, ed. by G. Clayton, J. C. Gilbert, and R. Sedgwick (Oxford University Press, 1971), pp. 233-56, and the discussions by Marcus H. Miller, *ibid.*, pp. 257-59, and P. M. Oppen-

cussion of the determinants of the current account, particularly equation (3), we thus note that conditions of optimality constrain the sum of the current account *plus* investment, but not investment or the current account per se.

Efficiency

With respect to sustainability and optimality alone, there is not a unique level for the current account. In each instance, investment plays the same role in allowing consumption to be productively deferred to the future. Introduction of conditions of efficiency in the international allocation of investment, however, does break this nexus. In particular, economic theory indicates that an efficient distribution of a fixed amount of investment in the world is characterized by the international equalization of the expected rates of return thereon. Accordingly, the level of investment in any one country is determined by its marginal productivity of capital schedule vis-à-vis that in other countries and total world savings. With its own (private *plus* public) savings determined by intertemporal utility considerations, its current account is totally determined. With investment effectively exogenous, the minimal sustainable current account as well as the optimal current account can be derived from the respective savings level.

This consideration leads to a more general comment about the current account in the long run. As several writers¹⁵ have emphasized, and as the optimizing approach makes clear, the level of the current account is not important in and of itself.

heimer, pp. 260–63. See also John Williamson, “Payments Objectives and Economic Welfare,” *Staff Papers*, Vol. 20 (November 1973), pp. 573–90.

Williamson (1971) assumes fixed exchange rates and prices, a constant rate of time preference, and a negative relation between income and the trade balance. In his analysis (p. 239), “there exists a steady-state stock of foreign assets where the marginal rate of return on foreign assets is equal to the rate of time preference (the ‘Modified Golden Rule’), and this position is approached asymptotically.” Hence, he implicitly assumes that the rate of return on foreign assets is inversely related to the stock of those assets held domestically. While this is an undefended and possibly indefensible assumption, the basic idea of his analysis (p. 238) that “a payments surplus, or a high growth rate, is a means to an end and in no sense an end in itself,” remains valid. Moreover, his overall approach of maximizing the present discounted value of the future stream of consumption is consistent with that followed in the literature on optimal growth.

¹⁵ See, for example, Harry G. Johnson, *The Canadian Quandary: Economic Problems and Policies* (Toronto, 1963), and Williamson (1971, cited in footnote 14).

Granted, there is an optimal current account, but its level is incidental to the optimal consumption stream.¹⁶ Hence, if a country's attitude toward thrift were to change, the optimal consumption stream would be altered and, along with it, the optimal current account. Moreover, in terms of targets, while it is true that a determinate optimal current account exists, the appropriate public policy control variable for maximizing social welfare is not the current account but the government deficit. It is this variable that has a direct link to the level of savings.

Worldwide equilibrium

In long-run equilibrium, the intersection of the schedule of the supply of world savings and the schedule of the marginal efficiency of investment determines the real interest rate. Each country then takes this rate as given and saves in accord with its tastes (i.e., it may choose a sustainable consumption stream, it may optimize, it may consume all its wealth in the first period) and invests geographically until, at the margin, all projects are equally profitable.¹⁷

¹⁶ The literature on economic growth, which addresses the question of optimal consumption paths, relies heavily on the concept of the steady state. This construct has all real magnitudes growing at the rate of growth of population, usually denoted by n . In per capita terms, let K_D be the domestic capital stock and K_F be net ownership of capital abroad. Letting r represent the rate of return on capital, one can rewrite equation (3):

$$X - M + rK_F = n(K_D + K_F) - nK_D \quad (3')$$

This is true because rK_F is factor payments from abroad; $n(K_D + K_F)$ is the steady-state level of savings that keeps per capita wealth constant; nK_D is per capita investment that maintains the capital/labor ratio. Simplifying equation (3') to

$$X - M + rK_F = nK_F \quad (3'')$$

we note that the countries that are net owners of foreign capital will have current account surpluses. Moreover, for "normal" utility functions that display some time preference for present consumption, the optimal rate of savings and capital accumulation will be such that the rate of return on capital will exceed the rate of growth, that is, $r > n$. Hence, the trade account will be negative.

The meaning of this is straightforward. In the steady state, the pattern of current account surpluses is set by the pattern of ownership of foreign assets. For example, if country A owns capital abroad, its imports will exceed its exports, but because it will continue to replenish its holdings abroad, it will not consume all its factor payments. Rather, it will invest a portion; hence, its current account will remain positive.

¹⁷ This, of course, assumes perfect capital mobility. Without it, interest rates can differ across countries, and the determination of the worldwide equilibrium becomes more complicated, although it continues to be governed by the same

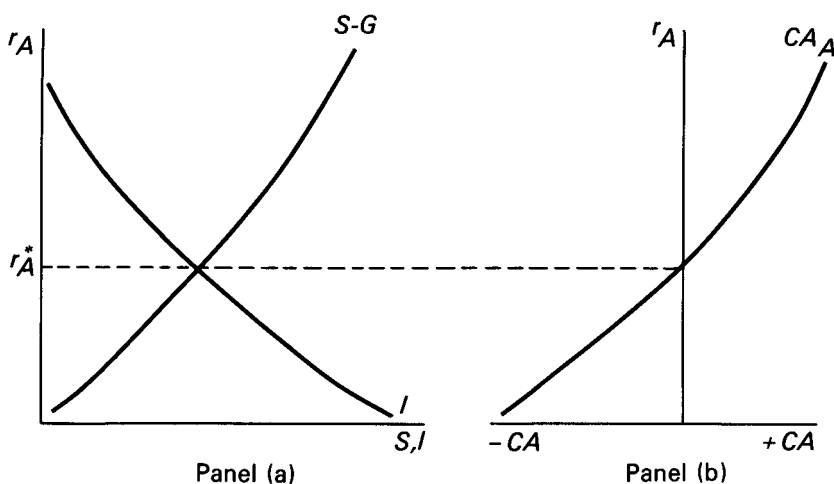


Figure 1

Panel (a) of Figure 1 depicts savings and investment schedules as functions of the interest rate, r_A ,¹⁸ for a hypothetical country A. If this were a closed economy, the market-clearing interest rate would be r_A^* . Panel (b) of Figure 1 portrays the excess of savings over investment at each interest rate as the corresponding current account, CA_A . Because, as drawn in Panel (a), the level of savings is never negative, the current accounts shown in

forces. For some interesting empirical analyses that challenge the appropriateness of the assumption of perfect capital mobility, see Jacques R. Artus, "Persistent Surpluses and Deficits on Current Account Among Major Industrial Countries" (unpublished, International Monetary Fund, May 24, 1979); and Martin Feldstein and Charles Horioka, *Domestic Savings and International Capital Flows*, Harvard Institute of Economic Research, Discussion Paper Series, No. 700 (April 1979), pp. 1-28.

¹⁸ Economic theory would have the interest rate determine the desired levels of the stocks of wealth and capital, rather than the flows of savings and investment. The posited relationships between the interest rate and these flows can be derived in one of two ways. First, the economy can be in a steady state with growing population. Here, savings and investment will vary directly with wealth and the capital stock, respectively. Hence, any interest-rate-induced change in these variables will likewise prompt a permanent change in the corresponding flow variables. In addition, there could be a stock adjustment mechanism that causes actual wealth and the capital stock to approach their desired levels only over time. Accordingly, a change in the interest rate would evoke flows of savings and investment, which could persist for some time, even if the ultimate equilibrium was one of constant wealth and capital.

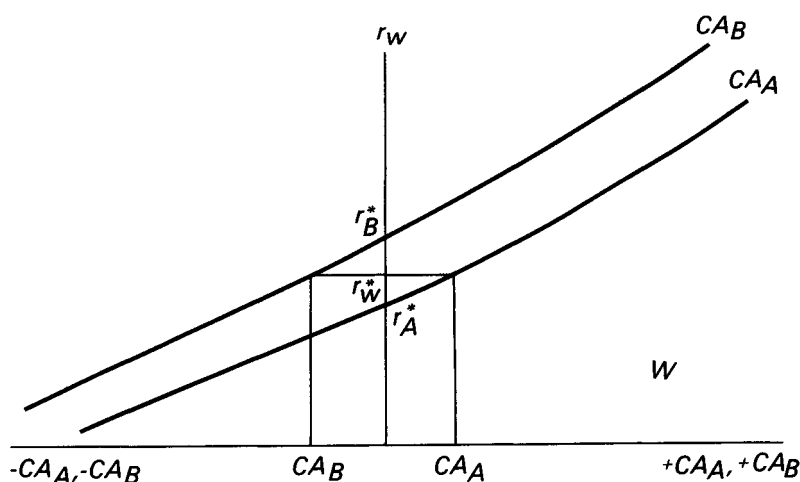


Figure 2

Panel (b) are all sustainable for an economy with constant population.¹⁹ Note that the current account is zero at r_A^* . Figure 2 overlays two such schedules for different countries, A and B, as functions of the world interest rate, r_w . Equilibrium obtains at r_w^* , where the surplus of country A just equals the deficit of country B.

The diagrams are useful in clarifying two aspects of the current account. First, international inconsistencies in countries' desired current accounts are precluded in Figure 2 by the schedules' being drawn with some slope. Accordingly, an incipient excess demand for current account surpluses, that is, an excess of world savings over world investment, would be extinguished by a decline in the interest rate, decreasing savings and increasing investment in both countries. Nevertheless, it is conceivable, although certainly not optimal, that countries would have current account schedules that are always vertical,²⁰ raising the possibility of mutual inconsistencies. Second, unsustainable deficits have also been ruled out by the construction of Figure 2,

¹⁹ Of course, if A is growing, minimal sustainable savings will exceed zero. The largest sustainable current account deficit would be reduced correspondingly.

²⁰ This formulation would imply that savings move inversely with the interest rate and, in fact, follow the course of the investment schedule.

in which savings are never negative. As noted earlier in the discussion of sustainability, an unsustainable deficit can occur and can continue, but only temporarily. The logic of its prolonged persistence would be that the surplus country was financing foreign consumption out of its own savings, so that it could continue the act of saving and not so that it could increase future consumption. This conclusion is due to the inevitability of arriving at the point where the deficit country's debt service burden exceeds its income, and, while possible, it would be irrational for the surplus country to perpetuate such a state.²¹

SHORTER-RUN CONSIDERATIONS

The preceding section outlined the factors that bear on the current account in the long run. It showed that, in principle, there exists a current account that is consistent with optimality and efficiency. While this may be taken as a long-run norm, the dual questions of what is the desired current account and should it be pursued as a policy target are surely meant to apply over the short run. Moreover, these questions have operational content at this level only when viewed in the context of disturbances that beset the economy and cause it to depart from its long-run equilibrium. In what follows, two kinds of shock are differentiated—permanent and temporary. The former necessitates adjustment, that is, embarking on the path to the new long-run equilibrium. In this respect, the question is, What is the desired level of the current account during the adjustment period? Regarding the latter, it is whether an economy should pursue its desired current account as a target in the face of reversible shocks that would otherwise cause its desired and actual current accounts to diverge.

²¹ While an unsustainable deficit necessarily gives rise to a complementary, unsustainable surplus, the surplus country can dictate the timing of adjustment to the deficit country in a way that the deficit country cannot do in reverse. Hence, while a surplus may not be sustainable, it is a matter of national discretion when and how it adjusts. This difference between surplus and deficit positions frequently causes the free market's allocation of the burden of adjustment to fall more heavily on deficit countries, and explains the continuing quest for a resolution of this asymmetry at the international level. This same issue caused Robinson to write some 30 years ago, "The rules of good neighbourly behavior in international trade require that a country should have a surplus no larger than its continuous lending can cover." See Joan Robinson, "Exchange Equilibrium," in her *Collected Economic Papers*, Vol. 1 (Oxford, 1951), pp. 214–24, especially p. 221.

Reversible shocks

Temporary, reversible shocks, when unchecked, have ramifications for the level of employment, prices, and the current account. Stabilization policy, to some extent, is directed at minimizing the disutility associated with departures of these variables from their longer-run, desired levels, and its formulation can be viewed as the selection of target variables and the assignment of policy instruments for their achievement. The literature on targets and instruments allows for two interpretations of the word "target." In one, the current account would be a final target, desired for its own sake and in the pursuit of which other goals would be sacrificed. In the other, the current account would be a "proximate" target, aimed at because of its relation to the true target and its more direct controllability. In this case, its desired level would be derived from the desired level of the true target.

If one were to ask whether the current account should be added to the economy's short-run employment and price stability goals, the answer would surely be No. Our long-run analysis indicates that the current account matters primarily because of its relation to savings. Savings, however, are important for maintaining the path of consumption, that is, optimizing behavior would have savings varying in the face of fluctuations in income, so that a steady consumption stream could be maintained over all. The same reasoning applies to the current account. Hence, the current account should be included as a short-run target only if it helps to stabilize employment and prices.

Using aggregate demand as a proxy for employment and inflation,²² we find that an exogenous increase in domestic expenditure tends to increase aggregate demand and to crowd out net exports. Similarly, an exogenous increase in net exports enlarges total aggregate demand and displaces some purely

²² If aggregate demand is too high, inflation will accelerate. If it is too low, there will be unemployment. Hence, stabilizing aggregate demand tends to facilitate the continuous attainment of the economy's inflation and employment targets. This treatment is consistent with much of the literature on stabilization policy, which seeks to minimize a quadratic loss function with respect to the values of the policy instruments. The quadratic form allows excesses and shortfalls in aggregate demand to enter with equal weight. See, for example, William Poole, "Optimal Choice of Monetary Policy Instruments in a Simple Stochastic Macro Model," *Quarterly Journal of Economics*, Vol. 84 (May 1970), pp. 197-216.

domestic expenditure. Stabilizing the current account in the latter case tends to stabilize aggregate demand, whereas, in the former, it aggravates the effect of the disturbance on overall aggregate demand—the primary target. This suggests that countries for whom the largest source of exogenous variance in aggregate demand is the foreign sector might find it advantageous to pursue current account targets. On the other hand, those countries where domestic expenditure is exogenously the more variable component would be well advised to have the current account act as a shock absorber. The transformation of this general principle into a specific program for policy, however, depends on the availability of an effective instrument of control.

From the early literature,²³ one would infer that a flexible exchange rate regime is a suitable vehicle for achieving the desired stabilization of aggregate demand in the face of shocks from either quarter. Specifically, according to the version of the Fleming-Mundell model that posits perfect capital mobility, an exogenous increase in aggregate demand prompts an appreciation of the exchange rate that restores aggregate demand to its preshock level. The source of the shock simply determines whether, after the appreciation, net exports are less than or equal to their preshock level. Widespread experience with floating in recent years, however, has greatly increased the perceived importance of the caveats that delimit this analysis. Thus, while the primary source of variance in aggregate demand remains a reasonable criterion for establishing the desirability of stabilizing the current account, knowledge gained since 1973 has rendered the analysis largely irrelevant as a practical matter: Without an instrument of control, it is hardly worthwhile to ponder in what direction the current account should be manipulated.

A primary source of difficulty with the older analysis is its time perspective. Since it relies on a static construct, it necessarily compresses all actions and reactions, which in actuality take varying lengths of time to unfold, into a single moment. Amending the model to allow the posited mechanism of adjustment to proceed in stages, we find that as output and the interest rate drift upward, the exchange rate still appreciates, but by a greater

²³ J. Marcus Fleming, "Domestic Financial Policies Under Fixed and Under Floating Exchange Rates," *Staff Papers*, Vol. 9 (November 1962), pp. 369–80; Robert Mundell, "Flexible Exchange Rates and Employment Policy," *Canadian Journal of Economics and Political Science*, Vol. 27 (November 1961), pp. 509–16.

amount.²⁴ Because trade flows take time to react to price and exchange rate changes,²⁵ the capital account must equilibrate the market for foreign exchange. Hence, the exchange rate "overshoots" so as to establish expectations of a subsequent depreciation and reduce the otherwise too-high expected rate of return on domestic assets. Over time, if the shock persists for a while, the higher interest rate will reduce consumption and investment, and the appreciation will diminish export demand. In this version, then, floating tends to offset the real effects of expenditure shocks,²⁶ but the process is far from instantaneous. Hence, over the period of interest here, floating is not an effective means to stabilize demand. There is an additional complication that a change in the exchange rate introduces via its possible effect on prices. Either because of wage indexation or union power in general, exchange rate reductions, even if otherwise they were eventually to be reversed, may become embedded in the cost structure of the economy, thereby requiring their

²⁴ See Rudiger Dornbusch, "Exchange Rate Expectations and Monetary Policy," *Journal of International Economics*, Vol. 6 (August 1976), pp. 231-44, for an analysis that places the Fleming-Mundell model in a framework where asset markets clear faster than goods markets.

²⁵ See Helen B. Junz and Rudolf R. Rhomberg, "Price Competitiveness in Export Trade Among Industrial Countries," *American Economic Review, Papers and Proceedings*, Vol. 63 (May 1973), pp. 412-18; and C. A. Enoch, "Measures of Competitiveness in International Trade," Bank of England, *Quarterly Bulletin*, Vol. 18 (June 1978), pp. 181-95.

²⁶ Even within the confines of the Fleming-Mundell analysis, the general presumption that flexible exchange rates tend to stabilize aggregate demand depends on the comparative stability of the goods market relative to the money market. Consider the effects of a shift in the demand for money under both fixed and floating exchange rates. Under the former, the country's stock of international reserves will change. Under the latter, the interest rate and the exchange rate will change, both with repercussions for the real economy. Hence, as a general rule, if most disturbances are of the monetary variety, the country should fix its exchange rate, or at least have an active intervention policy directed at ratifying monetary shocks. See Victor Argy and Michael G. Porter, "The Forward Exchange Market and the Effects of Domestic and External Disturbances Under Alternative Exchange Rate Systems," *Staff Papers*, Vol. 19 (November 1972), pp. 503-32.

In a closed economy framework, Poole (1970, cited in footnote 22), found that a money supply target is the preferred strategy if most shocks to the economy are of the expenditure variety, whereas an interest rate target would better stabilize aggregate demand if more variance is due to the money market. In his analysis, the selection of targets must be made in advance, before knowledge is available about the source of the shock in any particular instance. The choice of fixed versus floating exchange rates can be seen in a similar light: If the type of disturbance is not apparent when an offsetting policy measure could most profitably be used, then it is preferable to have a rule the pursuit of which maximizes expected utility.

maintenance and aggravating the inflationary bias in the system as well as diminishing the effect of any exchange rate change on net exports. This influence from the supply side of the economy further limits the usefulness of the exchange rate as an instrument of very short-run stabilization policy.²⁷

The adjustment process

The economy is also subject to shocks of a more enduring nature. Because these tend to alter the long-run position of the economy, adjustment is in order. In this context, the role of stabilization policy is not to buffer temporary shortfalls and excesses in aggregate demand but rather to ease the economy's transition from one long-run stochastic equilibrium to another. This paper is concerned with two aspects of this problem. First, from the individual country's point of view, how does the current account, in general, fit into the overall adjustment process? Second, and in particular, is it always preferable to have a higher current account? An affirmative answer here would raise the potential for conflict among countries pursuing similar adjustment goals and would suggest that some scheme for allocating current accounts across countries might be desirable.

Prior to addressing these questions, it is useful to sketch a simple basic framework for thinking about the adjustment process. To this end, consider a negative but permanent demand shock. This could be either an exogenous increase in the domestic savings function or an exogenous decrease in the investment function or the demand for net exports. In either case, aggregate demand falls in the first instance. If prices and wages were fully flexible, downward movements therein would move the economy automatically to a new equilibrium. And, if this were a closed economy, the new output level would be the same as initially—prices and wages would simply be lower. Essentially, lower prices combined with an unchanged money stock reduce the interest rate and cause the level of investment to rise, thereby replenishing real aggregate demand.²⁸ In the open economy,

²⁷ See Jürg Niehans, "Some Doubts About the Efficacy of Monetary Policy Under Flexible Exchange Rates," *Journal of International Economics*, Vol. 5 (July 1975), pp. 275–81.

²⁸ In the long run, the lower real interest rate would be consistent with reduced stocks of wealth and capital if the initial shift were a decrease in investment or with increased stocks of both if the initial shift were an increase in savings.

the picture is only slightly more complicated. Here, as prices fall, the quantity demanded of net exports rises. Incipient decreases in the interest rate prompt a capital outflow that continues until interest rates worldwide are likewise lower. Investment at home and abroad both rise, but full employment at home is restored primarily through exports. In the open economy, the new "full employment" level entails less output and employment as well as a lower real wage to labor,²⁹ this being necessary to lower the relative price and to generate an increase in the quantity demanded of net exports.³⁰

In a Keynesian world, money wages and prices are inflexible downward. Introducing this constraint into our shock example, we find that adjustment to the new full employment point will not occur immediately. Rather, unemployment will persist until either the experience of recession weakens prices and wages or policy intervenes. With respect to the latter, the authorities have basically two options—they can either expand fiscally or devalue.³¹ Either initiative will restore aggregate demand and employment to their previous levels. The deciding factor is whether it is preferable to increase consumption today or tomorrow. If tomorrow, then, within the confines of the Keynesian model, devaluation facilitates the attainment of this objective. Net exports will increase, and the proceeds can be invested abroad³² to be redeemed when desired. Note the implications of this model for the political importance of the international distribution of current accounts and the level of the exchange rate between two countries. In response to a negative demand shock,

²⁹ In the closed economy, both labor and its employers deal in the same commodities. In the open economy, employers are concerned about the price of their products, that is, exports. Labor consumes both exportables and imports. It can be shown that this dichotomy causes a one-to-one positive relation between the relative price of domestically produced goods and the real wage to labor. Moreover, if it is assumed that the supply of labor services varies positively with its wage, the full employment level of output likewise varies positively with the relative price of exports and the real wage. In such a model, a negative shock would lower both the real wage and the full employment level of output. See Joanne Salop, "Devaluation and the Balance of Trade Under Flexible Wages," in *Trade, Stability, and Macroeconomics: Essays in Honor of Lloyd A. Metzler*, ed. by George Horwich and Paul A. Samuelson (New York and London, 1974), pp. 129–51.

³⁰ Clearly, if the demand for exports is perfectly elastic so that any domestic reductions in demand are absorbed by exports, the real wage need not fall in response to a negative demand shock.

³¹ Or cause the exchange rate to depreciate by expanding the money supply.

³² Presumably, domestic investment is already being carried out efficiently, so that the marginal product of capital equals the rate of interest.

a country's dual goals of maintaining employment and deferring consumption can be satisfied by increasing its current account surplus, through a devaluation. Clearly, this kind of setting can breed conflict among nations when all are subjected to the same disturbance. This was evident enough during the 1930s, and the sentiments it evokes are not unknown today.

If, however, real wages are inflexible in the downward direction, the power of exchange rate policy is greatly diminished.³³ The preservation of real wages will cause nominal wages to rise with consumer prices, including import prices, and the subsequent effect of increased wages on export prices will offset some or all of the improvement in relative prices arising from the devaluation. While the actual postdevaluation outcome in terms of employment and the current account depends on the accompanying set of demand policies, a general point can be made. If domestic demand is restrained so that the rise in domestic prices following the devaluation is moderated, the current account will improve but the employment situation will deteriorate. Here the prevailing real wage will be in excess of its market-clearing level. Conversely, if domestic demand is expanded to alleviate the unemployment, wages and prices will rise sufficiently to worsen the current account. Here, generous demand conditions raise the market-clearing real wage and the actual real wage may rise as well. In this kind of climate, two alternative policy reactions are possible. Either a recession can be endured until real wage demands have weakened sufficiently that the lower associated relative price of exports can induce export demand in quantities consistent with full employment; or adjustment can be forestalled by a permanent increase in the government deficit,³⁴ which restores full employment by increasing the market-clearing real wage. As before, the deciding factor should be what

³³ See Victor Argy and Joanne Salop, "Price and Output Effects of Monetary and Fiscal Policy Under Flexible Exchange Rates," *Staff Papers*, Vol. 26 (June 1979), pp. 224-56; W. M. Corden, *Inflation, Exchange Rates, and the World Economy: Lectures on International Monetary Economics* (University of Chicago Press, 1977), p. 33; Jeffrey Sachs, "Wage Indexation, Flexible Exchange Rates, and Macro-Economic Policy" (scheduled for publication in the *Quarterly Journal of Economics*); Tibor Scitovsky, "Asymmetries in Economics," *Scottish Journal of Political Economy*, Vol. 25 (November 1978), pp. 227-37.

³⁴ If investment or export demand were to fall exogenously, clearly an increase in government consumption would not be consistent with optimality, if the preshock path had been optimal. If it is consumption that falls, the judgment is more complicated: If private sector consumption falls, does one infer a shift in time preference toward the future? Should the government offset it?

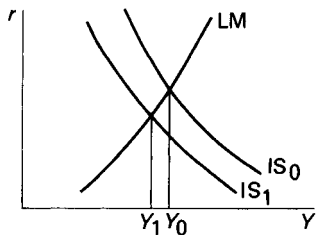
path ³⁵—fully accommodating, fully adjusting, or some intermediate position—promises the highest level of total utility.

Probably the most relevant model is one that combines the nominal wage and price rigidities of the Keynesian system with the real wage rigidity of the other. ³⁶ In this kind of environment,

³⁵ The issue of the optimal speed of adjustment is simply a complication, albeit a thorny one, to the optimal consumption problem discussed earlier. The same utility function applies, the only difference arising in the economy's ability to transform production today into production tomorrow. It does not seem unreasonable to assume that there exists some positive relation between the level of employment within a period and the degree of adaptation of real wage demands, that is, more unemployment earlier will cause real wages to adjust faster and will prevent unemployment later. This being true, an adjusting economy can productively defer consumption from today until tomorrow via exports and investment as before, but also by enduring unemployment today. More unemployment today permits there to be less unemployment tomorrow and more production and consumption then. The general solution would have the rate of return on deferring consumption via investment or via unemployment equal on the margin. Because the relative price of exports, for a given real wage, falls as the level of unemployment rises, net export demand rises with the level of unemployment. This relationship follows from the profit-maximizing condition of the firm, whereby labor is employed up to the point where its marginal revenue product equals the nominal wage, and from the assumption that labor earners deflate their nominal wage by a price index that includes both imports and domestically produced goods. A fall in the price of the exportable good will be met with a smaller proportional decline in the nominal wage. The rise in the relative cost of labor services causes demand for them to decline.

³⁶ The increase in oil prices is the most important recent example of a large shock necessitating adjustment, and its effects are most fruitfully analyzed in terms of the combined model. In the first instance, the oil shock raised the value of imports. This had a doubly contractionary effect on oil consuming countries. First, the level of nominal and real aggregate demand was reduced. Second, on the supply side, the market-clearing level of the real wage fell. Both effects could be reversed by a cut in taxes. However, if the consumption path prevailing prior to the price increase had been optimal, such a response would not be consistent with continued adherence to such a criterion. Instead, some adjustment to a lower consumption path should occur.

Treating the industrial countries as a single entity, we note in IS-LM terms that a shock, such as the withdrawal of purchasing power accompanying the price increase by the Organization of Petroleum Exporting Countries (OPEC), shifts the IS curve to the left. As shown, aggregate demand falls from Y_0 to Y_1 . The contractionary effect on nominal aggregate demand can be reversed by either a fiscal or a monetary expansion each of which shifts its respective locus to the right. As previously noted, however, the oil price rise also reduced the market-clearing level of the real wage. If real wages



a negative shock to aggregate demand results in unemployment on two counts. First, there is inadequate demand for goods and services at current prices. As a consequence, producers employ fewer workers than would be consistent with their equating labor's marginal revenue product with the wage.³⁷ Second, because the real wage is too high, there would be excess labor supply even if firms, not being constrained by demand, were to employ labor in accord with their profit-maximizing marginal productivity conditions. Currency depreciation, by increasing the demand for net exports, raises the price that clears the economy's goods market. Attendant to the prevailing price becoming consistent with equilibrium there, an improvement in the current account and an expansion in output and employment are simultaneously fostered. Hence, an increase in the current account unequivocally improves a country's situation and is therefore a potential source of friction among countries, but only up to a point. Once the point is reached where downward nominal price rigidity no longer constrains the market-clearing process, devaluation of the currency can improve the current account only as employment falls.

were not to fall commensurately, employment would have to fall. Attempts to increase employment above the level determined by these real wage demands would result in nominal price and wage increases with no lasting employment effects. The ability of expansionary policy to have real effects depends, then, on the level of potential output determined by these supply forces relative to the level of actual output. In terms of the diagram, one may ask whether potential output is in the neighborhood of Y_1 , in which case expansion would affect mostly prices; or whether it is in the neighborhood of Y_0 , in which case real output could be increased by expansionary demand measures. If the latter is true, then currency depreciation by a single country can be effective in simultaneously improving the current account and expanding output.

In their analysis of the coincidence of the high unemployment and inflation rates that have beset the industrial countries in recent years in the wake of the oil crisis and other supply disturbances, Bruno and Sachs stress the importance of the level of potential output, determined by supply factors, relative to the level of actual output, determined by aggregate demand. See Michael Bruno and Jeffrey Sachs, "Supply Vs. Demand Approaches to the Problem of Stagflation," National Bureau of Economic Research, Working Paper No. 382 (August 1979). See also Knut Anton Mork and Robert E. Hall, "Energy Prices, Inflation, and Recession, 1974-1975," National Bureau of Economic Research, Working Paper No. 396 (July 1979).

³⁷ For an analysis of the closed economy when firms are demand constrained, see Robert J. Barro and Herschel I. Grossman, "A General Disequilibrium Model of Income and Employment," *American Economic Review*, Vol. 61 (March 1971), pp. 82-93.

II. Official Views on the Current Account

Economic authorities on the national and the international level have expounded their views on desired current account developments on a number of occasions. This part of the paper presents a selected survey of the views that are best seen in the context of the discussion in the preceding sections. Long-run and shorter-run considerations both apply in varying degrees to national and international pronouncements. Strictly long-run notions about the current account are entertained only implicitly and in very few countries. The majority of pronouncements refer to the adjustment problem over the shorter run.

The fundamental long-run objective of economic policy in all countries is that of prosperity, the current account being conceded a subsidiary role. Most everyone would agree that, "... neither the current account nor the exchange rate should be viewed as an ultimate objective of policy in the same sense that real income and the rate of unemployment are. These external variables do not directly affect the welfare of citizens, although they have important effects on variables that do."³⁸ As their sights are set on the full employment of the labor force in the future, the authorities are concerned with long-run developments in aggregate demand in general and in investment and savings in particular. The Netherlands is a case in point. Its authorities pursue what they call a "structural budget policy," a policy that aims at a level of investment consistent with full employment, given the trends in population, labor force, and savings developments.³⁹ In view of the apprehension at present that private investment will prove insufficient, the authorities plan to complement it with a rise in public investment. They envisage, therefore, a larger structural budget deficit in years to come.⁴⁰

³⁸ *Annual Report of the Council of Economic Advisers* (Washington, January 1978), p. 116.

³⁹ In their own words, a structural budget policy is a policy that "—disregarding fluctuations of an incidental or cyclical nature—is compatible with the desirable longer term level of saving and investment in the other sectors of the economy." See Ministry of Finance, *The Netherlands Budget Memorandum*, 1976, p. 42.

⁴⁰ With reference to public investment, the authorities point out that "the impression [is] that the acceptable structural budget deficit could undergo an upward adjustment. On the basis of the likely trends in the period after 1976 a number of factors would also seem to point in the same direction. Private investment will make smaller demands on savings, due among other things to the decline in population growth and, partly in conjunction with this, to a more

Clearly, then, recalling that the current account surplus is determined by the excess of private *plus* public savings over private and public investment, the long-run current account developments in the Netherlands will fall out of its structural budget policy given private savings and investment behavior.

Although the current account is not, and should not be, a primary target in the long run, its sustainability is considered important. For example, the Norwegian authorities acknowledge that current account deficits accompanied by high rates of capital formation are sustainable while those accompanied by high rates of public consumption may not be sustainable.⁴¹ This echoes the U.S. view that the sustainability of a current account deficit is a question of “. . . whether the willingness of foreign investors to acquire claims on a country or the willingness of domestic investors to reduce claims on foreigners will remain strong enough to finance a given deficit.”⁴²

With regard to the medium-term adjustment problem, many countries have made their views known: France, the United Kingdom, the United States, Canada, Japan, the Federal Republic of Germany, Italy, Denmark, Austria, and Norway. France apparently aims at a zero current account balance by 1980. This is an objective that is to be achieved simultaneously with the restoration of full employment.⁴³ The United Kingdom aims at a trade surplus that would be at least large enough to finance its foreign debt between now and the mid-1980s (estimated at some \$20 billion), implying a zero current account balance or a current account surplus on average over the years from about 1978 to 1985.⁴⁴ At the same time, the authorities would have to pursue

frequent occurrence of saturation phenomena in the construction industry.” *Ibid.*, p. 43.

⁴¹ Eivind Erichsen, “Economic Planning and Policies in Norway,” *Challenge*, Vol. 20 (January–February 1978), pp. 5–13.

⁴² *Annual Report of the Council of Economic Advisers* (cited in footnote 38), p. 116.

⁴³ France considers the restoration of a durable current account balance by 1980 a fundamental objective of the VII Plan, and in view of its aim to restore full employment, the VII Plan pursues maximum growth consistent with equilibrium in the current account. See Philippe Rossignol, “Régler la facture pétrolière,” *Economie & Statistique* (December 1976), pp. 45–51; Commissariat Général du Plan, “Rapport sur l’orientation préliminaire du VII^e Plan,” *Documentation Française*, 1975, and “VII^e Plan de développement économique et social 1976–1980,” *Documentation Française* (1976).

⁴⁴ See the speech by Denis W. Healey at the Fund’s Annual Meeting, *Summary Proceedings of the Thirty-Second Annual Meeting of the Board of Gover-*

an exchange rate policy that would be consistent with a desired trade surplus of that size.⁴⁵ Denmark and Italy are two more countries that have recognized the need to reduce foreign indebtedness and to improve the current account over the next few years as a precondition for a sustainable increase in employment; both countries appreciate that improvement in the current account requires moderation in the rise of income.⁴⁶ Austria and Norway, in line with their full-employment policies, have allowed their current accounts to deteriorate substantially in recent years. However, the larger than expected deficits in both countries have prompted the authorities to induce a return to more "normal" levels. In Austria, this would mean a trade deficit that is approximately matched by a surplus on net services, while Norway expects the deficits to turn into surpluses in the 1980s—largely on account of expectations that the current transactions of the oil sector would move from the pattern of deficits that it recorded from 1970 to 1977 to a pattern of surplus.⁴⁷

The Canadian case is of particular interest, owing to the role that the current account is accorded in the general strategy to realize primary targets. At present the authorities aim at a reduction in both the output gap and inflation over the medium term

nors (Washington, 1977), pp. 57–63, and the speech by Gordon Richardson at the Overseas Bankers Club, January 31, 1977.

⁴⁵ The desirability of a surplus on current account over the next several years is also expressed in "Economic Commentary," Bank of England, *Quarterly Bulletin*, Vol. 17 (December 1977), p. 431: "... after large current account deficits for four years, it seems clearly desirable for the current account now to stay in surplus," and "It has been the relative weakness of the United Kingdom's current account position in the post-war period that has underlain the chronic exposure of the United Kingdom's external financial position and the past instability of sterling. A current account surplus having now been achieved, it would surely be imprudent to re-create those conditions by not maintaining a position of surplus."

⁴⁶ See Guido Carli, "Italy's Malaise," *Foreign Affairs* (July 1976), pp. 708–18; Rinaldo Ossola's statement on Italy in *The New International Monetary System*, ed. by Robert A. Mundell and Jacques J. Polak (New York, 1977), pp. 37–40; and Raymond Lubitz, *The Italian Economic Crisis of the 1970's*, International Finance Discussion Papers, No. 120, Board of Governors of the Federal Reserve System (Washington, June 1978). For the case of Denmark, see, for example, the report by Reuters on a statement by the Danish Finance Minister Knud Heinesen, August 16, 1978.

⁴⁷ See Österreichisches Institut für Wirtschaftsforschung, *Monatsberichte*, various issues. In Austria, reduction of the current account deficit in 1978 was in large measure accomplished through restrictive fiscal and monetary policies, including the doubling of the value-added tax on a broad range of goods, many of which are imported, and the substantial tightening of growth in bank credits to consumers. For the Norwegian case, see Erichsen (1978, cited in footnote 41), p. 10.

from 1978 to the end of 1981.⁴⁸ Implicit in the output and inflation targets, which may be regarded as primary, is a target for the current account, since exports and the various components of absorption are all assigned specific roles in the realization of desired output and inflation.⁴⁹ From this it may be inferred that the primary targets have to be aimed at jointly, rather than individually, and that they will be consistent with only one particular composition of the current account.⁵⁰ The Canadian authorities see no difficulty in financing the prospective current account deficit through a net inflow of long-term capital.⁵¹ The situation appears to be one in which all current account deficits within a fairly broad range would be sustainable. Hence, the authorities can pursue their output and inflation targets without being constrained by the size of the concomitant current account deficit.

The situation in Japan is again different. Matching the current account surplus with a net long-term capital outflow has proved more or less difficult in the past five years. At the time that the economic plan for Japan for the second half of the 1970s was formulated, the avowed aim of a zero basic balance seemed easy enough to realize.⁵² Soon afterward, however, the Japanese au-

⁴⁸ Canada, Department of Finance, *Canada's Economy—Medium-Term Projection and Targets* (February 1978).

⁴⁹ *Ibid.*

⁵⁰ Any straying from the charted path, such as a shift from net exports to absorption in pursuit of the output goal, would raise inflation above the target level owing to the depreciation in the exchange rate attending that shift over the medium term. The same would apply regarding inflation if depreciation were used to induce a shift from absorption to net exports. Yet, it is not the current balance per se that matters. What is important is the level of exports and the level of imports that are contingent on the role envisaged for absorption and on the desired improvements in competitiveness. The resulting balance is purely incidental. Aiming at it, for example, through relatively greater reliance on specific measures that reduce imports rather than on expanded exports would likely compromise both the output and the inflation target. This would occur because a shift to import substitutes would tend to boost inflation and, if the real value of wealth is to be maintained, induce a switch from expenditure to savings. Thus, the authorities' specific output and inflation targets and the current account target—in terms of the levels of exports and imports that are consistent with the desired composition of aggregate demand over the medium term—are mutually dependent and can be reached only simultaneously.

⁵¹ *Ibid.*

⁵² For the aim of a zero basic balance over the medium term in Japan, see Economic Planning Agency, *Economic Plan for the Second Half of the 1970s* (May 1976). The plan covers the five years from fiscal 1976 to fiscal 1980. See also Ministry of International Trade and Industry, *White Paper on International Trade, 1979*, Part II (June 1979).

thorities introduced an emergency import program⁵³ and relaxed capital controls so that a rapidly rising surplus on current account could be offset at least in part by a net outflow of long-term capital.⁵⁴ Since late in 1978, the tendency of the current account surplus to rise has been reversed. Owing both to the strengthening of the volume effects in the wake of the preceding yen revaluations and the rise in domestic demand, the current account has moved into rough balance.

The United States does not appear to have set itself any specific current account target, having generally argued against such targets.⁵⁵ Nevertheless, it has clearly been concerned over its large trade deficit with Japan, and the emergency import programs, inter alia, may be seen in the context of U. S. promptings to reduce the Japanese surplus.

The authorities in the Federal Republic of Germany, like those in the United States, do not set explicit targets for the current account. Still, the notion appears to be accepted that an advanced industrial country should typically show a current surplus, since it is expected to promote the international transfer of resources through net exports of long-term capital.⁵⁶ How large that surplus would be is not a question that is dealt with in any specific way, yet the surplus recorded in 1978, amounting to less than 1 per cent of total output, was regarded as "normal."⁵⁷

⁵³ See, for example, the report on Japan's plan to seek \$12.5 billion in "emergency imports" in the *Journal of Commerce* (August 16, 1978), p. 9.

⁵⁴ On an annual average level, the current account showed a surplus of some US\$10.5 billion in the years 1976 through 1978—about half of this amount being offset by net long-term capital outflow. See *White Paper on International Trade, 1979* (cited in footnote 52).

⁵⁵ See *The Future Pattern of Current Balances and Related Policy Questions*, Organization of Economic Cooperation and Development, Economic Policy Committee, Working Party 3 (75)12 (Paris, October 27, 1975), p. 4.

⁵⁶ A view that is also shared by Japan—see *Economic Plan for the Second Half of the 1970s* (cited in footnote 52)—and by the United States—see *Annual Report of the Council of Economic Advisers* (cited in footnote 38).

⁵⁷ See *Jahresgutachten 1978/79 des Sachverständigenrates zur Begutachtung der gesamtwirtschaftlichen Entwicklung* (November 1978). As for the future, there are reasons to believe that the structural current account surplus may increase, at least in the long run. The Federal Republic of Germany may no longer continue to attract large numbers of foreign workers and instead may shift production to low-wage countries, inducing a decline in the rate of domestic capital formation and a rise in the current account surplus. Giersch points out that "... more and more of [total household and business savings which is channeled into domestic investment] needs to be and will be invested abroad. One reason is the political decision based on widespread public feeling that we should cease to attract more workers from abroad. If industrial labour becomes scarcer and more expensive in relation to capital we shall have to substitute

The authorities recognize that, at the present juncture, they cannot rely on exports to sustain recovery because of the need for adjustment of payments imbalances among their trading partners. More than in the past, this is a role that will have to be played by domestic absorption.⁵⁸

III. Summary, Conclusions, and Implications

Our analysis suggests that there does exist an optimal long-run current account that is derived from optimal savings behavior and the efficient international distribution of investment expenditure. Economic welfare within a country is reduced by a current account in excess of this level, and the optimal long-run current account may be either a surplus or a deficit. Because optimal savings vary directly, and the number of profitable investment opportunities inversely, with the interest rate, mutual inconsistencies in the international set of optimal current accounts are precluded, in principle, by the establishment of a market-clearing interest rate, which equates the worldwide sums of efficient investment and optimal savings. While the optimal current account is uniquely defined by the economy's opportunity set and its social welfare function, any number of current accounts are equally sustainable in the long run. This criterion requires only that the economy's savings rate be high enough to maintain the present level of per capita wealth, income, and consumption. As noted in the text, any level of consumption can be maintained indefinitely if savings equal the product of the rate of growth of population and wealth. A current account deficit consistent with savings greater than or equal to this amount would be sustainable. If savings fall short of this amount, per capita consumption will ultimately have to decline, even though, as long as savings remain positive, long-term financing may still be forthcoming in support of the economy's remunerative investments.

In a stochastic environment, disturbances occur that cause the economy to cycle about its equilibrium path. Because the opti-

capital for labour. But this is becoming more and more difficult. Hence there will be an increasing tendency for firms to shift production . . . to low wage countries. . . ." See Herbert Giersch, "Current Problems of the West German Economy," *Nationaløkonomisk Tidsskrift*, Vol. 114 (No. 1, 1976), pp. 46-56, especially p. 47.

⁵⁸ See *Jahresgutachten 1978/79* (cited in footnote 57).

mal policy would stabilize aggregate demand, the authorities would want to stabilize the current account if it is the primary source of exogenous variance in aggregate demand, and to let it act as a buffer if domestic demand is exogenously more variable. Their ability to achieve these alternative goals, however, depends on the availability of an effective instrument of control. In theory, a flexible exchange rate stabilizes aggregate demand in the face of expenditure shocks regardless of source and, accordingly, provides a mechanism for achieving the desired goal. However, in practice, there are many complications (not the least of which are lags in the adjustment of exports and imports to changes in their prices) that seriously detract from the ability of floating to stabilize aggregate demand in the short run; this suggests that the effects of short-run reversible disturbances are fairly impervious to treatment and must simply be borne.

In the medium run, the economy adjusts to disturbances of a more permanent nature. In general, adjustment to a negative demand shock entails unemployment unless offset by a counterbalancing policy response. As in the short-run analysis, the source of the shock influences the desirability of stabilizing net exports. If the shock is to the foreign sector, then both the long-run consumption/savings decision and the short-run goal of stabilizing aggregate demand are served by restoring net exports to their preshock level. If, however, it is investment that falls, the dual objectives are met by an expansion in net exports, that is, the current account should be used as a buffer. Moreover, the general desirability of having the current account perform a particular role translates into a meaningful policy presumption only if a suitable instrument is available to achieve its desired stabilization, in the one instance, or movement, in the other. As it happens, the efficacy of exchange rate policy in accomplishing this task depends on the appropriate characterization of the supply side of the economy. In particular, if it is Keynesian, so that nominal wages cannot fall, depreciation of the exchange rate can simultaneously restore employment and net savings to their desired levels over much the same time that it takes for exports and imports to adjust to price changes. On the other hand, if laborers are determined to maintain their purchasing power so that real wages cannot fall, a wage/price spiral will ensue, offsetting much of the competitive edge gained by devaluation. In this kind of environment, the current account can be improved and full employment restored only after a recession has weak-

ened real wage demands. Over much of the horizon, though, recessionary conditions will be in evidence, and any short-term to medium-term improvement in the current account will be at the expense of employment.

This analysis has some bearing on the importance of exchange rate surveillance. Strictures against anticompetitive exchange rate policy and maintaining an undervalued exchange rate make most sense in an environment that is fundamentally Keynesian. Accordingly, there would be an overall inadequacy of global aggregate demand, and each country would have the incentive as well as the ability to secure "for its own national output a larger share of the existing world demand" ⁵⁹ through currency devaluation. For a single country intent on reducing unemployment, the alternative is fiscal expansion. This would entail a departure from its prevailing consumption/savings mix, and some of the fruits of expansion would flow abroad. While a certain amount of leakage is inevitable, it is clearly in the interests of the community of nations to control the overexploitation via competitive devaluations of this natural externality to forestall incipient "beggar-my-neighborism." In the Bretton Woods era, this was accomplished by limiting exchange rate changes to cases of "fundamental disequilibrium." In the current era, surveillance is the vehicle.

The alternative model (i.e., where real wages are rigid) presents a less optimistic view of the ability of devaluation to circumvent the costs of adjustment to negative demand shocks, and, as a result, reduces the potential for conflict over exchange rate policy. Because the current account and employment are inversely related over the short run to medium run, the incentive to devalue competitively is greatly diminished. Moreover, that this relation is one of trade-off imparts to a country's attempts to increase its current account a degree of legitimacy lacking in a more Keynesian context, where the current account and employment can be simultaneously improved by currency depreciation. Furthermore, while an improvement in one country's current account still entails a deterioration in its partner country's current account, the cost of this interdependence is

⁵⁹ Ragnar Nurkse, *Conditions of International Monetary Equilibrium*, Essays in International Finance, No. 4, International Finance Section, Princeton University (Spring 1945); reprinted in *Readings in the Theory of International Trade*, American Economic Association (Philadelphia, 1949), pp. 3-34, especially p. 14.

reduced in the rigid real wage model,⁶⁰ since real wages and employment can rise there.

Nevertheless, because currency depreciation retains in this model the important role of facilitating the adjustment to negative demand impulses in the face of downward *nominal* rigidities, some risk of international friction remains. Specifically, with both prices and real wages rigid, a decrease in aggregate demand tends to cause unemployment on two counts: Output prices become too high for the goods market to clear, and the real wage becomes too high for the labor market to clear. With the real wage rigid, devaluation can do nothing about the unemployment deriving from the latter. However, it can remedy the former by inducing an increase in demand for exports via a decrease in their foreign price. As the goods market clears, the demand for factor inputs, including labor, can rise. That currency depreciation can circumvent Keynesian unemployment for one country suggests that the complementary appreciation abroad will exert a contractionary influence there if prices are not flexible downward. Granted, this can be offset by fiscal expansion, but that country may not want to alter its consumption/savings mix. The same reasoning suggests that a general shortfall in global demand, such as that attending the petroleum price rise in 1973–74, can produce a setting in which, by devaluing, any one country individually can improve its current account and employment situation at the expense of its trading partners, even while its wages are fully indexed. In such an environment, surveillance retains an important role.

The present economic situation of the industrial countries is probably best characterized by the combined rigid price and rigid real wage models. For both the importance of surveillance and the efficacy of global expansion, the relevant questions then become: To what extent is the present slack attributable to inadequate aggregate demand, that is, the effect of nominal rigidities, and to what extent are we observing the requisite recessionary adjustment to a lower path of real wages? Based on the material presented in Section II, we note that most countries in their official statements appear cautious about their current account prospects. Their concern seems to reflect the view that

⁶⁰ See, for example, Victor Argy and Joanne Salop, "Price and Output Effects of Monetary and Fiscal Expansion in a Two-Country World Under Flexible Exchange Rates" (unpublished, International Monetary Fund, May 8, 1979).

adjustment is in order now, and that employment must be sacrificed to attain the desired improvement in the current account. This attitude is consistent with the view that the present slack is adjustment-related rather than deriving from Keynesian inadequate demand.⁶¹ On the other side, several countries are on record as favoring adjustment of their own current account balances within the framework of an internationally coordinated program of expansion.⁶² However, the broadest support for this idea has come from international bodies⁶³ in terms of the "con-

⁶¹ Haberler's assessment of the U. S. economy is of particular interest in this connection. He argues that, while the economy came close to capacity in 1978, the existence in earlier years of relatively high rates of excess capacity and unemployment, on the one hand, and inflation, on the other hand, was largely attributable to real wage rigidity. Accordingly, he finds fault with the Keynesian position that the U. S. current account deficit was a "drag" on the economy in the sense that a reduction of the deficit would have primarily meant higher employment and output rather than higher prices. On the contrary, the deficit is seen to have had a "mild anti-inflationary effect; it has somewhat moderated the speed of cyclical expansion after the recession and thus has helped to lengthen the cyclical upswing which has carried the economy close to full employment in 1978." See Gottfried Haberler, "Flexible Exchange Rates: Theories and Controversies Once Again" (unpublished, 1979), pp. 19-20, and his "Reflections on the U. S. Trade Deficit and the Floating Dollar," in *Contemporary Economic Problems*, 1978, ed. by William Fellner, American Enterprise Institute for Public Policy Research (Washington, 1978), pp. 211-43.

⁶² See, for example, *Annual Report of the Council of Economic Advisers* (cited in footnote 38), p. 117, "... appropriate national policies and international cooperation will be particularly important to ensure that the international financial system remains adequate to the demands that will be made on it and to reduce the large imbalances that exist aside from the OPEC surplus." See also C. W. McMahon, "Is There an International Monetary System?" Bank of England, *Quarterly Bulletin*, Vol. 18 (June 1978), pp. 240-43.

⁶³ Extracts and summaries of reports and statements may be found in various issues of the Fund's *IMF Survey*. Specifically, for the relevant passages in the Bank for International Settlements, *Annual Report*, 1977/78, see the *IMF Survey*, Vol. 7 (June 19, 1978), pp. 189-90; for the statement of the Interim Committee of the Board of Governors on the International Monetary System, see the *IMF Survey* (May 8, 1978), p. 129; for the views of the International Monetary Fund, see the address of J. de Larosière to the Overseas Bankers Club, "Toward a More Stable World Economy," reprinted in the *IMF Survey*, Vol. 8 (February 5, 1979), pp. 33 and 43-45, and the address of J. J. Polak to the Economic and Social Council of the United Nations in Geneva, reprinted in the *IMF Survey* (July 17, 1978), pp. 210-13; for the agreement reached by the members of the Organization for Economic Cooperation and Development, see the *IMF Survey* (July 3, 1978), pp. 193 and 199. The view of the European Community is given in Jean Claude Morel, "The Medium-Term Economic Programme of the Community," a speech delivered at the conference of the Austrian National Bank in Baden, Austria, May 30-June 1, 1978, published as "Wirtschaftsprogramm der Europäischen Gemeinschaft und die mittelfristigen Aussichten," *Wirtschaftsprognose und Wirtschaftspolitik* (Vienna, 1978), pp. 95-103.

certed action program," which envisages current account adjustments in the context of an internationally coordinated expansion of aggregate demand. ⁶⁴ Nevertheless, there are those who would strongly disagree with the wisdom of concerted action at this time. ⁶⁵ Recalling the record of the joint expansion in 1972 and 1973, they argue that a rapid rise in import prices in general and commodity prices in particular would ensue, causing inflation to accelerate in the process. A similar conclusion, that is, that expansion will simply go into prices over the medium run, emerges from this analysis if the primary cause of the slack is excessive wage demands. In our view, it would be fruitful to investigate empirically to what extent the present situation is

⁶⁴ In 1974-75, it was widely held that higher import bills of the oil consuming nations coupled with the purportedly limited absorptive capacity of the oil producers would lead to excess savings and rising unemployment on an international level, and that countercyclical demand management was accordingly in order. In the meantime, the absorptive capacity of OPEC has proved larger than was thought possible a few years ago. (See, e.g., Tamir Agmon and Arthur B. Laffer, "Trade, Payments and Adjustment: The Case of the Oil Price Rise," *Kyklos*, Vol. 31 (No. 1, 1978), pp. 68-85. See also Bruce K. MacLaury, "OPEC's Billions," *The Brookings Bulletin*, Vol. 15 (Fall 1978), and David R. Morgan, "Fiscal Policy in Oil Exporting Countries, 1972-78," *Staff Papers*, Vol. 26 (March 1979), pp. 55-86.) Nevertheless, investment activity in many of the industrial countries has yet to recover convincingly from the recession. A situation of insufficient aggregate demand appears thus to have persisted, although the oil crisis alone can no longer account for it. (See W. M. Corden, "Expansion of the World Economy and the Duties of the Surplus Countries," *The World Economy*, Vol. 1 (January 1978), pp. 121-34, regarding the "Keynesian" problem of excess savings in the international economy.) In these circumstances, coordination both in the expansion of demand and in current account adjustment is seen by many as the most appropriate route toward lasting recovery, while the recent increase in protectionist measures appears to signal the urgency of such action. The increasing use of protective trade measures in 1977 and 1978 is documented in the Fund's *Twenty-Ninth Annual Report on Exchange Restrictions* (Washington, 1978). See also *The Rise in Protectionism*, International Monetary Fund, Pamphlet Series, No. 24 (Washington, 1978). Two frequently cited reasons for the sluggishness of investment activity are the high level of public indebtedness, which is purported to constrain public investment, and the uncertainty attributed to exchange rate volatility, which, it is argued, inhibits private investment. Doubts about the role of the exchange rate in the adjustment process have compounded difficulties in this respect. On the one hand, not all exchange rate changes induce changes in production—only those that are considered as lasting. See, for example, Niehans (1975, cited in footnote 27). On the other hand, to the extent that constant real exchange rates prevail, lasting changes are excluded. This point is made, for example, in Corden (1978, pp. 122-34), and in McMahon (1978, cited in footnote 62).

⁶⁵ See, for example, Corden (1978, cited in footnote 62), and Gottfried Haberler, *Oil, Inflation, Recession and the International Monetary System*, American Enterprise Institute, Reprint No. 45 (June 1976).

one of inadequate demand ⁶⁶ or a period of necessary adjustment to overinflated expectations.

⁶⁶ It should be acknowledged that a finding of inadequate aggregate demand would not imply the inevitability of economic warfare as was experienced during the 1930s. This is most clearly seen in the industrial countries' response to the OPEC shock. The oil importing countries as a group had two basic options with respect to the distribution of their collective current account vis-à-vis the OPEC countries: either to rely on market forces to effect that distribution or to act in concert and carry out a distributional arrangement. Generally, opinion favored the idea of at least some intervention, for fear that the exchange rate mechanism would not be effective, especially with regard to the correction of payments imbalances in the short run, or that several countries would pursue conflicting policies, from which all would suffer because of the resulting disruption in commercial relations. A number of specific criteria for the distribution of the collective deficit were suggested, and some of these, such as the efficiency or "rate of return" and "economic size" criteria, received fairly broad support. No formal or informal agreements involving any particular criterion for allocation were concluded; although there was clearly some concern in the United States over "caution" by Japan and the Federal Republic of Germany, in general, the period of crisis was weathered in a spirit of cooperation if not actual coordination. See International Monetary Fund, *Annual Report, 1977* (Washington, 1977), p. 12; Jacques R. Artus and Andrew D. Crockett, *Floating Exchange Rates and the Need for Surveillance*, Essays in International Finance, No. 127, International Finance Section, Princeton University (May 1978); Andrew D. Crockett and Duncan Ripley, "Sharing the Oil Deficit," *Staff Papers*, Vol. 22 (July 1975), pp. 284-312; John Williamson, "The International Financial System," Ch. 6 in *Higher Oil Prices and the World Economy: The Adjustment Problem*, ed. by Edward R. Fried and Charles L. Schultze, The Brookings Institution (Washington, 1975), pp. 197-225; and Robert Solomon, "The Allocation of 'Oil Deficits'," *Brookings Papers on Economic Activity: 1* (1975), pp. 61-87.

Estimation of the Timing Asymmetry in International Trade

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BECAUSE OF THE TIME INVOLVED in transporting goods between countries and in fulfilling certain customs requirements, the export shipments of a country or region during a given period will not all be received and counted as imports by trading partners during the same period. It follows that, apart from differences in coverage and the basis of valuation (for example, f.o.b. or c.i.f.), the value of a region's exports will necessarily exceed the value of partners' imports from it if international trade is increasing, and the converse will be true if trade is declining. Moreover, the discrepancy between exporter-reported and importer-reported values will tend to vary directly with the size of the increase or decrease. In this paper, the lag between the recording of goods as exports and the recording of the same goods as imports is called the transport lag. The discrepancy between exporters' and importers' merchandise accounts for a given period that is to be expected because of the transport lag is called the timing asymmetry.¹

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The author is indebted to colleagues in the Fund for unusually generous interest in, and correspondingly numerous comments on, earlier drafts. The result remains the responsibility of the author.

¹ The asymmetry is similar to the central bank "float" in that both arise because of a transit delay. However, the float refers to a stock of items while the asymmetry is a flow—in effect, the change in the "international trade float" over a specified period.

A standard reference on this topic is John S. Smith, "Asymmetries and Errors in Reported Balance of Payments Statistics," *Staff Papers*, Vol. 14 (July 1967), pp. 211–36; see especially p. 223. Smith explains that the lag would not arise if trade data were collected on a balance of payments basis, according to which a shipment is counted as exports by one partner and as imports by the

This paper presents a method for estimating the lag and the corresponding asymmetry indirectly, on the basis of differences between the exporter and importer records of trade values. The primary use of the results occurs in comparisons of world aggregates of exports and imports. If the aggregates are of historical data, one is interested in how much of the apparent discrepancy is explainable on the basis of the lag.² If the figures are for future periods, a forecast of the total trade asymmetry provides a measure of the difference to be expected between global export and import forecasts, as a check on their consistency. The timing asymmetry is only a part of this discrepancy. However, evidence to be presented later suggests that it is a substantial and, in recent years, highly variable part. After subtracting the estimated timing asymmetry, the residual asymmetry on world trade account becomes relatively smooth and is therefore itself not difficult to forecast. Estimates of these asymmetry components are given in Table 1 for the years 1967-77.³

Another use of the transport lag calculations relates to the evidence they contain regarding the currency in which foreign trade invoices are denominated. Several recent studies suggest that the typical practice is use of the currency of either the exporter or the importer.⁴ While only indirect evidence on this point is

other at the moment when ownership changes. However, in practice, trade data are generally collected as goods move through customs, and the information required for adjusting more than a few unusual shipments to the balance of payments basis is not available.

For an earlier description of the problem, see Herbert B. Woolley, "On the Elaboration of a System of International Transaction Accounts," Ch. 3 in *Problems in the International Comparison of Economic Accounts: Studies in Income and Wealth*, Vol. 20, National Bureau of Economic Research (Princeton University Press, 1957), pp. 217-90, especially p. 263. Also, it is noted regularly in the introductory notes contained in International Monetary Fund, *Direction of Trade Yearbook*, various issues.

² See, for example, Organization for Economic Cooperation and Development, *OECD Economic Outlook*, No. 23 (July 1978), Table 27 and the discussion on pp. 42-43 and 117.

³ The residual asymmetry in recent years is smaller and shows a slightly different movement if the trade balances of countries that are not members of the Fund, other than Switzerland and Hong Kong, are taken into account (that is, if "world" trade is defined on a truly global basis); see the final column of Table 1. Of course, increased lumpiness of any component of the residual asymmetry, such as Soviet agricultural imports, would reduce the prospective sufficiency of the timing asymmetry as an explanation of the irregular part of the total.

⁴ See Sven Grassman, "A Fundamental Symmetry in International Payment Patterns," *Journal of International Economics*, Vol. 3 (May 1973), pp. 105-16, and Stephen P. Magee, "U. S. Import Prices in the Currency-Contract Period," *Brookings Papers on Economic Activity: 1* (1974), pp. 117-68.

TABLE 1. VALUES OF THE "WORLD" TRADE ACCOUNT ASYMMETRY AND ESTIMATED COMPONENTS, 1967-77 ¹

(In billions of U. S. dollars)

Year	Total Trade Asymmetry ²	Timing Asymmetry	Residual Trade Asymmetry ³	Residual as Per Cent of "World" Exports	Rate of Growth of "World" Exports	Memo Item: Trade Balance of Fund Non-members ⁴
1967	4.2	0.2	4.0	2.2	7.5	
1968	5.9	0.9	5.0	2.4	12.1	
1969	6.7	1.0	5.7	2.4	14.1	
1970	8.2	1.0	7.2	2.6	15.3	-0.5
1971	10.8	0.9	9.9	3.2	11.4	-0.8
1972	13.8	2.0	11.8	3.2	18.9	-2.0
1973	20.4	4.8	15.6	3.1	39.5	-3.6
1974	30.9	6.4	24.5	3.2	48.6	-3.7
1975	28.9	0.5	28.4	3.6	3.1	-9.6
1976	27.9 ⁵	5.1	22.8 ⁵	2.6 ⁵	13.7	-7.7
1977	26.4 ⁵	2.0	24.2 ⁵	2.4 ⁵	12.7	-5.8

¹ "World" is defined to be members of the International Monetary Fund (IMF) that report data *plus* certain nonmembers (including Switzerland and Hong Kong but excluding the so-called Sino-Soviet countries and other countries that do not report balance of payments statistics to the IMF).

² These data are from the IMF Data Fund as of February 1979. Except for revisions and conversion from special drawing rights to U. S. dollars, they are the same as those in line 1, Table A-1 of IMF, *Balance of Payments Yearbook, 1971-77: Supplement to Volume 29* (December 1978). For both exports and imports, valuation is f.o.b. and coverage is balance of payments basis as far as practicable.

³ If the timing asymmetry has been estimated with reasonable accuracy, the residual is attributable to asymmetries of valuation and coverage. Numerous hypotheses exist regarding the sources of such discrepancies. (See, for example, Smith, "Asymmetries and Errors in Reported Balance of Payments Statistics," cited in footnote 1 in the text.) Two of the more general hypotheses, which are also consistent with the observed surplus of recorded credits, are (1) that relatively higher tariffs borne by imports create pervasive incentives for underreporting of import values, and (2) that actual freight charges below the conventional 10 per cent rule of thumb imply overimputation of the c.i.f. component, and thus result in underrecording of merchandise debits and overrecording of service debits in balance of payments statistics.

⁴ The figures cover countries not included in the "world" as defined in footnote 1. Besides the Sino-Soviet area, the group includes seven independent countries and nine territories—principally Brunei, Angola, and Mozambique. The figures have been estimated on the basis of partner-country reports in *Direction of Trade*. Territories in addition to these appear in *Direction of Trade*, but their trade is already included in the balance of payments statistics of the respective metropolitan areas.

⁵ Preliminary figures.

provided here, it is based on a broad sample—namely, world trade. By contrast, the existing direct assessments of the currency denomination of trade contracts are based on samples of individual invoices, and in any case, the practices of only a few countries have been studied.

I. Basic Model

Let X_t be defined as the value of exports of Region A to Region B in period t as recorded by Region A, and let M_t be imports of Region B from A as recorded by B. If there were no differences of valuation, timing, or coverage, one would observe that $M_t = X_t$ in each period.

The coefficients b_i , $i = 0, 1, \dots$, are defined to be the proportions of X_t that are not received and counted as imports until period $t + i$. The b_i are assumed to be constant over time. Also assumed constant are the parameters a , the ratio of the value of costs, insurance, and freight to the value of exports at the exporter's border, and k , the average value of net trade between Regions A and B that is misclassified as to origin or destination. Instead of $M_t = X_t$, the relation is

$$M_t = k + (1 + a)(b_0 X_t + b_1 X_{t-1} + \dots) \quad (1)$$

The assumption of constant parameters is better satisfied the more stable are the distributions of regional trade flows (1) over individual importing and exporting countries of unequal distance from partner regions, (2) over commodities having dissimilar ratios of freight charges to value, and (3) over modes of transportation (air or surface carriers).

Apart from recording errors, discussed later, all exports are eventually counted as imports. It is therefore appropriate to constrain the b_i to equal unity. Substituting for b_0 according to

$$b_0 = 1 - \sum_{i=1} b_i$$

one may rewrite equation (1) as

$$M_t = k + (1 + a)[X_t - b_1(X_t - X_{t-1}) - b_2(X_t - X_{t-2}) - \dots] \quad (2)$$

For annual data, equation (2) simplifies to

$$M_t = k + (1 + a)(X_t - b\Delta X_t) \quad (3)$$

since on the basis of extraneous information, such as shipping schedules, it is apparent that the average lag is likely to be a small fraction of a year. Regression analysis will not yield estimates of the parameters of equation (2) directly, but rather of the c_i in

$$M_t = k + c_0 X_t + c_1 (X_t - X_{t-1}) + c_2 (X_t - X_{t-2}) + \dots + e_t \quad (4)$$

However, by inspection, the structural parameters are seen to be exactly identified and may be derived as follows:⁵

$$a = c_0 - 1 \quad (5')$$

$$b_i = -c_i/c_0 \text{ for } i > 0 \quad (5'')$$

In practice, equation (2) will be affected by recording errors and omissions, which may be large for certain countries. To the extent that such errors tend to be proportional to the recorded value of trade, as is likely, the estimates of the c_i will be biased. It follows that the structural parameter a will reflect some combination of freight and insurance payments and recording errors, and its interpretation must be modified correspondingly. But the estimates of the b_i s, which are of primary interest here, tend to be unaffected by such errors. Since the estimates of the coefficients c_i will be biased to the same proportional extent, this influence will cancel in computing the b_i s. (See equation (5'').) Thus, inclusion of a in the specification serves to separate the proportional discrepancy between importer and exporter data from the lag between the two versions so that the latter can be estimated.⁶

Estimates of the b_i will be affected by recording errors that are proportional to the *change* in the trade flow. This would occur, for example, if the officials in a particular customs post have an uneven work load such that incoming shipments are very heavy toward the end of each month and a fraction of these are regularly left unprocessed till the beginning of the following month.

⁵ These estimates can be shown to be the same as those resulting from nonlinear least-squares estimation and therefore asymptotically unbiased and efficient. See Jan Kmenta, *Elements of Econometrics* (New York, 1971), pp. 442-45. The nonlinear estimation algorithm used in this paper was provided by Data Resources, Inc.

⁶ For the case in which freight costs are assumed to vary with the transit lag, see Section A of a set of Supplementary Notes, which is available upon request from the author, in care of the European Department, International Monetary Fund, Washington, D. C. 20431.

Such effects as these, however, have been included, by definition, in the timing asymmetry. In light of the applications mentioned earlier, it is appropriate to measure the actual lag in the published data irrespective of whether it is attributable solely to "transport" or includes customs delays as well.

The value of the asymmetry itself, A_t , is logically defined to be the difference between recorded exports and imports after both are placed on the same basis of valuation and coverage. If imports are converted to "export" basis,

$$M'_t = (M_t - k)/(1 + a)$$

then the asymmetry is given by

$$A_t = X_t - M'_t = b_1 (X_t - X_{t-1}) + b_2 (X_t - X_{t-2}) + \dots \quad (6)$$

or, for annual data, by $b \cdot \Delta X_t$.

The length of the lag expressed in units of time can only be approximated from the regression results. For example, suppose the period of observation is a month. Shipments both exported and imported in the same month can have a lag, at one extreme, of zero days (if sent by air, or across a common land boundary) or, at the other extreme, of about 30 days. If it is reasonable to assume that, within a month, the lags of individual shipments are distributed uniformly between these two extremes, then shipments exported on the first day and imported during the same month will have a mean lag of about 15 days, or 0.5 month. This mean applies only to shipments exported at the very beginning of the month. A lag of zero obtains, at the other extreme, to shipments exported on the last day of the month and imported on the same day. The mean, in turn, of this second pair of two extremes—0.25 month—may be taken as a crude approximation of the average lag of all shipments exported and imported during the same month. Applying this reasoning to shipments imported i months after the month of exportation, one derives the following expression for the mean lag:

$$L = \sum_{i=0} \hat{b}_i (i + 0.25) \quad (7)$$

This formula is used later for results based on monthly data. Whether or not it provides a good approximation cannot be determined without data of higher frequency. However, it is very likely superior to the assumption of an average lag of zero

for shipments exported and imported in the same month. In any case, expression of the lag in terms of time units is of secondary interest, as the simulations of the asymmetry are based on the \hat{b}_i and are independent of L .

II. Exchange Rate Effect

For this study, it is necessary to express all countries' trade flows in terms of a single currency, for which purpose the U.S. dollar is the convenient choice. However, to the extent that world trade is not invoiced in U.S. dollars (as suggested by Grassman and Magee in their works cited in footnote 4), and the dollar is depreciating against other currencies on average, the customs value in dollars of a particular shipment will be higher on arrival than at departure because of exchange rate movements during transit. Conversely, if the U.S. dollar is appreciating, the customs value will, in effect, fall somewhat during transit. This factor will tend to create a systematic difference between importer and exporter records expressed in dollars, especially for recent years. It is appropriate to modify the basic model to allow for such exchange rate effects.

If all shipments were in transit precisely one month, the maximum exchange rate effect for a single pair of trading countries would be equal to the monthly proportionate exchange rate change *times* the monthly export value lagged one period, this quantity summed over the months in the period of observation. Thus, for annual data, the effect, R_t , would be written (where X is exports and r^* is the proportionate change in the exchange rate expressed in terms of dollars per unit of exporter's currency)

$$R_t = \sum_{i=1}^{12} r_{t:i}^* X_{t:i-1}$$

$$R_t \approx \frac{1}{12} \left[\frac{r_{t:Dec}}{r_{t-1:Dec}} - 1 \right] X_t$$

For an exporting region of n countries, r in the preceding expressions would be replaced by a suitably weighted average exchange rate. Addition of the exchange rate effect to the annual version of the model yields

$$M_t = k + (1 + a)(X_t - b\Delta X_t) + dR_t \quad (8)$$

The coefficient d may be interpreted as the proportion of trade invoiced in currencies other than the U. S. dollar and other than those pegged to the dollar.

The foregoing development holds for annual or quarterly data, but if a monthly version of the model is estimated, the assumption of a uniform one-month transport lag is unnecessary. The import record in period t of goods exported i months ago is increased approximately by the factor $d(r_t/r_{t-i} - 1)$ where, as earlier, d is the proportion of exports not denominated in dollars. Based on equation (2), the monthly model including the exchange rate effect may thus be written

$$M_t = k + (1 + a)[X_t(1 + d r0_t^*) - b_1 X_{1t}(1 + d r1_t^*) - b_2 X_{2t}(1 + d r2_t^*) - \dots] \quad (9)$$

utilizing the substitutions

$$Xi_t = X_t - X_{t-i} \\ ri_t^* = r_t/r_{t-i} - 1^7$$

Equation (9) is overdetermined but can be estimated by use of nonlinear methods.

III. Econometric Approach

The bilateral trade data appearing in the IMF publication, *Direction of Trade (DOT)*, are appropriate for estimating the model developed earlier, in that time series of both importer and exporter records are available for any desired degree of geographical disaggregation. During a period in which the trade flows of various groups of countries grow at unequal rates, such as recent years, it may be possible to improve estimates substantially by dividing the world into more homogeneous regions, estimating the transport lag for each separately, and reaggregating the asymmetry simulations to obtain the desired world total.

⁷ In a foregoing passage, it was argued that shipments exported and imported in the same month are subject to a lag of, roughly, 0.25 month on average, shipments exported and imported in successive months to an average lag of 1.25 months, and so on; see the discussion on expressing the transport lag in units of time. This logic has been carried over to the computation of the exchange rate change series: ri^* is a weighted average of the percentage changes over i and $(1 + i)$ months, with weights of 0.75 and 0.25, respectively. While logical consistency is thus preserved, the empirical results are not noticeably affected by this a priori specification—relative to, say, a straight-forward i -period percentage change.

On the other hand, *DOT* provides only annual data. Higher frequency series—in particular, monthly data—are not generally available for countries outside the industrial group. (So-called derived entries can be generated, but these are not useful for present purposes, as discussed later in this section.) Estimates based on monthly data are desirable from the point of view of precision, since the transport lag is short relative to a year. Such monthly data as do exist, from the summary tables at the front of the IMF publication, *International Financial Statistics (IFS)*, are available from both exporter and importer records only for the world as a whole.⁸ The availability of data thus imposes a choice between disaggregation into regions and “disaggregation” into shorter units of time.

The alternative based on annual data is pursued first, as there is a presumption of potentially large differences in the transport lag among geographical areas. The annual data samples are found to yield lag estimates implying a global average rather larger than the traditional one-month rule of thumb. These plausible results are, nevertheless, ultimately rejected. First, inter-regional differences among the estimates are found to be surprisingly slight, at least for the regional breakdown chosen for the study. Second, the estimates are seen to be peculiarly vulnerable to collinearity, which is present among the relevant annual series to an extreme degree, particularly because of large rates of growth of trade values in the early 1970s. The regional disaggregation is therefore discarded, and the transport lag is re-estimated with the monthly data available for the world as a whole. These latter series yield an estimate of the lag that is substantially shorter than the traditionally assumed magnitude, and direct evidence on transportation lags is cited as a check on the results.

As suggested by the first alternative, estimates of the transport lag based on annual data have been prepared for the four-way regional disaggregation of world trade that is used in IMF data publications: industrial countries, more developed primary producing countries, oil exporting countries, and other (“non-oil”) developing countries.⁹ Being partly structural, this grouping is

⁸ For additional notes on data sources, see the Statistical Appendix.

⁹ These regional designations are the ones utilized in *DOT* and in *IFS*, through 1979, “more developed primary producing countries” being the combination of “other Europe,” Australia, New Zealand, and South Africa. Trade with the so-called Sino-Soviet area countries and with other countries that are nonreporters is omitted.

at least similar to what one would devise for convenience in organizing or summarizing a comprehensive trade-forecasting effort. Results based on a second, five-way, purely geographical, disaggregation are mentioned later. The potentially more uniform distances between importing and exporting countries of this second grouping will tend to yield regression coefficients with smaller margins of error, other things being equal. Estimates of the transport lag have been calculated both for the exports of these two groups of regions to the world and for exports to other regions individually, as well as for world trade in the aggregate.¹⁰

Two special considerations apply to estimates based on annual *DOT* data. The first is the presence of so-called derived statistics—the use of partner-country figures for missing bilateral entries. The associated regression estimates of the transport lag are biased toward zero (use of the same record for X and M implies no lag), and the c.i.f. factors are biased toward 10 per cent (the proportion assumed in converting the available record from f.o.b. basis to c.i.f., or the other way around). The incidence of derived data is zero or nil for all regions except the oil exporting countries, in which case a degree of error as large as one third of the regression estimate is not unlikely. Consequently, for the oil region, an a priori estimate of the transport lag of one month has been substituted in the annual-data simulations of the timing asymmetry reported later.¹¹

The second special consideration is a consequence of the likelihood, in the light of extraneous information, that the transport lag is much shorter than a year. In this case, export developments in the early months and quarters are irrelevant from the point of view of the lag, as most of this trade will be imported in the same year in which it is exported. The term ΔX_t in the model—equation (3)—is thus a proxy for the year-on-year difference in export developments occurring toward the end of the year, the only portion of the yearly flow that is potentially caught in the float. Consequently, the estimate of b can be improved, in

¹⁰ The disaggregation may be carried further. Pajit Habanananda has studied selected bilateral flows between individual countries of different regions; see "The Transit Lag in Trade Statistics," *Papers on International Financial Statistics* (International Monetary Fund, January 22, 1979).

¹¹ For a description of the method used in preparing the estimates of bias, see Section B of the Supplementary Notes mentioned in footnote 6.

principle, by replacing ΔX_t by $(\dots + X_{t:Nov} + X_{t:Dec} \dots - X_{t-1:Nov} - X_{t-1:Dec})$, and adjusting the scale of b accordingly.¹² The precise number of end-year months to be included in this term cannot be determined analytically, but whatever error may be introduced by making an incorrect a priori judgment is likely to be much smaller than that caused by using the annual proxy. The smaller the number of months included, the greater is the risk of excluding shipments with long lags;¹³ the larger the number of months, the greater the amount of irrelevant variation that is introduced. The final three months comprise the subperiod used here.¹⁴ This variant of the annual-data equation is labeled end-year in the description of results that follows.

The regression results calculated from samples of annual data for the four-way disaggregation of world trade are shown in Table 2. The estimation is based on samples ending in 1974 because the published data for succeeding years are subject to revision. While the magnitude of further revisions is likely to be small—not exceeding 1 to 2 per cent—only the import series is affected; export revisions are negligible. As the differences between global exports and imports are inherently slight, spurious discrepancies of an additional couple of percentage points may have a sizable effect on the calculated estimates. Coefficients of variation are reported in place of coefficients of multiple correlation in Table 2; the latter are uniformly very high. The table shows that the standard errors of the regressions lie between about $1/2$ of 1 per cent and $1 1/2$ per cent of the means of the respective dependent variables, except for oil exporting countries. The hypothesized exchange rate effect is not supported by the annual data, as may be seen in part (b) of Table 2. The coefficient on the exchange rate variable has the incorrect sign for exports of the industrial countries and the more developed primary producing countries. These two groups together

¹² Let s be the ratio of the specified end-year months' (December *plus* November *plus* . . .) exports to annual exports, estimated by taking the arithmetic mean over the sample period. Then, $b_y = \hat{s} \cdot b$; see part (c) of Table 2.

¹³ To the extent that the excluded shipments are correlated with the included ones—which is probably large in this case—the estimated timing asymmetry figures will not be biased, despite the upward bias in the regression estimate of b .

¹⁴ For regions' exports to the "world," the fourth-quarter flow was estimated by applying the relevant proportion calculated from *IFS* monthly data to the annual *DOT* figure.

TABLE 2. REGRESSION ESTIMATES OF THE TRANSPORT LAG EQUATION FOR REGIONS' EXPORTS TO THE WORLD, BASED ON ANNUAL DATA, 1959-74 ¹

	Coefficient of Variation	Durbin- Watson Statistic	k	a	b	d	b_v
(a) Basic equation							
Industrial countries	0.0042	1.6	-1,174 (2.0)	0.0535 (8.2)	0.1118 (5.4)		
More developed primary producing countries	0.0105	1.1	-209 (1.8)	0.1691 (12.2)	0.1510 (3.8)		
Oil exporting countries	0.0159	1.1	-213 (0.8)	0.1617 (7.1)	0.1695 (7.0)		
Non-oil developing countries	0.0088	1.8	-842 (2.4)	0.1845 (11.1)	0.2201 (6.9)		
(b) Basic equation with exchange rate effect							
Industrial countries	0.0037	2.1	-1,311 (2.5)	0.0539 (9.4)	0.0981 (5.2)	-0.0816 (2.3)	
More developed primary producing countries	0.0105	1.5	-125 (0.8)	0.1549 (7.4)	0.0999 (1.4)	-0.0599 (0.9)	
Oil exporting countries	0.0164	1.2	-114 (0.3)	0.1531 (4.6)	0.1612 (4.8)	0.0460 (0.4)	
Non-oil developing countries	0.0077	1.7	-899 (2.9)	0.1961 (12.7)	0.2368 (8.4)	0.1541 (2.3)	
(c) End-year variant of basic equation							
Industrial countries	0.0035	1.6	-644 (1.6)	0.0480 (11.1)	0.3516 (7.0)		0.0962
More developed primary producing countries	0.0110	1.6	-137 (1.2)	0.1601 (12.6)	0.4631 (3.4)		0.1312
Oil exporting countries	0.0312	0.9	1,157 (2.7)	0.0417 (1.1)	0.1179 (0.5)		0.0317
Non-oil developing countries	0.0155	0.6	562 (1.4)	0.1150 (6.6)	0.3190 (2.1)		0.0826
World	0.0038	1.5	670 (0.9)	0.0681 (13.2)	0.3308 (6.5)		0.0899

¹ The coefficient of variation was computed as the ratio of the standard error of the regression (corrected for degrees of freedom) to the mean of the dependent variable. The constant term, k , is in millions of U. S. dollars. The statistic, b_v , is the regression estimate of b re-expressed as a proportion of a year's trade. Figures in parentheses are t -values. For b , which is nonlinear, only the large sample standard error can be computed; the t -test of statistical significance does not apply, strictly speaking. The nonlinear algorithm used to estimate the structural parameters was provided by Data Resources, Inc.

account for 75 per cent of world trade over the sample.¹⁵ As for the parameters of primary interest, the estimates of a and b for the end-year are all of reasonable magnitude, and the t -ratios are generally high. (Since the estimates of b are nonlinear, and only large-sample standard errors are known, their statistical significance cannot be judged, strictly speaking.)

The choice between results based on annual data and on end-year data—parts (a) and (c) in Table 2—is not an empirical matter but one of a priori specification. As discussed, the latter set is taken to be more efficient, and thus preferable, on logical grounds. Actual differences between them are slight, however, except that the lag for the non-oil developing region is reduced in the preferred version (again omitting the major oil exporters).

The most striking result is that the estimates of b are so nearly the same across regions. Lying between 0.32 and 0.46 of fourth-quarter trade (again excluding the estimate for oil exporters), or between 0.08 and 0.13 of the yearly flow (final column, included for comparison with parts (a) and (b) of the table), the estimates of b imply a transport lag that is highly uniform. This conclusion depends in part on the foregoing judgment that use of end-year (fourth-quarter) differences in place of ΔX_t is a superior specification. Since the annual-data asymmetry simulations are accordingly to be based on these end-year lag estimates, and given that the a priori estimate for the oil exporting region—one month—also falls in this range, it follows that such simulations will not be appreciably different from those that would result from assuming no interregional differences in \hat{b} .

This is shown explicitly in Table 3. Estimates of the timing asymmetry are presented there on two bases—namely, the sum of estimates for the four regions individually, and direct world estimates that result from aggregating the data series across regions and then estimating a global transport lag. The effect of the regional disaggregation can be seen by comparing these two types of estimate. The differences are clearly small. In particular, they are negligible, compared with those between the world

¹⁵ A mixture of correct and incorrect signs, with instances of statistical significance being distributed fairly evenly between the two categories, is typical of the estimates of d based on annual data—irrespective of changes in, for example, sample length, explanatory variables, or geographic disaggregation. Additional regression results for equation (8), including the exchange rate effect, are presented in Section C of the Supplementary Notes mentioned in footnote 6.

TABLE 3. ANNUAL-DATA ESTIMATES OF THE TIMING ASYMMETRY, 1960 AND 1967-77 ¹*(In billions of U. S. dollars)*

Year	Sum of Regions						World	
	Timing asymmetry						Timing asymmetry	Residual trade asymmetry
	Industrial countries	More developed primary producing countries	Oil exporting countries	Non-oil developing countries	Sum of regions	Residual trade asymmetry		
1960	0.6	—	—	—	0.6		0.6	
1967	0.3	0.1	0.2	0.1	0.6	3.6	0.6	3.6
1968	2.3	0.1	0.1	0.3	2.8	3.1	2.8	3.1
1969	2.2	0.3	0.1	0.4	3.0	3.7	2.9	3.8
1970	2.3	0.2	0.1	0.2	2.8	5.4	2.7	5.5
1971	2.1	0.3	0.4	0.2	2.9	7.9	2.8	8.0
1972	5.0	0.6	0.3	0.7	6.7	7.1	6.4	7.4
1973	10.2	1.2	2.3	2.2	15.9	4.5	15.3	5.1
1974	10.1	0.9	5.6	1.9	18.4	12.5	17.9	13.0
1975	0.2	-0.2	-0.4	-0.4	-0.8	29.7	-0.8	29.7
1976	8.0	0.8	2.7	2.4	13.9	14.0	13.5	14.4
1977	6.9	0.6	-1.6	-0.5	5.4	21.0	5.1	21.3

¹ The sample for estimation of the transport lag was 1959-74. See also the footnotes to Table 1.

estimates given in Table 3 and the estimates based on monthly data given in Table 1. These simulations demonstrate the first important result of the paper: The data imply relatively unambiguously that the refinements to be made by way of greater geographical disaggregation are, for the transport lag, much less important than the refinements achieved by use of monthly data. In the light of this result, the appropriate course is to dispense with regional disaggregation and to estimate the transport lag with monthly data for the world as a whole.

A further result based on annual data supports this alternative and, at the same time, contains a strong clue as to the econometric basis of the superiority of monthly-data results. This is the set of estimates for flows between pairs of individual regions. Instances of erratically high or low values of both \hat{a} and \hat{b} together suggest that X and ΔX are highly collinear (b enters the estimating equation with a negative sign). Thus, the greater stability that, in principle, characterizes the more disaggregated estimates is offset by an increased degree of statistical indeterminacy. The disaggregation is fruitless, and an element of doubt arises concerning results based on annual data in general. The estimates of the coefficients for the bilateral flows, for both the four-way and five-way regional disaggregations, are presented in Section D of the Supplementary Notes mentioned in footnote 6.

IV. Estimates from Monthly Data

Regression estimates of the monthly version of the transport lag equation are given in Table 4, both excluding the exchange rate effect (equation (2), part (a) of the table) and including it (equation (9), part (b)). The samples for estimation cover the period January 1959 through December 1975, as the data for subsequent months are subject to revision.

The monthly equations allow for estimation of the monthly pattern of the lag and not just the overall impact at yearly intervals. Table 4 contains results for lag distributions of various numbers of months, as this aspect of the specification cannot be determined *prima facie*. In these regressions, there is a clear indication that the lag extends over three past periods, judged by the usual criteria of dwindling t -values and erratic signs.¹⁶ Esti-

¹⁶ It may be objected that, in general, standard errors of additional lag terms can be large because of collinearity, in which case application of the t -test will

TABLE 4. REGRESSION ESTIMATES OF THE TRANSPORT LAG EQUATION FOR WORLD TRADE, IMPOSING VARIOUS LAGS, BASED ON MONTHLY DATA, JANUARY 1959–DECEMBER 1975 ¹

Coefficient of Variation	Durbin-Watson Statistic	k	\hat{a}	\hat{b}_0	\hat{b}_1	\hat{b}_2	\hat{b}_3	\hat{b}_4	\hat{b}_5	\hat{b}_6	\hat{d}
(a) Basic equation											
0.0262	2.0	573 (7.6)	0.0184 (6.9)	0.8613	0.0862 (3.1)	0.0525 (2.2)					
0.0255	1.9	556 (7.6)	0.0208 (7.8)	0.8446	0.0751 (2.8)	-0.0044 (0.2)	0.0847 (3.6)				
0.0252	1.9	564 (7.8)	0.0195 (7.3)	0.8445	0.0858 (3.2)	0.0008 (—)	0.1204 (4.3)	-0.0515 (2.2)			
0.0253	1.9	562 (7.8)	0.0199 (7.2)	0.8401	0.0883 (3.2)	-0.0013 (—)	0.1188 (4.2)	-0.0626 (2.2)	0.0167 (0.7)		
0.0252	1.9	557 (7.7)	0.0210 (7.4)	0.8395	0.0802 (2.9)	0.0032 (0.1)	0.1154 (4.1)	-0.0659 (2.3)	-0.0099 (0.3)	0.0375 (1.5)	
(b) Basic equation with exchange rate effect											
0.0262	2.1	570 (7.6)	0.0186 (7.0)	0.8512	0.0907 (3.3)	0.0581 (2.5)					0.440 (1.4)
0.0253	2.0	552 (7.6)	0.0212 (8.0)	0.8317	0.0799 (3.0)	0.0002 (—)	0.0882 (3.8)				0.569 (1.8)
0.0250	2.0	559 (7.8)	0.0199 (7.4)	0.8306	0.0913 (3.4)	0.0062 (0.2)	0.1252 (4.5)	-0.0533 (2.3)			0.596 (1.9)
0.0251	2.0	557 (7.7)	0.0204 (7.4)	0.8251	0.0944 (3.5)	0.0036 (0.1)	0.1234 (4.4)	-0.0667 (2.4)	0.0202 (0.8)		0.623 (1.9)
0.0250	2.0	553 (7.7)	0.0216 (7.5)	0.8230	0.0857 (3.1)	0.0091 (0.3)	0.1202 (4.3)	-0.0708 (2.5)	-0.0094 (0.3)	0.0422 (1.7)	0.672 (2.1)

¹ "World" is defined as in Table 1. The coefficient \hat{b}_0 is calculated as $1 - \sum \hat{b}_i, i > 0$. See also footnote 1 to Table 2.

mates of the coefficients on the first and third lagged periods (b_1 and b_3) are large relative to that on the second (b_2).¹⁷ The foreign exchange effect has the correct sign; the value of \hat{d} implies that the proportion of trade invoiced in currencies other than the U.S. dollar (and currencies pegged to it) is about half, although with a large margin of error (discussed later in this section). By the approximation devised in Section I, equation (7), the mean length of the lag is estimated to be 0.57 month if the exchange rate effect is excluded, 0.59 month if included.¹⁸

The lag estimated from monthly data is substantially smaller than that estimated from annual data. This can be demonstrated by calculating, from the monthly results, the value of b_y (the implicit coefficient on lagged annual exports). This coefficient will be equal to December exports not imported in December (16.8 per cent, using the results including the exchange rate effect) *times* the average weight of December in yearly trade (0.094) *plus* November exports that are imported neither in November nor December (8.8 per cent) *times* the November trade weight (0.089) *plus* October exports not arriving until January (8.8 per cent) *times* the October weight (also 0.089). The value of b_y implicit in the monthly estimates is thus 3.1 per cent, compared with 9.0 per cent in the annual results. (See the final stub entry in part (c) of Table 2.)

result in inappropriate exclusion of those terms and a downward-biased estimate of the average lag. In the present instance, however, the sign on the first excluded term is negative, and inclusion of additional terms does not result in a larger average lag. Moreover, bias from this source in the estimate of the lag measured in units of time does not imply bias in the estimated asymmetry values, since if the terms are collinear, the included terms capture the effects of the excluded ones. It has been pointed out to the author that the equation can be rewritten so that the lag terms are all first differences, a modification certain to lessen the degree of collinearity among the regressors. However, when the equation modified in this way was fitted, the estimates of the b_i remained unaffected to two (in most cases, three) significant digits, even in the specification including six lag terms (corresponding to the last line of part (a) of Table 4). Thus, the problem of collinearity among terms of the form $(X_t - X_{t-i})$ is minimal in the present context.

¹⁷ Apart from the possibility of sampling error, this counterintuitive pattern may be due to customs verification procedures. Declarations containing irregular or implausible information may be set aside until further checking is possible, the shipments involved being counted as imports when this process has been completed.

¹⁸ Other things being equal, attribution of part of the value of imports to exchange rate change increases the remaining difference between exporter and importer records if dollar depreciation has been more common than dollar appreciation. This larger difference, in turn, results in generally smaller reduced form coefficients—a reduction in \hat{d} , but an indeterminate effect on the b_i .

This striking difference constitutes the second basic result of the study. Both the implicit transport lag and the timing asymmetry to be expected in recorded global export and import values would be smaller by two thirds in the estimates based on monthly data than in those computed from annual data. The explanation for the difference has two major parts.¹⁹ First, there is a problem of scale. Had the transport lag turned out to be, say, three months on average (involving perhaps 0.20 of annual exports), a discrepancy of 0.06 ($= 0.09 - 0.03$) would have been noticeable but not very troublesome. Second, and more important, inspection reveals a very high degree of collinearity between annual values of X and ΔX , the simple correlation coefficient being 0.97. For monthly data, the analogous measure is 0.35.²⁰ This signals a dramatic improvement in the estimated statistics with respect to discriminating between the timing discrepancy (coefficient b) and the "c.i.f." discrepancy (coefficient a). For both of these reasons, but especially the latter, the monthly-data results are strongly to be preferred.

A transport lag rather longer than the one estimated here has commonly been assumed, at least by some researchers—typically on the order of a month, in contrast with the present estimate of about 2½ weeks.²¹ Nevertheless, the shorter estimate is no less reasonable on a priori grounds. About one fourth of U.S. trade, and as much as one half for European countries, occurs with partner countries having a common border. For the portion of such flows carried overland, the transport lag is necessarily zero days, apart from customs procedures. The lag applying to the balance of this trade (between ports) must be on the order of no more than a few days—a period not appreciably shorter than intracontinental flows between nonadjacent partners. Such very short lags are likely to be typical, for example, of the bulk of intra-European trade, which comprises about one third of world trade. Also contributing to a short average lag is

¹⁹ For a brief discussion of the econometric factors that account for differences in lag estimates from data of different frequencies, see Section E of the Supplementary Notes mentioned in footnote 6.

²⁰ The simple correlation coefficient between monthly values of X and ΔX is even smaller, 0.21, but this is not the appropriate statistic for comparison, since the monthly version of the model contains three terms of the form $X_t - X_{t-i}$. The quoted statistic, 0.35, is the correlation coefficient, r , resulting from regressing X on all terms of the form $X_t - X_{t-i}$, just as the 0.97 for annual data could be calculated by regressing X on ΔX .

²¹ For example, see Smith (cited in footnote 1), pp. 223–24.

the fact that numerous commodities are shipped by air, even across long intercontinental distances.

Magee (pp. 132–33) reports some direct evidence bearing on this point. Based on his samples of invoices, the mean “transportation” lag for U.S. imports from Japan was 21 days in the fiscal year 1972/73, 14 days for U.S. imports from the Federal Republic of Germany.²² To these figures must be added estimates of the “entry” lag, since, until 1978, shipments were included in U.S. import data only after customs processing was substantially complete. As the mean entry lag was about two weeks for both countries in 1973, Magee’s samples indicate transport lags (in the sense used here) of about four and five weeks, respectively, for the Federal Republic of Germany and Japan²³—too long to be easily reconciled with the 2½ week regression estimate, even allowing for the incidence of common border trade in global flows. However, for most of the 1960s, the entry lag was much shorter—a matter of a day or two. In those years, importers did not gain custody of goods until their customs obligations had been met. When procedures were relaxed to allow immediate release, first for perishables and later for merchandise in general, traders took increasing advantage of the ten-day grace period for filing forms and paying duties. (This is undoubtedly a factor in Magee’s finding that the entry lag was only one week in 1971, half as long as in 1973, for both countries.) As the entry date became increasingly distant from the timing of the actual flow of foreign goods, the U.S. Census Bureau changed its procedures so that the “importation” date (roughly, when goods arrive in port) now determines when a particular shipment is included in foreign trade statistics. Such shifts in procedures contribute to the unexplained regression residuals in this study, and in some contexts would merit explicit attention. Moreover, even had U.S. practice remained unchanged during the sample period, it would be no more than suggestive of what other countries may do. But at least Magee’s direct estimates of transport lags for particular transoceanic

²² These averages naturally mask commodity differences; for example, for Japan, the range is from 2 days for electronic calculators (the median lag for calculators is zero days, as just over one half are shipped by air) to 52 days for steel plates and sheets.

²³ Magee gives a figure of 31 days for the average entry lag for the Federal Republic of Germany (Table 4, p. 133), but this is clearly a typographical error, as none of the components of the mean approach this figure. The correct value, which is 15 days, can be computed from the horizontal sum in his table.

flows are not inconsistent with the global average estimated here by regression.

The estimates of a —the part of the coverage and valuations differences between recorded exports and imports that is proportional to trade—fall from 7 per cent for annual data to 2 per cent as calculated from monthly data. That this estimate decreases, along with that of the transport lag, is precisely consistent with the collinearity argument, since the relevant coefficients enter the equation with opposite signs. This overstates the change in \hat{a} , however, because the two estimates are not strictly comparable. It is not possible to exclude such asymmetrically recorded flows as trade with the Sino-Soviet area and special category trade from the monthly series, whereas it is possible with respect to the annual data; consequently, additional discrepancies in coverage enter the monthly equation. Recorded net exports of the world to the Sino-Soviet area have amounted to about $\frac{1}{2}$ of 1 per cent of global exports in recent years, and net exports of special category trade, a full percentage point. Thus, the decrease in \hat{a} defined consistently is perhaps no more than from 7 per cent to $3\frac{1}{2}$ per cent.

Moreover, the estimate of k —the part of the discrepancy in coverage that is not proportional to trade—increases from about \$ $\frac{1}{2}$ billion in the annual-data results to \$ $6\frac{1}{2}$ billion in the monthly-data results (expressed at an annual rate). This change amounts to about 3 per cent of world exports, valued at mid-sample. Alternatively, the equation can be re-estimated with k constrained to equal zero. In this case, the estimate of a increases by $1\frac{1}{2}$ percentage points; compare lines 1 and 2 of Table 5. (On economic grounds, there does not seem to be any a priori reason for constraining valuations and coverage discrepancies to be proportional, however, and the Durbin-Watson statistic is reduced.) For both of these reasons, the 2 per cent estimate of a is not simply the difference between freight and insurance and global net underreporting of imports.

In the light of these comments, the monthly estimate of a does not seem to be implausibly low. Nevertheless, a respectable argument for negative bias in this estimate does exist. If the transport lag has decreased during the sample period—say, because an increasing proportion of trade is transported by aircraft—then all the c_i can be shown to be subject to some degree of negative bias. (The demonstration is by application of the common result on omitted variables.) The effect on the estimate of the transport

TABLE 5. REGRESSION ESTIMATES OF THE TRANSPORT LAG EQUATION FOR WORLD TRADE, USING ALTERNATIVE SPECIFICATIONS, DEFINITIONS, OR SAMPLES, BASED ON MONTHLY DATA¹

Sample	Coefficient of Variation	Durbin-Watson Statistic	k	\hat{a}	\hat{b}_1	\hat{b}_2	\hat{b}_3	\hat{d}	$\Delta \hat{d}^2$
(a) Basic equation including exchange rate effect									
(1) Jan. 1959-Dec. 1975	0.0253	2.0	552 (7.6)	0.0212 (8.0)	0.0800 (3.0)	0.0002 (—)	0.0882 (3.8)	0.569 (1.8)	
(2) Jan. 1959-Dec. 1975	0.0287	1.6		0.0368 (19.4)	0.0838 (2.8)	0.0023 (0.1)	0.0982 (3.8)	0.659 (1.8)	
(3) Jan. 1967-Dec. 1975	0.0227	2.0	786 (4.8)	0.0160 (3.6)	0.0715 (1.9)	-0.0004 (—)	0.0880 (2.8)	0.508 (1.2)	
(4) Jan. 1959-Dec. 1974	0.0257	2.0	505 (6.8)	0.0251 (7.4)	0.0771 (2.8)	0.0399 (1.4)	0.0896 (3.6)	0.525 (1.4)	
(5) Jan. 1959-Dec. 1975	0.0253	2.0	552 (7.6)	0.0214 (8.0)	0.0765 (2.8)	0.0012 (—)	0.0914 (3.9)	0.247 (0.5)	0.536 (0.8)
(b) Forecasting version of (1) ³									
Jan. 1959-Dec. 1975	0.0254	2.0	549 (7.5)	0.0212 (8.0)	0.0842 (3.1)	-0.0032 (0.1)	0.0866 (3.8)	0.402 (1.5)	

¹ See footnotes to Tables 1 and 2.² The proportion of trade invoiced in U. S. dollars is assumed to undergo a once-for-all change beginning in January 1974.³ In this regression, the effective exchange rate for the U. S. dollar presented in *IFS* has been substituted for the trade-weighted moving average that was constructed for this study.

lag is diluted, if not negated, because the b s are functions of ratios of the c s, but the effect on a is definitely negative. To investigate this possibility, the monthly model was re-estimated with data from the latter half of the sample, 1967–75. The results, given in line 3 of Table 5, do not indicate an increase in a , but rather a slight decrease (compare line 1). The hypothesis is not conclusively disproved, as the estimate of a becomes less stable in the smaller sample (the t -value being half as large), suggesting a complex assortment of factors bearing on this coefficient in recent years. But it is quite unlikely that there exists a downward trend in the transport lag sufficiently strong to invalidate the general magnitudes of the reported estimates.

A second source of difference between yearly and monthly estimates arises because the monthly sample includes an additional year—1975. If the annual samples are similarly extended through 1975, the corresponding estimate of b is decreased considerably, bringing it closer to the reported monthly results. Further experimentation reveals, however, that while both estimates decrease somewhat when 1975 is added to the sample (first and fourth lines of Table 5), there remains a substantial difference between them.

A third difference is that the estimate of the transport lag based on annual data reflects the magnitude specific to years ending in December. This may be important in the light of the common assumption that revisions to trade data that cannot be allocated to particular months are added by statistical agencies to the December figure—trade that will not give rise to corresponding import flows, lagged or unlagged. The transport lag equations were modified to allow a constant percentage of December trade to be excluded from the normal pattern of recorded imports, but the econometric results were ambiguous. The estimate of the “December factor” was very sensitive to the omission of the final year or two from the sample (in addition to those very recent years, the numbers for which are still subject to revision). Either the data do not strongly support the hypothesis of proportionate December revisions or there has been a recent change in the pattern.²⁴ Consequently, the factor has

²⁴ As discussed, the revision pattern observable in published time series indicates that estimation would be impaired by including data from 1976 and 1977 in the sample, but there is no evidence that earlier years are likely to be affected by outstanding revisions. The Fund's Bureau of Statistics reports no change in its collecting or processing procedures dating from 1974 or 1975—

been omitted from the equations reported here. (The modified specifications and corresponding empirical results are given in Section F of the Supplementary Notes mentioned in footnote 6.)

To the extent that world trade is not denominated in U.S. dollars, a change in the effective dollar rate during the transport interval will affect the difference between exporter and importer records, as discussed in Section II. The monthly regression results suggest that, on average, about one half of world trade was invoiced in currencies other than the U.S. dollar during the years 1959–75. This is not out of line with the findings of Grassman and Magee. (Those studies reported that about two thirds of the examined trade flows were denominated in the exporter's currency and one fourth in the importer's currency—less in either case if the United States was the partner—for a small and recent sample of highly industrialized countries.)²⁵

Magee argues, quite reasonably, that these proportions will tend to vary with the strength or weakness of the dollar. A crude preliminary test of this hypothesis can be made by allowing the coefficient on the exchange rate variable to shift. Estimates are shown in line (5) of Table 5 for a dummy variable that takes the value of unity in January 1974 and later months, zero in preceding months. The results have the expected sign and are of reasonable magnitudes: an average of one fourth of world trade was invoiced in currencies other than the dollar through 1973 but a much higher proportion, about three fourths, in the succeeding portion of the sample. Neither aspect of the exchange rate effect approaches statistical significance, however, and therefore this specification was not used to calculate the preferred results (Table 1). Changing the period of the hypothesized shift in invoicing practices does not much affect the numerical results if the shift occurs later, but the estimates become unreasonable (although insignificant) if the change is specified to commence earlier—say, 1971 or 1972. This suggests that the non-dollar invoicing is more recent than the devaluations of 1971 and 1973, as would be expected if the adjustment of institutional arrangements occurs with a lag. If this interpretation is correct, the accumulation of additional observations will tend to add precision and statistical significance to these preliminary results.

In a forecasting application, the transport lag equation yields

such as the cutoff date for incorporating late revisions—that would explain the apparent tapering of the December factor.

²⁵ See Magee, pp. 118–19, and Grassman (cited in footnote 4), *passim*.

estimates of the timing asymmetry for the forecast period based on projections of world export values and an effective exchange rate for the U.S. dollar. Regarding the exchange rate variable, a convenient simplification of the preceding empirical treatment may be employed. The potential exchange rate effect was defined initially in terms of a flow between two particular regions, the exchange rates included in the weighted average being those of the countries in the exporting region and the weights reflecting exporters' shares in the importing region. (See the Statistical Appendix.) Such an elaborate variable would be cumbersome to use in an actual forecasting exercise, and the regional disaggregation has been dropped in any case. The effective exchange rate for the U.S. dollar published in *IFS* was tried as a proxy and found to be a nearly perfect substitute. The value of d is slightly different, but all other coefficients and related regression statistics are virtually unchanged. This is shown in Table 5, the first and final entries (the basic equation including the exchange rate effect and the "forecasting version" of that equation, respectively).²⁶ The timing-asymmetry estimates for the years 1967-77 presented in Table 1 are based on this forecasting version of the equation. For a decomposition of the asymmetry into components attributable to the lag itself and to the exchange rate effect, and a side calculation on the size of the effect of the hypothesized shift in dollar invoicing, see Section G of the Supplementary Notes mentioned in footnote 6.

V. Conclusions

The central finding of the present study relates to the length of the transport lag implicit in recorded world trade. In terms of flows, about 3 per cent of exports is not received and counted as imports until the following calendar year. In terms of time units, the transport lag averages about 0.6 month (if the assumed intra-month distribution of trade is not wide of the mark). The global timing asymmetry attributable to the transport lag varied between zero and \$6½ billion during the 1970s. For forecasting purposes, the asymmetry on world merchandise account that

²⁶ The exchange rate variable was transformed by computing percentage changes. In the forecasting version, the value zero was used for all months through December 1970 because the U. S. effective rate has not been calculated for earlier periods in the IMF Data Fund.

remains after taking account of the timing asymmetry is relatively smooth.

Empirical research on the transport lag is constrained by the availability of data in that it is possible to improve accuracy by estimating components of the lag distribution over relatively short units of time, or by estimating the lag for relatively small groups of countries, but not by both. The former alternative is more fruitful by far. Essentially, the lesser degree of collinearity among the relevant monthly series permits satisfactory discrimination between the lag and other effects, whereas geographic disaggregation with annual data appears to compound this problem severely. Regressions with monthly data indicate that the lag distribution extends over four periods, with most of the weight on the unlagged term. The alleged tendency for statistical authorities to include unallocable revisions in the December trade figures does not receive consistently strong empirical support.

Recorded "world" imports (using the *IFS* definition) tend to exceed "world" exports by about \$6½ billion a year *plus* 2 per cent, after allowing for the transport lag. At present, the \$6½ billion amounts to about an additional ½ of 1 per cent—implying, say, that import values exceed exports by 3 per cent apart from timing. (As a percentage of trade, the timing asymmetry is small, ⅓ of 1 per cent if trade is growing at the rate of 10 per cent a year, and so on.) Reflected in the 3 per cent are two important instances of incomplete partner records—the flow of net exports to the Sino-Soviet area, roughly ½ of 1 per cent of world trade in *IFS*, and net exports of special category commodities, 1 per cent. Adjustment for these recording inconsistencies would thus bring import values to a level roughly 4½ per cent greater than recorded exports on average (again, adjusting for the transport lag). The remaining nonreporting countries are believed to be net exporters, taken as a group, but in amounts substantially less than ½ of 1 per cent of recorded world trade. At 4½ per cent, the excess of recorded import values over export values is consistent with the conjecture of general net underreporting of imports, unless freight and insurance are much smaller in proportion to f.o.b. values than is commonly supposed.

Grassman and Magee, in published studies, report evidence that international trade is not denominated predominantly in U.S. dollars. To the extent that it is not, there is a tendency for

recorded import values to exceed (fall short of) exports if the dollar depreciates (appreciates) during the transport interval. With allowance for this effect in the transport lag equation, the proportion of trade not invoiced in U.S. dollars is estimated to be on the order of 50 per cent. While this estimate is subject to a large margin of error, it does tend to confirm—on a very broad if indirect basis—the findings of Grassman and Magee, which were necessarily based on quite narrow samples. There is also evidence, although even less certain, that the proportion of non-dollar invoicing has increased in recent years, indicating a somewhat reduced role for the U.S. dollar as a vehicle currency.

STATISTICAL APPENDIX

The annual time series for bilateral export and import flows among regions are from the IMF *Direction of Trade* data bank. In these series, trade with nonreporting countries, notably the Sino-Soviet group, is excluded both in reporter and in partner records. Special category trade and trade with “countries not specified” are necessarily excluded from regional flows. The latter, but not the former, is included in global totals; importer records of special category trade are relatively incomplete. Data from national sources have been substituted for the *DOT* partner entries for Malaysia and Singapore for the years 1958–66. The monthly time series for global exports and imports are from the IMF *International Financial Statistics* data bank. Exports to and imports from nonreporters are included.

The effective U. S. dollar exchange rates calculated for this study are weighted averages of the period-average dollar exchange rates (inverse of line *rf* in *IFS*) of the countries in the exporting region (those having exports valued at \$0.5 billion or greater in 1975). The weights are the shares of the exporting countries in that region’s total exports to the importing region. The weights vary over time, being linear interpolations of the shares at the beginning and end of the sample period, 1959–60 and 1974–75, respectively. For the “forecasting version” of the monthly equation, the effective exchange rate given in *IFS* (line *amx* on the page for the United States) was substituted for the world weighted-average rate just described.

The Influence of Social Security on Household Savings: A Cross-Country Investigation

GEORGE KOPITS and PADMA GOTUR*

THE IMPORTANCE OF SOCIAL SECURITY revenue and expenditure as instruments of fiscal policy is on the rise in a number of developed and developing countries. Pressures are mounting to expand protection for old age and against current risks, especially through liberalized health-care and income-maintenance programs, often in the face of inadequate growth in revenue raised chiefly through payroll taxation. These pressures are brought about by the emergence of a more equity-oriented social philosophy, as well as by various demographic and economic trends, the main ones being the increase in the proportion of retired to employed persons and accelerated inflation. In many countries, the ensuing rise in the need for resources cannot be met with relatively inelastic social security revenue, given regressive payroll taxes and nearly full tax coverage of the working population.

To cope with these developments, governments must consider a number of policy options regarding changes in the structure and size of social security benefits, on the one hand, and in the sources of financing, on the other hand. In weighing the options,

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they have to take into account the potential repercussions on income distribution, stability, and the allocation of resources. With respect to the latter, a major question relates to the choice by households—in their dual capacity as beneficiaries and taxpayers—between savings and consumption in response to social security. But, despite the sizable literature on savings and consumption behavior, the answer cannot be provided through theoretical deduction alone. Rather, it is necessary to ascertain empirically whether social security schemes tend to encourage, discourage, or leave unaltered the savings propensity of households. In view of conflicting evidence reported in earlier research on the subject, this paper attempts to shed further light on the impact of social security on variations among countries in savings propensity of households, by introducing certain methodological refinements and using richer and more recent data.

To begin with, a model of long-run household savings consistent with the principal hypotheses of savings behavior is formulated. Then, appropriate social security variables are incorporated in the model. The theoretical sections are followed by a survey of past research on the cross-country relationship between social security and savings. In the remainder of the paper, the influence of social security benefits and taxes on household savings is estimated separately across industrial and developing countries for the period 1969–71. The concluding section presents a summary and discussion of some policy implications.

I. A Model of Household Savings

For any meaningful test of the influence of social security schemes on intercountry differences in savings propensities, it is necessary to adopt a widely accepted theoretical explanation of household savings activity. Clearly, the explanation must be consistent with the major hypotheses of long-run savings behavior, be able to capture international variations in such behavior, and be amenable to estimation on existing statistical information. Whereas adequacy under the last two criteria will become apparent in later sections, the affinity of this model with the accepted hypotheses is discussed next.

A model of household savings that appears to meet these characteristics can be stated in the structural form

$$\begin{aligned}
SH/YH = & \alpha_0 + \alpha_1(1/YH) + \alpha_2G + \alpha_3NRR + \alpha_4(WH/YH) \\
& + \alpha_5(RE/YH) + \alpha_6INQ + \alpha_7LPA + \alpha_8DA \\
& + \alpha_9DM + \alpha_{10}LEA
\end{aligned} \tag{1}$$

where for any given country

- SH* = real household savings per capita
- YH* = real household disposable income per capita
- G* = growth rate of labor productivity
- NRR* = aftertax real rate of return on household savings
- WH* = real stock of nonhuman wealth per capita
- RE* = real flow of corporate retained earnings per capita
- INQ* = index of income inequality
- LPA* = labor-force participation of the aged
- DA* = dependency ratio for the aged
- DM* = dependency ratio for minors
- LEA* = life expectancy of the aged

Equation (1) depicts, in the absence of social security schemes, the average propensity of households to save (by country, over a number of years) as a function of economic, social, and demographic variables. It indicates that the savings rate may rise across countries above a constant value ($1 > \alpha_0 \geq 0$) in response to an increase in such economic determinants as per capita income ($\alpha_1 \leq 0$), the growth rate of productivity ($\alpha_2 \geq 0$), or the rate of interest ($\alpha_3 \geq 0$), and to a decline in wealth ($\alpha_4 \leq 0$) or in corporate retentions ($\alpha_5 \leq 0$). As for socioeconomic variables, an increase in the inequality of income or a contraction in the labor-force participation of the aged may lead to a higher savings rate ($\alpha_6 \geq 0$ and $\alpha_7 \leq 0$, respectively). Further, the savings propensity is likely to fall as a result of demographic forces in the form of an increase in the ratio of the aged or of minors to working-age population ($\alpha_8 \leq 0$ and $\alpha_9 \leq 0$) or of a decline in life expectancy at retirement age ($\alpha_{10} \geq 0$). Accordingly, the model can accommodate any of three prototypes for which we express no preference a priori: the absolute-income hypothesis, the permanent-income hypothesis, and the life-cycle hypothesis.

The absolute-income hypothesis, derived from the Keynesian consumption function, states that savings is determined by the level of income. Moreover, household savings is negative at zero income ($\alpha_1 < 0$), and the marginal propensity to save is always positive and larger than the average propensity to save ($1 > \alpha_0 > SH/YH$) at any income level. The other determinants given in

equation (1) are omitted from the original form (so that $\alpha_2, \dots, \alpha_{10} = 0$), although the hypothesis does assign a minor role to the interest rate as well as to certain demographic variables.¹

According to the permanent-income hypothesis, developed by Friedman partly on the basis of the Fisherian theory of interest, long-run savings is a constant proportion of long-run income. This proportion is in turn determined by the interest rate, the ratio of nonhuman wealth to income, and various social and demographic factors.² Thus, in terms of equation (1), the savings ratio is affected negatively by the wealth ratio ($\alpha_4 < 0$) and the dependency ratios ($\alpha_8 < 0$, $\alpha_9 < 0$), and positively by the interest rate ($\alpha_3 > 0$)³ and the life expectancy of the aged ($\alpha_{10} > 0$). The influence of other characteristics of households may be reflected in the intercept, but the remaining variables shown in equation (1) are excluded from the hypothesis ($\alpha_1, \alpha_2, \alpha_5, \alpha_6, \alpha_7 = 0$).

The life-cycle hypothesis, introduced and refined by a number of authors, also in the Fisherian tradition, provides perhaps the most versatile microeconomic explanation of savings behavior.⁴ In essence, it is based on the assumption that an individual accumulates wealth in his working years to compensate for the lack of earnings during retirement and thus to maintain a stable stream of consumption. Hence, under static conditions and barring intergenerational transfers, the net lifetime (long-run) sav-

¹ The fundamental Keynesian equation is given by

$$S = \alpha_0 Y + \alpha_1 \quad (2)$$

where S and Y denote aggregate (or per capita) savings and income, respectively. However, Keynes (1936, Chs. 8 and 9) discussed a number of cultural and demographic determinants that he called "subjective" factors, as distinct from the absolute level of income and the interest rate, regarded as "objective" factors.

² For the theoretical underpinning of the model, see Fisher (1930, Part III). Although Friedman focused on the determination of short-run consumption or savings, he explained (1957, Ch. 2) the permanent component thereof with the general form

$$S = k(R, W/Y, U)Y \quad (3)$$

which can be expressed by the linear relationship

$$S = [k_0 R + k_1 (W/Y) + k_2 U]Y \quad (4)$$

where S denotes permanent savings, R the interest rate, W nonhuman wealth, U social and demographic variables that determine the utility function of households (age, family composition, etc.), and Y permanent income. The parameter values are $k_0 > 0$, $k_1 < 0$, and $k_2 \geq 0$.

³ For a derivation and test of the substitution effect of the interest rate (at a constant level of permanent income), see Wright (1969).

⁴ The hypothesis was first proposed by Harrod (1948, Lecture 2). For derivations, see Ando and Modigliani (1963), Tobin (1967), Modigliani (1970), and the recent extension by Feldstein (1977).

ings of the individual is zero; likewise, there is no net aggregate savings ($\alpha_0 = 0$).⁵ However, in a growing economy, the long-run aggregate savings/income ratio becomes positive as each successive generation enjoys a higher income from which to save. Thus, in a dynamic context, the savings ratio is affected by the rate of growth of productivity, as well as by variations in the distribution of lifetime between work and retirement and in the distribution of the population between workers and dependents. In terms of equation (1), the average propensity to save increases owing to a rise in the growth rate of productivity ($\alpha_2 > 0$) or the life expectancy of the aged ($\alpha_{10} > 0$), or owing to a fall in the stock of wealth ($\alpha_4 < 0$), the labor supply of the aged ($\alpha_7 < 0$), or dependency ratios ($\alpha_8 < 0$, $\alpha_9 < 0$).⁶

Other less frequently listed determinants of the household savings ratio, under the life-cycle hypothesis, are the interest rate, corporate savings, and income distribution.⁷ The positive effect of a rise in the interest rate ($\alpha_3 > 0$) reflects the substitution of future for present consumption, dampened by any increase in corporate savings taken into account by shareholders in their personal savings decisions ($\alpha_5 < 0$). A similar positive response to a rise in the unevenness of the distribution of income ($\alpha_6 > 0$) is based on the trade-off between equity and efficiency, as relatively high savings propensities may tend to be associated with high levels of disposable income.⁸

In the life-cycle approach, there is no place for the absolute level of income as an explanatory variable ($\alpha_1 = 0$). Yet in an

⁵ In the event of a steady rise in intergenerational transfers through bequests, the parameter $\alpha_0 > 0$ would obtain.

⁶ The role of the growth rate and dependency ratios has been analyzed and tested by Leff (1969), Modigliani (1970), and Feldstein (1977); yet, unlike others, Modigliani substituted the growth rate of labor productivity for the overall economic growth rate. In a recent elaboration of the hypothesis, Feldstein (1977) argued that, in addition to these determinants, individuals would raise their target wealth/income ratio (or equilibrium savings ratio) in view of accelerated retirement from the labor force and of extension in the retirement period owing to increased life expectancy.

⁷ Following Harrod (1948, Lecture 2), Modigliani (1970) and Feldstein (1973) highlighted the inverse relationship between corporate and household savings. Tobin (1967) emphasized the influence of the interest rate, and Modigliani (1970) tested the effect of the functional distribution of income in savings behavior, while acknowledging the problems associated with his measure of such distribution in terms of the ratio of nonwage income to total private income before taxes and transfers.

⁸ For a contrary view, namely, that a more equitable income distribution need not lead to a long-run reduction of savings (whereby $\alpha_6 = 0$) in an international context, see Tanzi and Aschheim (1965).

extension of the hypothesis, it has been suggested that the savings ratio is influenced indirectly by income through the labor-force participation of the aged.⁹ According to this view, individuals will tend to lengthen their work life if their real income is relatively low, so as to generate sufficient purchasing power to complement leisure with an adequate level of consumption during the retirement years. Also, higher life expectancy at normal retirement age will prompt them to prolong participation in the work force, everything else being equal. Thus, labor-force participation of the aged is explained by the relationship

$$LPA = \beta_0 + \beta_1(1/YH) + \beta_2LEA \quad (5)$$

indicating the impact of income ($\beta_1 > 0$) and of life expectancy of the aged ($\beta_2 > 0$), above a constant rate ($\beta_0 > 0$), whereby the labor-force participation variable is to be treated endogenously in the savings equation (1). In sum, equations (1) and (5) comprise the analytical framework adopted to examine the link between social security and savings behavior.

II. The Role of Social Security

Individuals are associated with social security schemes as recipients of benefits, on the one hand, and as contributors, or rather as taxpayers, on the other hand. For purposes of this inquiry, namely, to assess the impact of these schemes on household savings, the benefits can be classified in three basic categories: old-age transfers, transfers related to current contingencies, and loans. Although normally the beneficiaries must be enrolled under the scheme, in some countries certain benefits are provided universally or upon meeting certain requirements.

Old-age transfers consist predominantly of pensions disbursed periodically to eligible retirees—in some countries qualifying automatically at a specified age, and in others subject to a retirement test, an income test, or a means test—in an amount more or less related to covered preretirement wages. Alternatively, in a few developing countries, a lump-sum payment is made to each retiree from a provident fund (normally operated on a funded rather than a pay-as-you-go basis), in an amount equivalent to past tax contributions into the fund plus accrued interest. Addi-

⁹ See Feldstein (1977).

tional cash benefits are provided under old-age programs upon disability or death of eligible workers or retirees.

Other social security transfers to eligible households cover (fully or partially) medical contingencies, unemployment, work injury, and/or indigence. These benefits, in cash or in kind, are provided either to the entire population, or to enrolled workers and their dependents, or to individuals who qualify under a means test.

The third category of benefits, available in certain developing countries, involves the extension of loans to enrolled individuals—in some instances, limited on the basis of seniority or a means test. These loans are provided for housing or for other personal needs (such as expenditure on education, marriage, or certain durable goods).

Among the various forms of financing social security schemes, individuals are directly aware of payroll tax payments, which alone in many countries confer eligibility for benefits—fostering the popular belief that payroll taxes for social security are tantamount to insurance premiums or pension fund contributions. Other less common sources of financing, such as general revenue or revenue from earmarked taxes, are provided by taxpayers at large.

Social security schemes may influence the household savings ratio via three effects: the income effect, the wealth effect, and the retirement effect.¹⁰ In the framework of equations (1) and (5), any change in benefits or payroll taxes has an *income effect* on the savings ratio by altering the average level of disposable income and the degree of income inequality. This impact is contingent on the extent to which, over the long run, benefits raise disposable income while payroll taxes reduce it, from the level that would obtain otherwise, for households in different income brackets. In the event that parameters α_1 , α_4 , α_5 , α_6 , and β_1 turn out to be zero, the income effect vanishes. Also, insofar as benefits move closely with tax payments (as tax proceeds are used to finance benefits in unfunded or pay-as-you-go schemes) and as they have similar incidence on households across income categories, there is no income effect even in the presence of nonzero parameters.

The *wealth effect* indicates the direct savings response of indi-

¹⁰ For a theoretical derivation of the wealth and retirement effects of old-age benefits, see Feldstein (1977).

viduals to expected future benefits. It is negative if individuals feel that they need to accumulate less wealth for retirement and current contingencies (such as sickness and unemployment) and thus reduce their desired ratio of savings to income, as a result of the protection afforded by social security. Alternatively, the effect is positive if the introduction of social security educates individuals as to the need to insure themselves for old age and against current risks, thereby raising their desired savings ratio.¹¹ The net wealth effect may be either negative or positive, depending on the relative strength of the individual's perception of the substitutability between expected social security benefits and savings, and of his effort to complement such benefits with additional savings because of the educational impact.

In addition, an indirect repercussion of social security benefits on the savings ratio may take place through the *retirement effect*. The prospect of receiving an old-age pension or lump-sum transfer may encourage individuals to retire sooner than they would in its absence. Hence, the retirement effect on savings is expected to be positive, reflecting the increased savings ratio brought about by the benefit-induced reduction in the labor supply of the aged and by the consequent need to provide for the longer retirement period.

The wealth and retirement effects are incorporated into the savings model by modifying equations (1) and (5), respectively, as follows:

$$\begin{aligned} SH/YH = & \alpha_0 + \alpha_1(1/YH) + \alpha_2G + \alpha_3NRR + \alpha_4(WH/YH) \\ & + \alpha_5(RE/YH) + \alpha_6INQ + \alpha_7LPA + \alpha_8DA \\ & + \alpha_9DM + \alpha_{10}LEA + \alpha_{11}(SSP/YH) \\ & + \alpha_{12}(SSF/YH) + \alpha_{13}(SSO/YH) \\ & + \alpha_{14}(SSL/YH) + \alpha_{15}AGE \end{aligned} \quad (6)$$

and

$$\begin{aligned} LPA = & \beta_0 + \beta_1(1/YH) + \beta_2LEA + \beta_3(SSP/YH) \\ & + \beta_4(SSF/YH) + \beta_5AGE \end{aligned} \quad (7)$$

where the new variables are

SSP = social security pension per aged person

SSF = social security lump-sum transfer (from provident fund) per aged person

¹¹ Cagan (1965) observed that, similarly, pension plans may induce households to recognize the need to save more for the retirement years.

SSO = other social security transfers per capita

SSL = social security loans per capita

AGE = age of social security system

Parameters α_{11} through α_{15} reflect the net wealth effect, and β_3 through β_5 , multiplied by α_7 , indicate the retirement effect. As discussed earlier, the net wealth effect of the rate of each major type of benefit can be positive or negative ($\alpha_{11}, \alpha_{12}, \alpha_{13}, \alpha_{14}, \geq 0$), whereas the retirement effect of the old-age benefit rates cannot be negative ($\alpha_7\beta_3, \alpha_7\beta_4 \geq 0$) on the savings ratio—where benefit rates are defined as the proportion of per capita benefit to per capita disposable income. But these effects are qualified by variations in the age of social security schemes across countries. The educational impact of social security on savings habits may register with a lag; analogously, individuals may delay the reduction of savings or the acceleration of retirement induced by increased benefits. In contrast, it can also be argued that the wealth and retirement effects may wear off as the scheme matures, if individuals no longer believe that they will receive an adequate old-age benefit stream upon retirement—especially in countries where the size of benefits is not corrected sufficiently for inflation or where the number of taxpayers supporting the scheme shrinks in relation to the number of beneficiaries. Thus, the possible direction of the relationship between the age of the system and either the savings ratio or the labor-force participation of the aged is ambiguous ($\alpha_{15} \geq 0, \alpha_7\beta_5 \geq 0$).

Alternatively, savers may adjust their desired wealth/income ratio to the social security tax liability that they actually incur (that is, payroll tax payments of employers and employees) rather than to the social security benefits that they are entitled to receive in case of a contingency. To take into account this view of the wealth effect, equation (6) must be replaced by

$$\begin{aligned} SH/YH = & \alpha_0 + \alpha_1(1/YH) + \alpha_2G + \alpha_3NRR + \alpha_4(WH/YH) \\ & + \alpha_5(RE/YH) + \alpha_6INQ + \alpha_7LPA + \alpha_8DA \\ & + \alpha_9DM + \alpha_{10}LEA + \alpha_{11}(SST/WS) \\ & + \alpha_{12}AGE \end{aligned} \quad (8)$$

where the effective payroll tax rate is calculated from the ratio of tax payments, *SST*, to gross wages and salaries, *WS*. Similarly, equation (7) is to be changed if individuals near retirement age are more apt to base their choice between work and leisure on the tax proxy for the expected stream of old-age benefits, so that

$$LPA = \beta_0 + \beta_1(1/YH) + \beta_2LEA + \beta_3(SST/WS) + \beta_4AGE \quad (9)$$

The parameters of the effective tax rate represent the wealth effect ($\alpha_{11} \geq 0$)¹² and the retirement effect ($\alpha_7\beta_3 \geq 0$), qualified by the age of the system ($\alpha_{12} \geq 0$, $\alpha_7\beta_4 \geq 0$).

A criticism that can be leveled at the foregoing analysis of wealth and retirement effects of social security is that it ignores the role of the extended family as a social security institution in certain countries. Gainfully employed individuals provide financial support to the retired, invalid, and sick members of the family in the expectation that they in turn will be similarly protected upon reaching old age or becoming invalid. This arrangement, which operates much like an unfunded social security scheme, may explain in part the relatively depressed savings ratio in a number of developing countries, implicitly casting doubt on the general applicability of the life-cycle hypothesis. However, notwithstanding the diminished importance of the negative wealth effect and the retirement effect in the presence of an extended family structure, the positive wealth effect reflecting the educational factor may still hold in these countries.

III. Review of Past Studies

There have been relatively few studies on the relationship between social security and savings behavior across countries—in contrast to the more extensive research based on U. S. time series.¹³ In the first attempt to analyze such a relationship, Aaron (1967) adopted a household savings function broadly in accord with the life-cycle hypothesis. Although he was concerned primarily with explaining social security expenditure (in terms of the age of the system and household savings, *inter alia*), he also explored the effect of the ratio of such expenditure to national income, the age of the system, the old-age benefit rate, and the growth rate of national income on the household savings ratio. Ordinary least-squares estimates on a cross section of 19

¹² As against equation (6), where the wealth effect is allowed to differ by major type of benefit, equation (8) does not discriminate by type of benefit or contingency, since normally all benefits are financed from the same payroll tax.

¹³ See the recent survey by Esposito (1978). The only studies of other individual country experiences, by Shome and Saito (1978) and by Wallich (1978), relate to five Asian countries and to Chile, respectively.

countries (most of them developed) for 1957 yielded a significant positive coefficient for the age of the system and a negative one for the ratio of social security outlays. But re-estimation by Pechman, Aaron, and Taussig (1968, Appendix D) on 1960 data for practically the same sample failed to confirm the significance of the inverse relationship between the social security expenditure ratio and the household savings ratio. In addition, they estimated, also on 1960 data, the labor-force participation of the aged as a function of the proportion of the population over retirement age, per capita national income, and the ratio of old-age benefits per aged person to per capita wages in manufacturing, all of which displayed the expected significant negative coefficients.

On the basis of the most comprehensive version of the life-cycle hypothesis, Feldstein (1977) tested the impact of old-age benefits and other characteristics of social security schemes with a two-equation model—which to a large extent has inspired our model. The two endogenous variables—the private savings ratio (including corporate savings) and the labor-force participation of the aged—are determined by the following exogenous variables: growth rate of real private national income, dependency ratios, real per capita national income, life expectancy of the aged, old-age social security benefit per aged person as a ratio of per capita income, age of the scheme, and the ratio of corporate retained earnings to national income. Alternatively, in an effort to identify more precisely the effects of old-age benefits, the benefit rate per aged person was replaced by the benefit rate per old-age pensioner, the coverage rate of aged persons, and the presence of a retirement test. Feldstein (1977) used averages from national income statistics for the years 1954–60 and social security data for 1958–60 for a sample of 12 developed and 3 developing countries to measure the variables. The model was estimated by applying single-equation as well as simultaneous-equation techniques: weighted ordinary least squares on the structural and reduced form equations, and weighted two-stage least squares—the weights consisting of the respective country's population.

On the whole, Feldstein's (1977) results gave support to the life-cycle hypothesis. The coefficients of the following exogenous variables of the savings function were significant (although indicating sensitivity to the inclusion or omission of particular variables) and carried the indicated signs: positive for the growth rate, the life expectancy of the aged, and the retirement test; and

negative for the dependency ratios, various measures of the benefit rate, the per capita income level, and its inverse. As to the equation for the labor-force participation, varying degrees of significance were obtained with positive coefficients for per capita income and its inverse, and with negative coefficients for the components of the benefit ratio and, in some instances, the retirement test. The significance of the reciprocal of the income variable declines markedly (while that of other variables falls slightly) upon removal of the absolute level of income from either equation.¹⁴ The coefficients of the age of the social security system and the corporate retention ratio are insignificant in virtually all regressions.

In another recent study, Barro and MacDonald (1979) tried to explain the ratio of consumer expenditure to gross domestic product (GDP) with a pooled sample of annual observations for the period 1951–60 on 16 developed Western countries. They employed a one-equation model, also based essentially on the life-cycle hypothesis, in which the consumption ratio is determined by the growth rate in real per capita GDP, the reciprocal of real per capita GDP, the ratio of government expenditure to GDP, the proportion of old-age persons in total population, the old-age benefit rate, the unemployment rate, and the ratio of last year's to the current year's per capita GDP. Aside from the variables already discussed, the last two are supposed to take into account cyclical fluctuations, while the parameter of the government expenditure ratio is meant to capture the household's perception of a proportion of government outlays as constituting an equivalent amount of imputed private consumption or saving.

Barro and MacDonald (1979) presented four sets of ordinary least-squares estimates. In one instance, the consumption function was weighted by the square root of population, in another it was not so weighted; further, each of these regressions was run alternatively with a constant term or with country dummy variables. In the equations with the intercept, the coefficients of all variables (except the ratio of past to current GDP) were at least marginally significant: carrying a negative sign for the government expenditure ratio, the growth rate, and the old-age benefit rate; and a positive sign for the proportion of elderly in the popu-

¹⁴ Feldstein (1977) failed to provide sufficient justification for including both the per capita income and its reciprocal in the reduced form savings equation and the labor-force participation equation.

lation, the unemployment rate, and the reciprocal of per capita GDP. Not surprisingly, the overall performance of the equation improved sharply upon introduction of country dummies (and exclusion of the growth rate), retaining the significance of the aforementioned variables although with reversal to a negative sign for the proportion of elderly and to a positive sign for the old-age benefit rate. The presence of dummies also contributed to a reduction in the serial correlation of residuals, which seems to be particularly severe otherwise (as revealed by the low value of the Durbin-Watson statistic). As for differences between weighted and unweighted regressions, the latter provided worse fits than the former, as expected.

Before interpreting the results, one should consider several problems associated with the measurement of variables and the estimation of the foregoing models. Measurement difficulties are likely to arise with respect to savings, per capita real income, and social security variables. The savings variable should be limited to the household sector,¹⁵ without including the corporate sector, so as to test rather than assume the transparency of the corporate veil in the personal choice between savings and consumption, and to acknowledge the possible distinction in the motives to save of households and corporations. Instead of translating per capita real income into U. S. dollars at the official exchange rate, as has been done in all the preceding models, the correct approach would be to adjust real income for differences in the purchasing power of currencies. Although one may criticize Aaron (1967) for using a crude social security variable, namely, the global social security expenditure ratio, it may also be questionable to break down, as Feldstein does, the benefit rate on the basis of rather soft data on the coverage ratio and the retirement test (obtained from statutory information that vaguely reflects actual practices), while ignoring the income and means tests used in some countries.

The estimation problems involve identification, specification, heteroscedasticity, distinction between long-run and short-run effects, and sample homogeneity. The first three are econometric issues, whereas the last two may affect only the interpretation of results. Estimation of most savings functions, including the ones discussed here, ignores the possible bias

¹⁵ Ideally, in this context, savings should include additions to the stock of durable goods.

introduced by the difficulty of identifying such a function as distinct from the investment function, which also contains the growth rate and the interest rate as explanatory variables. This bias can be corrected through simultaneous equation estimation, but outside evidence suggests that the extent of the bias is not likely to be important.¹⁶

Another source of bias present in these models is the possible specification error brought about by the omission of certain key variables, notably, the interest rate, income distribution, the stock of wealth, and social security variables other than the old-age benefit rate. This error can result also from the linear form of savings function, given the generality of the underlying theory. Incidentally, the severe serial correlation reported by Barro and MacDonald (1979) may be symptomatic of the exclusion of certain exogenous variables or the choice of an incorrect functional form.

The weighting procedure employed by some authors to enhance the relative importance of larger countries in the regressions, by population size, may lead to heteroscedastic disturbances that (much like serial correlation) tend to inflate the significance of the estimated coefficients upon application of conventional tests of statistical significance.

Several studies fail to isolate long-run from short-run effects of social security. The Aaron (1967) and Pechman-Aaron-Taussig (1968) estimates, based on single-year cross sections, are undoubtedly influenced by short-run forces. Despite the explicit inclusion of certain cyclical variables, the Barro-MacDonald (1979) estimates do reflect short-run behavior, particularly in the presence of dummies that serve to eliminate intercountry variations (or shifts) among ten-year strings of country observations.

Most regressions were run on cross-sectional samples containing countries at different stages of development (although the majority are developed), under the assumption that they are drawn from the same population. A more realistic approach would have been to recognize that developed and developing countries may belong to different populations, by allowing differences in behavior to be reflected in differences in the values of corresponding parameter estimates.

Having discussed possible empirical shortcomings of previous research, one can summarize and interpret the findings on the

¹⁶ See the results of the experiment undertaken by Modigliani (1970, pp. 206-209).

impact of social security. In their estimates of the labor-force participation function, Pechman, Aaron, and Taussig (1968), as well as Feldstein (1977), found support for the postulated retirement effect: an increase in the old-age benefit rate may lead to a rise in household or private savings, via reduction in the labor supply of the aged. However, Aaron (1967) and Feldstein (1977) also produced evidence indicating that on balance the net negative wealth effect swamps the retirement effect, so that social security has a depressing impact on the propensity to save. Further, according to Aaron's (1967) estimates, as the system matures, the negative influence of social security expenditure wears off. A plausible explanation is that individuals raise the savings ratio as they increasingly feel that the expected benefits will not be sufficient to provide protection against various contingencies, including old age.

Against these results, Barro and MacDonald (1979) found that increased old-age benefit rates are related to a rising savings propensity, suggesting that the retirement effect and/or the positive wealth effect more than offset the negative wealth effect. In the absence of a direct estimate of the labor-force participation equation, it is not clear whether indeed the retirement effect or a positive wealth effect, representing the educational role of social security, is the dominant influence. In sum, the conflicting findings of past studies, as well as the underlying empirical problems, warrant a fresh attempt to solve some of these problems and thus to provide more reliable evidence on the influence, if any, of social security on intercountry differences in savings propensities.

IV. Empirical Estimates of the Model

The theoretical model presented earlier is a two-equation system where the household savings ratio and the labor-force participation of the aged are endogenous. Having ruled out the application of either ordinary least squares to each structural equation¹⁷ or two-stage least squares to the savings equation,¹⁸

¹⁷ Despite the appearance of a recursive system that would have justified the use of ordinary least squares, we found that the error terms of the savings equation and the labor-force participation equation, estimated by two-stage least squares, are highly correlated.

¹⁸ This approach had to be rejected because of the relatively small samples, particularly for industrial countries.

a third alternative was adopted to break the simultaneity. Specifically, the labor-force participation equation was substituted in the structural savings equation, and then ordinary least-squares estimation was applied to the resulting reduced form savings equation and the original labor-force participation equation. This approach is equivalent to indirect least-squares estimation, although without the advantage of being able to derive structural parameters from the reduced form coefficients.

The equations were estimated on cross sections of country averages of 1969–71 annual observations, grouped in samples of 14 industrial countries and 40 developing countries, the size of the samples being dictated chiefly by the availability of data.¹⁹ Other refinements over previous research include the measurement of per capita real income (taking into account intercountry differences in purchasing power) and the rate of growth of labor productivity (i.e., the difference between the growth rates of output and of the labor force). Further, several additional explanatory variables were introduced: various social security benefit and tax rates; the aftertax long-term interest rate on financial savings *less* inflation (for developing countries the inflation rate alone was used because of the lack of adequate data on interest and tax rates); and an index of income inequality consisting of estimates of the Gini coefficient. However, no attempt was made to deal with the savings/investment simultaneity and to quantify the wealth variable.

With regard to social security variables, special care was taken in selecting the appropriate economic bases to calculate effective benefit and tax rates. Four benefit rates were measured by the ratios to household disposable income of (1) old-age pensions, (2) old-age lump-sum payments (from provident funds), (3) other transfers, and (4) loans. Old-age transfers, in addition, were normalized for the proportion of the elderly in the total population. The tax rate was given by payroll taxes for social security as a ratio of compensation of employees *plus* entrepreneurial income. Because of insufficient data, for developing countries the tax rate could not be computed, while the benefit rates were taken as ratios to private disposable income.

Albeit unweighted and population-weighted regression estimates are shown in Tables 1 through 4, the following discussion focuses primarily on the unweighted estimates. Weighted esti-

¹⁹ A description of the data is provided in the Appendix.

mates (obtained by multiplying each observation by population size) substantially raised the goodness-of-fit of the regressions, but at the cost of introducing a high degree of collinearity among several variables for all samples, and some heteroscedasticity for developing countries. Nonetheless, both sets of results have essentially the same implications regarding the effects of social security.

Table 1 presents the unweighted results for industrial countries. In regression (1), fitted on the basic household savings

TABLE 1. INDUSTRIAL COUNTRIES: UNWEIGHTED REGRESSION RESULTS ¹

Independent Variables	Dependent Variable				
	<i>SH/YH</i> (1)	<i>SH/YH</i> (2)	<i>SH/YH</i> (3)	<i>LPA</i> (4)	<i>LPA</i> (5)
Constant	53.776 (46.748)	20.558 (7.481)	36.656 (10.045)	-11.786 (57.412)	17.828 (49.901)
<i>1/YH</i>	2.294 (5.364)			4.654 (5.614)	5.362 (5.370)
<i>G</i>	0.033 (1.900)	1.794 (0.507)	0.790 (0.516)		
<i>NRR</i>	1.486 (1.142)	0.700 (0.583)	1.215 (0.540)		
<i>RE/YH</i>	0.284 (0.438)				
<i>INQ</i>	19.800 (24.578)				
<i>DA</i>	-0.712 (0.494)		-0.601 (0.267)		
<i>DM</i>	-0.242 (0.207)	-0.157 (0.093)	-0.270 (0.102)		
<i>LEA</i>	-2.208 (2.940)			2.081 (3.360)	0.094 (2.888)
<i>SSP/YH</i>		0.092 (0.039)		-0.178 (0.090)	
<i>SSO/YH</i>		-0.406 (0.202)			
<i>SST/CN</i>			0.292 (0.107)		-0.522 (0.225)
<i>AGE</i>		-0.118 (0.053)	-0.086 (0.047)	-0.115 (0.127)	-0.220 (0.101)
Summary Statistics ²					
\bar{R}^2	0.210	0.725	0.759	0.317	0.386
\overline{SEE}	4.380	2.584	2.418	6.242	5.921
\bar{X}	11.375	11.375	11.375	12.464	12.464

¹ The figures in parentheses are standard errors of the regression coefficients.

² The statistics \bar{R}^2 and \overline{SEE} represent the coefficient of determination and the standard error of estimate, respectively, corrected for loss in degrees of freedom; \bar{X} is the arithmetic mean of the dependent variable.

TABLE 2. DEVELOPING COUNTRIES: UNWEIGHTED REGRESSION RESULTS ¹

Independent Variables	Dependent Variable			
	<i>SP/YP</i> (1)	<i>SP/YP</i> (2)	<i>SP/YP</i> (3)	<i>LPA</i> (4)
Constant	23.784 (5.770)	22.035 (8.821)	16.642 (2.925)	21.894 (3.730)
<i>1/YP</i>	-0.422 (0.166)	-0.423 (0.206)	-0.363 (0.171)	0.866 (0.267)
<i>G</i>	0.409 (0.360)	0.496 (0.428)	0.508 (0.316)	
<i>INF</i>	-0.259 (0.145)	-0.232 (0.175)	-0.290 (0.139)	
<i>INQ</i>	2.181 (9.223)	2.247 (10.631)		
<i>DA</i>	-0.014 (0.033)	-0.022 (0.037)		
<i>DM</i>	-0.047 (0.031)	-0.040 (0.042)		
<i>SSP/YP</i>		-0.004 (0.074)		-0.257 (0.095)
<i>SSF/YP</i>		0.151 (0.168)		-0.199 (0.257)
<i>SSO/YP</i>		0.302 (0.394)	0.426 (0.272)	
<i>SSL/YP</i>		-0.179 (1.725)		
<i>AGE</i>		-0.041 (0.092)		0.250 (0.133)
Summary Statistics ²				
\bar{R}^2	0.303	0.226	0.341	0.326
\overline{SEE}	4.760	5.016	4.627	8.125
\bar{X}	15.584	15.584	15.584	29.594

¹ The figures in parentheses are standard errors of the regression coefficients.

² The statistics \bar{R}^2 and \overline{SEE} represent the coefficient of determination and the standard error of estimate, respectively, corrected for loss in degrees of freedom; \bar{X} is the arithmetic mean of the dependent variable.

function (without the social security variables) the coefficients of the growth rate of productivity, interest rate, income inequality, and dependency ratios carry the expected signs, whereas those of the reciprocal of per capita real income and retained corporate earnings are insignificant and have incorrect signs. Regressions (2) and (3), incorporating alternatively the social security benefit and tax rates—along with the age of the system—while excluding the weakest basic variables, ²⁰ indicate a significant positive

²⁰ Namely, excluding variables whose coefficients are smaller than their corresponding standard errors, to minimize the loss in degrees of freedom.

relationship between savings and old-age transfers or payroll taxation, and a negative relationship between savings and other social security transfers. Labor-force participation regressions (4) and (5) show the expected positive although insignificant coefficients for the reciprocal of income and life expectancy, and negative significant ones for the old-age transfers or payroll taxes and the age of the system.

The response of household savings to independent variables that exhibit significant coefficients is summarized in Table 5. The

TABLE 3. INDUSTRIAL COUNTRIES: WEIGHTED REGRESSION RESULTS ¹

Independent Variables	Dependent Variable				
	<i>SH/YH</i> (1)	<i>SH/YH</i> (2)	<i>SH/YH</i> (3)	<i>LPA</i> (4)	<i>LPA</i> (5)
Constant	64.085 (47.800)	12.154 (6.205)	31.335 (5.823)	198.837 (43.629)	238.263 (49.306)
<i>1/YH</i>	-3.353 (2.140)			-1.910 (2.261)	-2.287 (2.884)
<i>G</i>	1.552 (1.618)	2.486 (0.308)	1.037 (0.262)		
<i>NRR</i>	1.681 (0.778)	0.288 (0.395)	0.868 (0.372)		
<i>RE/YH</i>	0.181 (0.233)				
<i>INQ</i>	19.514 (23.625)				
<i>DA</i>	-0.677 (0.582)		-0.470 (0.200)		
<i>DM</i>	-0.386 (0.230)	-0.136 (0.062)	-0.239 (0.066)		
<i>LEA</i>	-1.335 (2.739)			-10.568 (2.681)	-13.127 (2.955)
<i>SSP/YH</i>		0.106 (0.023)		-0.099 (0.069)	
<i>SSO/YH</i>		-0.295 (0.146)			
<i>SST/CN</i>			0.338 (0.084)		0.072 (0.309)
<i>AGE</i>		-0.079 (0.040)	-0.092 (0.049)	-0.427 (0.102)	-0.565 (0.095)
Summary Statistics ²					
\bar{R}^2	0.993	0.998	0.997	0.986	0.984
\overline{SEE}	53.900	31.800	35.420	139.500	151.600
\bar{X}	511.364	511.364	511.364	710.218	710.218

¹ The figures in parentheses are standard errors of the regression coefficients.

² The statistics \bar{R}^2 and \overline{SEE} represent the coefficient of determination and the standard error of estimate, respectively, corrected for loss in degrees of freedom; \bar{X} is the arithmetic mean of the dependent variable.

TABLE 4. DEVELOPING COUNTRIES: WEIGHTED REGRESSION RESULTS ¹

Independent Variables	Dependent Variable			
	<i>SP/YP</i> (1)	<i>SP/YP</i> (2)	<i>SP/YP</i> (3)	<i>LPA</i> (4)
Constant	19.026 (6.237)	26.170 (13.364)	23.246 (1.708)	17.018 (5.784)
<i>1/YP</i>	-0.313 (0.106)	-0.551 (0.286)	-0.438 (0.073)	1.117 (0.311)
<i>G</i>	0.479 (0.279)	-0.049 (0.521)		
<i>INF</i>	-0.201 (0.124)	-0.255 (0.124)	-0.268 (0.091)	
<i>INQ</i>	0.754 (7.844)	5.384 (9.952)		
<i>DA</i>	-0.127 (0.169)	0.010 (0.163)		
<i>DM</i>	-0.003 (0.038)	-0.027 (0.073)		
<i>SSP/YP</i>		0.164 (0.070)	0.126 (0.039)	-0.328 (0.075)
<i>SSF/YP</i>		0.202 (0.138)		-0.789 (0.299)
<i>SSO/YP</i>		-1.447 (0.771)	-1.515 (0.406)	
<i>SSL/YP</i>		2.773 (1.790)		
<i>AGE</i>		-0.141 (0.140)		0.657 (0.196)
Summary Statistics ²				
\bar{R}^2	0.996	0.997	0.997	0.998
\overline{SEE}	67.240	59.740	57.760	170.000
\bar{X}	367.507	367.507	367.507	1,002.914

¹ The figures in parentheses are standard errors of the regression coefficients.

² The statistics \bar{R}^2 and \overline{SEE} represent the coefficient of determination and the standard error of estimate, respectively, corrected for loss in degrees of freedom; \bar{X} is the arithmetic mean of the dependent variable.

first column shows the elasticity of the household savings ratio with respect to these variables in industrial countries, based on unweighted regressions (2) and (3). Estimates of the elasticity with respect to the growth rate, interest rate, and dependency ratios are broadly consistent with those reported by other authors. ²¹ As to the social security variables, it appears that a rise of 1 per cent in the rate of old-age pensions or of payroll taxes leads to an increase of nearly 1/2 of 1 per cent in the savings

²¹ See, for example, the elasticity estimates given in Leff (1969) and Wright (1969).

TABLE 5. ELASTICITY OF SAVINGS WITH RESPECT TO SELECTED INDEPENDENT VARIABLES ¹

Independent variables	Unweighted Regressions		Weighted Regressions	
	Industrial countries ² (SH/YH)	Developing countries ³ (SP/YP)	Industrial countries ² (SH/YH)	Developing countries ³ (SP/YP)
<i>I/YP</i>		-0.19		-0.44
<i>G</i>	0.00/0.56		0.34/0.82	
<i>NRR</i>	0.00/0.07		0.00/0.09	
<i>INF</i>		-0.10		-0.13
<i>DA</i>	-1.07/0.00		-0.76/0.00	
<i>DM</i>	-1.41/0.00		-1.27/-0.72	
<i>SSP/YH</i>	0.47		0.43	
<i>SSP/YP</i>		0.00		0.08
<i>SSO/YH</i>	-0.49		-0.28	
<i>SSO/YP</i>		0.00		-0.24
<i>SST/CN</i>	0.34		0.34	
<i>AGE</i>	-0.56/0.00		-0.32/0.00	

¹ Elasticity estimates were computed using the arithmetic means of the relevant variables in each sample. The elasticity of savings with respect to variables whose coefficients are significant at the 10 per cent level or more is assumed to be zero.

² Estimates based on coefficients appearing in regressions (2) and (3) in Tables 1 and 3. The presence of two estimates for a given variable indicates a range of elasticities, derived from the coefficients of that variable in these regressions.

³ Estimates based on coefficients from regression (3) in Tables 2 and 4.

ratio, whereas a rise of 1 per cent in the rate of other benefits depresses the savings ratio by $\frac{1}{2}$ of 1 per cent. The size of the negative influence of the age of the system depends on the estimated regression.

These results confirm the extended life-cycle hypothesis, but they do not support the view that income inequality promotes savings propensities and that households count on corporate resources to meet their demand for wealth. The absence of a significant relationship between savings and inequality might be attributed chiefly to the crudeness of data on income distribution. ²² However, the lack of a negative impact of corporate savings underscores the households' perception that large, widely held corporations in industrial countries are independent of shareholder control, whereby households do not take into account corporate distribution policy in their decision to save. ²³

²² These data have been compiled by Jain (1975) from a large variety of primary sources.

²³ Alternatively, part of the explanation may lie in the relatively smaller proportion of shareholders in most countries other than the United States.

More important, the coefficients of the social security variables, and the corresponding elasticity estimates, suggest that in industrial countries the retirement effect overwhelms the net wealth effect of old-age transfers, while other transfers tend to exercise a negative wealth effect on savings, reflecting asset substitution. If the influence of social security is tested with the payroll tax rate instead of the benefit rates, it seems that, on balance, the schemes have a positive impact on household savings—presumably for the most part owing to the retirement effect. Yet, as the social security system grows older, the inducement to save is apparently eroded as enrolled households step up asset substitution, perhaps because of increasing belief in the adequacy of future benefits to provide protection for old age and against current contingencies.

The statistical performance of the model in the unweighted form, shown in Table 2, is on the whole weaker for developing countries, which is not surprising in light of the less reliable underlying data.²⁴ Given the limited number of countries for which national income accounts are broken down between the household and corporate components of the private sector, it was necessary to use data on private instead of household savings and income. By the same token, it was not possible to test the relationship between the household savings ratio and the corporate retention ratio. This impediment, in itself, should not constitute a major drawback for two reasons: first, the corporate share in private savings or income is smaller in developing countries (i.e., for the dozen or so countries where the breakdown is available) than in industrial countries; second, much of the corporate activity is carried out by family-owned enterprises whose savings activity may well be regarded as an extension of household savings behavior.

The coefficients of all the basic exogenous variables display the expected signs, but those of the reciprocal of income, the growth rate, and the inflation rate alone have some significance. Among the social security variables, which—besides the old-age pension and other transfer rates—also include the rates of old-age lump-sum transfers and of loans, only the negative coefficient of the old-age pension rate and the positive coefficient of the age of the system are significant in the unweighted run (4) of the labor-force participation equation.

²⁴ For a survey of empirical evidence regarding savings behavior in developing countries, see Mikesell and Zinser (1973).

Reflecting to a greater extent the behavior of more populated developing countries, the coefficients of several social security variables in Table 4 are highly significant: the rates of old-age pensions and of other transfers with positive and negative signs, respectively, in weighted regression (3); the rates of all old-age transfers with a negative sign, and the age of the system with a positive sign, in regression (4).

Accordingly, the elasticity estimates (based on weighted regression results) for developing countries, shown in the fourth column of Table 5, are larger than the estimates in the second column (based on unweighted results). In either case, the elasticities of the private savings ratio with respect to social security benefit rates are substantially smaller than the corresponding estimates for industrial countries. The weighted estimates for developing countries indicate that an increase of 1 per cent in the old-age pension rate would lead to a rise of less than $1/10$ of 1 per cent in the savings ratio, and an equivalent increase in the rate of other transfers would result in a drop of $1/4$ of 1 per cent in the savings ratio. No savings response to changes in benefit rates is detected in the unweighted estimates.

In contrast to the results for industrial countries, where per capita income has virtually no impact on the propensity to save, in developing countries an increase in income depresses the labor supply of the aged and raises the savings ratio. Although the latter is in line with the extended life-cycle hypothesis, it can also be interpreted as a vindication of the Keynesian view. In any event, the difference in behavior between developed and developing countries may be ascribed to the extended family structure and to the greater variance in per capita income in developing regions. Moreover, in developing countries, the inflation rate performs fairly well as an inverse proxy for the real return on financial savings, the reason being that in many developing countries nominal interest rates—often subject to discretionary ceilings—fail to catch up with rapidly rising prices, so that real interest rates decline and may become negative.

With regard to the wealth and retirement effects of social security on private savings, the unweighted regressions lend support to the null hypothesis—withstanding the possible income effect suggested by the significance of the income variable. At the same time, estimates of the labor-force equation indicate a potentially strong retirement effect of old-age pensions, dampened by the age of the system. The insignificant coefficient of

old-age benefits in the savings equation may be taken to mean that the retirement effect is fully offset by an equally powerful negative net wealth effect.²⁵ But perhaps a more plausible explanation is that neither effect operates, given the social security function of the extended family in many developing countries. In contrast, the weighted-regression results reveal some asset substitution in response to other than old-age transfers in countries with large populations.

All in all, the estimates of the savings function for developing countries are probably subject to considerable measurement error and to some misspecification.²⁶ The problem stems, at least in part, from the heterogeneous nature of the sample countries, which possess diverse cultural, social, and institutional characteristics not captured by the model.²⁷ More explicit account should also be taken of differences in economic environment among developing countries, particularly those involving variations in uncertainty and risk, which are reflected to a limited extent by the rate of inflation.

V. Summary and Conclusion

A model intended to explain differences in savings propensities of households among countries has been formulated in conformity with the absolute-income hypothesis, the permanent-income hypothesis, and an extended version of the life-cycle hypothesis. Comprised of two structural equations—the dependent variables being the average propensity to save of households and the labor-force participation of the aged—this eclectic model is especially useful in that it incorporates the effects of social security schemes. Such schemes provide protection for old age, through periodic pension payments or lump-sum disbursements from provident funds, and against current contingencies, through payments for medical expenses, unemployment, work injury, indigence, and, in some countries, the

²⁵ Support for this interpretation was provided by a two-stage least-squares estimate of the savings equation, in which a significant negative coefficient was obtained for the labor-force participation variable.

²⁶ Indirect evidence of misspecification is provided by relatively low values of the Durbin-Watson statistic, oscillating between 1.4 and 1.7 for regressions (1) through (3) in Tables 2 and 4.

²⁷ The introduction of four regional dummies (for Europe, Latin America, East Asia, and the remaining countries) improved the fits and raised the Durbin-Watson statistic, but without materially altering the results.

extension of loans. Although initially many social security schemes were funded, by now most of them are virtually unfunded, so that payroll taxes form the main source of revenue to finance benefits.

Social security institutions in their present form can have three distinct effects on the household savings ratio. First, the income effect consists of the possible repercussion of changes in benefit or tax rates transmitted through the average level of disposable income and the degree of income inequality. Second, the wealth effect represents the direct savings response of households to expected future benefits. Households may react either by cutting back savings if they perceive such benefits to be an adequate substitute for personal savings, or by raising their savings propensity if social security schemes enhance their awareness of the need to accumulate additional wealth as protection against various contingencies. Third, the retirement effect indicates the positive indirect relationship between old-age benefits and the savings ratio, via changes in the labor supply of the aged; an increase in old-age benefits is likely to induce earlier retirement, which in turn may lead to a higher propensity to save for the longer retirement period. Of these consequences of social security, particularly the wealth and retirement effects have attracted attention and generated controversy in the literature (as opposed to the income effect, which is likely to vanish over the long run, if benefits and taxes have similar incidence on households), and they are also the focus of this analysis.

Estimates of the model using cross sections of 1969–71 average observations, divided into samples of industrial and developing countries, suggest that social security schemes influence decisions on household savings, especially in industrial countries. In these countries, when allowance is made for a differential impact of various types of benefit, the (positive) retirement effect outweighs the (negative) wealth-substitution effect of old-age transfers, while the latter effect prevails for other transfers. An alternative test, performed under the assumption that households consider payroll taxes to be a proxy for future social security benefits, reveals that the positive retirement effect overrides the other effects. However, the results also indicate that the wealth-substitution effect strengthens as the social security system becomes older, apparently because of the gradual rise of household confidence in the system's ability to deliver an adequate stream of benefits.

For developing countries, the statistical power of the estimates is generally lower and the nature of the findings is less conclusive. Despite the significant inverse impact of old-age transfers on the labor supply of the aged, the net effect of these transfers on savings is a draw, implying that the retirement effect and the wealth-substitution effect offset each other. But it is more probable that these effects, as well as the validity of the life-cycle hypothesis, are precluded by the extended family structure, which in many developing countries operates like an unfunded social security system. Nonetheless, transfers for other than old age seem to have a negative net wealth effect on the savings ratio in countries with a relatively large population.

From this evidence, it can be inferred that the expansion of the rate or coverage of old-age social security pensions and of payroll taxes does not have an adverse impact on household savings. If anything, such benefits and taxes are more likely to encourage savings in industrial countries—although this incentive may wear off as the social security institutions mature. There seems to be, however, substitution of other social security transfers for savings in industrial countries and more populated developing countries. Therefore, to some extent, social security can serve as an instrument of resource mobilization if the authorities invest the surplus of social security institutions (at least to the extent that they are funded) in projects with an adequate social marginal rate of return, without inhibiting private savings and investment activity.

Nevertheless, policy decisions with regard to social security benefits and taxation should be made in a broader setting. Investigation should also be undertaken of their consequences on vertical and horizontal equity (taking into account, for instance, the usual regressivity of the payroll tax across income brackets and its uneven coverage of various income sources), the country's comparative advantage, and the choice of factor inputs, over the long run, as well as on internal and external stability over the short run.

APPENDIX

Data were collected for samples of 14 industrial and 40 developing countries from the following sources: ²⁸

²⁸ Complete information on the sources is provided in the References.

- (A) International Bank for Reconstruction and Development (1976);
- (B) International Labor Office (1976);
- (C) International Labor Office (1977);
- (D) International Monetary Fund (various issues);
- (E) Kravis, Heston, and Summers (1978);
- (F) Organization for Economic Cooperation and Development (1971);
- (G) Organization for Economic Cooperation and Development (1978);
- (H) Jain (1975);
- (I) United Nations (various issues);
- (J) United Nations (1976);
- (K) U.S. Department of Health, Education, and Welfare (1976);
- (L) unpublished data from national social security agencies.

The industrial countries included in the sample are Australia, Austria, Belgium, Canada, Denmark, the Federal Republic of Germany, France, Italy, Japan, the Netherlands, Sweden, Switzerland, the United Kingdom, and the United States. The developing countries are Brazil, Burma, Chile, Colombia, Costa Rica, Cyprus, the Dominican Republic, Ecuador, Egypt, El Salvador, Finland, Greece, Guatemala, Honduras, India, Ireland, Israel, Jamaica, Korea, Libyan Arab Jamahiriya, Malaysia, Malta, Mauritania, Mauritius, Mexico, Morocco, Nicaragua, Niger, Nigeria, Panama, the Philippines, Portugal, Senegal, Singapore, the Syrian Arab Republic, Thailand, Trinidad and Tobago, Tunisia, Turkey, and Venezuela.

All data refer to country observations for the period 1969-71 unless indicated with a subscript denoting the last two digits of the year. The variables used in the regressions are ²⁹

$$SH/YH = SH/(SH + CH)$$

$$SP/YP = SP/(SP + CH)$$

$$LPA = WP(+65)_{70}/P(+65)_{70}$$

$$1/YH = [GDP/(SH + CH)]/IDP$$

$$1/YP = [GDP/(SP + CH)]/IDP$$

$$G = \ln^{-1}[(\ln RDP_{73} - \ln RDP_{64})/9] - \ln^{-1}[(\ln WP_{70} - \ln WP_{60})/10]$$

$$NRR = [LRI(1 - MYT_{72})] - \Delta CPI/CPI$$

$$INF = \Delta CPI/CPI$$

$$RE/YH = (SP - SH)/(SH + CH)$$

$$INQ = GC$$

$$DA = P(+65)_{70}/P(20-65)_{70}$$

$$DM = P(-20)_{70}/P(20-65)_{70}$$

$$LEA = LE(65)_{70}$$

$$SSP/YH = [SSP/(SH + CH)] \cdot P_{70}/P(+65)_{70}$$

$$SSP/YP = [SSP/(SP + CH)] \cdot P_{70}/P(+65)_{70}$$

$$SSF/YP = [SSF/(SP + CH)] \cdot P_{70}/P(+65)_{70}$$

$$SSO/YH = SSO/(SH + CH)$$

$$SSO/YP = SSO/(SP + CH)$$

$$SSL/YP = SSL/(SP + CH)$$

$$SST/CN = SST/(CE + EN)$$

$$AGE = 1970 - START$$

The underlying data are defined as follows (sources are shown in parentheses):

²⁹ All the variables except *INQ*, *LEA*, and *AGE* have been premultiplied by 100.

- SH*: household savings, in national currency units (J)
SP: private savings (including gross savings of corporations), in national currency units (A)
CH: personal consumption expenditure, in national currency units (J), (A)
GDP: gross domestic product, in national currency units (D)
RDP: real gross domestic product, in national currency units in 1975 prices (D)
IDP: index of real per capita GDP, U. S. value = 100 (E) ³⁰
P: total population, in number of persons (D)
P(+65): population of age 65 or older, in number of persons (C)
P(20-65): population between ages of 20 and 65, in number of persons (C)
P(-20): population of age 20 or younger, in number of persons (C)
WP: total working population, in number of persons (C)
WP(+65): working population of age 65 or older, in number of persons (C)
LEA(65): life expectancy at age 65, in number of years (I)
LRI: nominal interest rate (net of withholding tax where applicable) on long-term bonds, or savings or time deposits (F)
MYT: marginal income tax as a proportion of gross earnings of a married couple with two children where husband earns an average production worker's wages (G)
CPI: consumer price index, 1975 = 100 (D)
GC: Gini coefficient of income inequality (H) ³¹
SSP: expenditure of social security institutions on old-age pension benefits, in national currency units (B)
SSF: expenditure of provident funds on old-age lump-sum benefits, in national currency units (B)
SSO: expenditure of social security institutions on other benefits (i.e., other than *SSP* and *SSF*), in national currency units (B)
SSL: gross flow of personal and housing loans extended by social security institutions, in national currency units (L)
SST: payroll tax revenue (from employee and employer contributions) of social security institutions, in national currency units (B)
CE: compensation of employees, in national currency units (J)
EN: entrepreneurial income, in national currency units (J) ³²
START: year in which basic social security legislation came into force (K).

³⁰ As the original index refers to 1970, the 1969 and 1971 values were calculated with the growth rate of real per capita GDP for the years 1969-70 and 1970-71, respectively, from (D).

³¹ For several countries, for which coefficients were not available, the coefficients of comparable countries were used.

³² Includes withdrawals from the entrepreneurial income of quasi-corporate enterprises for Austria, Belgium, Chile, Denmark, the Federal Republic of Germany, Panama, the Philippines, and Portugal.

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SUMMARIES

Distributional Aspects of Stabilization Programs in Developing Countries— OMOTUNDE JOHNSON and JOANNE SALOP (pages 1-23)

This paper reports the results of some preliminary research into the repercussions, for income distribution, of stabilization programs associated with the use of Fund resources in the upper credit tranches. In the first section, it explores the relationship between the balance of payments and the distribution of income from a theoretical perspective. Here the general concern is whether adjustment influences the distribution of income in some systematic manner; the particular concern is to delineate the conditions under which a decline in the real wage is necessary for adjustment actually to take place. Using neo-classical analysis, one finds that the ratio of the nominal wage to the price of exports must decline, but whether this involves a fall in the overall real wage depends on many variables, including the relative proportions of traded and nontraded goods in the consumer's market basket. Second, it presents a qualitative analysis of the distributional effects of the measures that tend to be included in these programs, viz., ceilings on net credit expansion, currency depreciation, and the relaxation and simplification of exchange restrictions and controls. Finally, drawing on unpublished case studies, it discusses the distributional consequences of stabilization programs in Bolivia (1972-73), Ghana (1966-70), Indonesia (1966-74), and the Philippines (1970-76).

A Supply Framework for Exchange Reform in Developing Countries: The Experience of Sudan—KARIM NASHASHIBI (pages 24-79)

The paper examines the question of exchange rate determination in a developing country with a structural imbalance, quantitative restrictions on trade, and extensive public administration of prices and production. The paper argues that, under conditions of widespread price and cost distortions, the purchasing power parity theory approach to exchange reform coupled with supportive demand management policies is inappropriate in determining the extent of exchange rate adjustment needed and in reorienting the economy toward equilibrium. Drawing on Sudan's experience over the past decade, the paper derives the cost structure of the country's major exports and import substitutes for 1972/73 and 1976/77. Competitiveness—defined as net foreign exchange earned or saved per unit of domestic resources used in the production process after correcting for all price distortions and netting out taxes and subsidies—was derived for seven irrigated crops and three rainfed crops. The results showed that Sudan had a strong comparative advantage in cotton and groundnut cultivation in irrigated areas and in oilseeds in the rainfed areas. The cultivation of cereals in irrigated areas was found to be highly inefficient. The analysis showed that the devaluation in 1972 was necessary to restore the competitiveness of some export crops but that it had little effect on expediting

the movement of exports and on correcting the structural imbalance in the economy. The devaluation was undermined by the reorientation of the cropping pattern toward inefficient crops and by expansionary fiscal and monetary policies that rapidly eroded the gains in competitiveness, as shown by the 1976/77 results. This prompted a further devaluation in 1978. A hypothetical supply curve of exportables as a function of the exchange rate was derived, and the implications of the exchange rate depreciation for income distribution in Sudan were drawn.

The paper argues that when a depreciation serves as an instrument of structural change, a reorientation of investment priorities must take place concurrently with the correction of distortions and the changes in relative prices to ensure the availability of all the supporting services that are the linchpin between an increase in production and an increase in exports. This has implications for demand management policies, which have to be applied selectively, allowing for a resurgence of investment and credit in the competitive external sector and a deflation of other sectors. Moreover, the envisaged adjustment period must be sufficient to allow for the shifts in production and consumption induced by the depreciation and its supportive policies to materialize fully.

The Optimal Basket in a World of Generalized Floating—LESLIE LIPSCHITZ and V. SUNDARARAJAN (pages 80–100)

Recently, policymakers have been discussing the best basket peg for a country seeking stability in a world of generalized floating. This paper argues that the *real* exchange rate is the important policy variable and that, although exchange rate data are available daily, price data are available only after a lag. Consequently, continuous, discretionary fine tuning of the real exchange rate is impossible, and a rule is needed for fixing the nominal exchange rate so that the real exchange rate is stabilized. This rule, or optimal basket, is one that minimizes the variance of the real exchange rate about its equilibrium, while maintaining the average value of the real exchange rate close to its equilibrium over the reference period.

A solution for the optimal basket is derived. In general, the optimal weight of the currency in the basket will differ from the preassigned elasticity weight (which denotes the importance of the currency in the real exchange rate index) because the variances and covariances of exchange rates and relative prices have an important effect on the real exchange rate index. Weights in the optimal basket are chosen to maximize the contribution of this effect to stability. Various cases of the general solution are discussed, with particular emphasis on the conditions under which a single currency peg is optimal.

A numerical illustration of the solution is provided, and a comparison, in terms of relative stability, is made between an optimal basket peg and a basket peg in which simple elasticity weights are used. The question remains as to whether the variances and covariances required to derive the optimal weights are stable over time and therefore useful in setting an exchange rate rule for the future. Since these parameters are of the nature of regression coefficients, their stability can be tested and the results of such tests are presented. It is argued that insofar as these parameters may be estimated from historical data, and may be expected to be stable, the derivation of useful optimal basket weights is feasible.

Why Does the Current Account Matter?—JOANNE SALOP and ERICH SPITÄLLER
(pages 101–34)

This paper focuses on the current account as an indicator of the need for adjustment, its role in the adjustment process, and the implications of possible inconsistencies in countries' desired current account for exchange rate surveillance. Fundamentally, the current account is the difference between the economy's savings and investment. Hence, any criterion for determining the appropriateness of adjustment action, such as a deviation from sustainability or optimality, depends on a corresponding assessment of the levels of savings and investment that underlie the current account. While in the long run the scope for conflict over countries' desired current account is likely to be small, mutual inconsistencies in countries' current account targets are more likely to arise over the short run to medium-run during which the adjustment actually takes place. This is due to the relationship between the current account and the level of employment that may exist at that time. Accordingly, during a period of inadequate demand, a country may find it desirable to maintain its level of aggregate demand and employment through the current account by devaluation. The efficacy of pursuing this strategy—and, by extension, the importance of surveillance—turns on whether the Keynesian model is an appropriate characterization of the supply sector of the economy. Some of the more interesting aspects of the paper are (1) an analysis of the concept of sustainability; (2) the depiction of the supply sector in terms of a framework of rigid real wages versus rigid money wages and the implications for the need for surveillance and the desirability of global expansion; and (3) the inclusion of a survey of official views on the current account.

Estimation of the Timing Asymmetry in International Trade—WILLIAM L. HEMPHILL (pages 135–60)

Because of the time required for transport and for customs procedures, the exports of a country or region in a given period will not all be received and counted as imports by partners during the same period. This article presents a method for estimating the transport lag and for simulating the corresponding asymmetry in international accounts. As the timing asymmetry is shown to be a large and variable portion of the total merchandise asymmetry, the primary use of the results is to explain the discrepancy between global sums of exports and imports—especially in determining the discrepancy to be expected in a consistent set of global trade forecasts. In addition, the model provides an indirect estimate of the proportion of trade invoiced in U. S. dollars.

The availability of data imposes a choice, in estimating the lag, between disaggregation into smaller geographical regions and "disaggregation" into smaller units of time. Annual-data regressions yield plausible estimates for regional groupings of countries, but the time series are found to be extremely collinear; these results are rejected. Monthly data for the world as a whole indicate that about 3 per cent of yearly exports is not received and counted as imports until the following year—an average lag of about 0.6 month. As this estimate is rather shorter than the magnitude often assumed, some direct corroborative evidence is marshaled in its support. The global timing asymmetry is found to have varied between zero and \$6 billion during the early 1970s. The

proportion of trade not invoiced in U. S. dollars is estimated to be on the order of one half, but with a large margin of error—especially if the tentative finding of a decrease in vehicular use of the dollar, starting about 1974, is confirmed by future observations.

The Influence of Social Security on Household Savings: A Cross-Country Investigation—GEORGE KOPITS and PADMA GOTUR (pages 161–90)

This article examines the role of social security schemes in determining intercountry differences in the savings propensities of households. To this end, an eclectic model of long-run household savings behavior is constructed on the basis of the absolute-income, the permanent-income, and the life-cycle hypotheses, incorporating the effects of social security benefits (old-age pensions or lump-sum disbursements, transfers against current contingencies, and loans) and taxes (payroll contributions). At a theoretical level, three types of effect are identified. The income effect consists of the possible repercussion of changes in benefit or tax rates transmitted through the level of disposable income and the degree of income inequality. The wealth effect represents the decline in savings in response to a rise in benefits if households perceive such benefits to be an adequate substitute for personal savings, or the increase in savings if social security schemes enhance the households' awareness of the need to accumulate additional wealth as protection against various contingencies. The retirement effect indicates the positive influence of old-age benefits on the savings ratio through changes in the labor supply of the aged; an increase in old-age benefits may induce earlier retirement, which in turn may raise the propensity to save for the longer retirement period.

The model is estimated on cross sections of 1969–71 average annual observations grouped in samples of industrial and developing countries. The results indicate that in industrial countries the retirement effect outweighs the wealth-substitution effect of old-age pensions, whereas the wealth-substitution effect prevails for other transfers. An alternative test, performed under the assumption that households consider payroll taxes to be a proxy for future benefits also reveals that the retirement effect overrides the other effects. However, the wealth-substitution effect appears to strengthen as the social security system becomes older. In developing countries, the net effect of the benefits is a draw, except in the more populated countries in this sample where transfers other than for old age seem to have a negative net wealth effect on the savings ratio. On the whole, the quality and scope of the data, as well as the statistical power of the regression estimates, are weaker for developing than for industrial countries.

From this evidence, it can be inferred that the expansion of the rate or coverage of old-age pensions and of payroll taxes does not have an adverse impact on household savings. If anything, such benefits and taxes are more likely to encourage savings in industrial countries—although this incentive may wear off as social security institutions mature. There seems to be, however, a substitution of other social security transfers for savings in industrial countries and in more populated developing countries.

RESUMES

Les programmes de stabilisation des pays en développement examinés sous l'aspect de la répartition du revenu — OMOTUNDE JOHNSON et JOANNE SALOP (pages 1-23)

Cet article rend compte des résultats d'un certain nombre de recherches préliminaires sur les conséquences qu'entraînent, pour la répartition du revenu, les programmes de stabilisation dont la réalisation est liée à l'utilisation des ressources du Fonds dans les tranches supérieures de crédit. Dans une première partie, les auteurs explorent la relation entre la balance des paiements et la répartition du revenu en se plaçant sous l'angle théorique. Le but recherché ici est de savoir si, en général, l'ajustement influence la répartition du revenu d'une façon systématique quelconque. Plus particulièrement, les auteurs veulent arriver à déterminer les conditions dans lesquelles une diminution du salaire réel est nécessaire pour que cet ajustement puisse réellement avoir lieu. En faisant appel à l'analyse néo-classique, on s'aperçoit que le ratio du salaire nominal au prix des exportations doit diminuer, mais que cela implique ou non une diminution du salaire réel global dépendra d'un grand nombre de variables, et notamment des proportions relatives de produits marchands et de produits non marchands dans le panier de consommation. Deuxièmement, les auteurs procèdent à une analyse qualitative des effets redistributifs des mesures généralement incluses dans ces programmes comme, par exemple, les plafonds fixant l'expansion nette du crédit, la dévaluation de la monnaie et l'assouplissement ainsi que la simplification des restrictions de change et de contrôle des changes. Finalement, en s'aidant d'études de cas non publiées, les auteurs examinent la façon dont la réalisation de programmes de stabilisation a affecté la répartition du revenu en Bolivie (1972-73), au Ghana (1966-70), en Indonésie (1966-74) et aux Philippines (1970-76).

La réforme de la politique de change dans les pays en développement analysée du point de vue de l'offre : le cas du Soudan — KARIM NASHASHIBI (pages 24-79)

La présente étude traite de la détermination du taux de change dans un pays en développement où existent un déséquilibre structurel, des restrictions quantitatives aux échanges commerciaux et un vaste appareil administratif de réglementation des prix et de la production. L'auteur soutient que, dans une situation caractérisée par des distorsions généralisées des prix et des coûts, une approche fondée sur la théorie de la parité de pouvoir d'achat et renforcée par une politique de gestion de la demande ne permet pas, lorsqu'on souhaite réformer la politique de change, de déterminer l'ampleur de l'ajustement de change requis, ni de réorienter l'économie vers une position d'équilibre. Se fondant sur l'expérience soudanaise des dix dernières années, l'auteur calcule la structure des coûts des principales exportations du pays et des principaux

produits de remplacement des importations pour 1972/73 et 1976/77. La compétitivité — définie par le montant net de devises gagné ou épargné par unité de ressources nationales utilisée dans le processus de production, après correction pour tenir compte de toutes les distorsions de prix et après déduction des impôts et subventions — a été calculée pour sept cultures irriguées et trois cultures pluviales. Les résultats indiquent que le Soudan jouit d'un fort avantage comparatif pour la culture du coton et des arachides dans les régions irriguées et pour les graines oléagineuses dans les régions non irriguées. La culture des céréales dans les régions irriguées s'est avérée très peu rentable. Il ressort de l'analyse que la dévaluation de 1972 a été nécessaire pour rétablir la compétitivité de certaines cultures d'exportation, mais qu'elle n'a guère contribué à accélérer le rythme des exportations, ni à corriger le déséquilibre structurel de l'économie. La dévaluation a été compromise par la réorientation de l'ensemble des cultures vers des cultures non rentables et par l'adoption de politiques budgétaire et monétaire expansionnistes qui ont rapidement réduit à néant les progrès accomplis en matière de compétitivité, comme le montrent les résultats de 1976/77. Cette dégradation a entraîné une nouvelle dévaluation en 1978. L'auteur a tracé une courbe hypothétique de l'offre de produits exportables en fonction du taux de change et tire les conséquences de la dépréciation du taux de change pour la répartition du revenu au Soudan.

L'auteur estime que, lorsqu'une dépréciation est l'instrument de changements structurels, elle doit s'accompagner d'une réorientation de l'ordre des priorités d'investissement, en même temps que de la correction des distorsions et variations des prix relatifs, pour que soit assurée la disponibilité de tous les services de soutien qui sont la cheville essentielle entre l'augmentation de la production et l'augmentation des exportations. Ces mesures ont des conséquences pour la politique de gestion de la demande, qui doit s'appliquer de façon sélective pour permettre un nouvel essor des investissements et du crédit dans le secteur extérieur compétitif et une déflation des autres secteurs. En outre, la période d'ajustement envisagée doit être suffisamment longue pour permettre aux changements provoqués dans la production et la consommation par la dépréciation et les politiques qui l'accompagnent de se réaliser pleinement.

Panier optimal de monnaies dans un monde caractérisé par le flottement généralisé des taux de change — LESLIE LIPSCHITZ et V. SUNDARARAJAN (pages 80-100)

Les responsables de la politique économique se sont récemment posé la question de savoir quel est, pour un pays en quête de stabilité dans un monde caractérisé par le flottement généralisé des taux de change, le meilleur panier par rapport auquel fixer le taux de sa monnaie. Les auteurs de la présente étude soutiennent que c'est le taux de change *réel* qui est la variable de politique économique importante, mais ils font remarquer que, si les données relatives aux taux de change sont disponibles quotidiennement, les données sur les prix ne sont connues qu'avec un certain retard. Il est donc impossible de procéder à un ajustement précis, continu et discrétionnaire du taux de change réel; aussi faut-il élaborer une règle permettant de fixer le taux de change nominal de façon à stabiliser le taux de change réel. Cette règle, dite du panier

optimal, minimise la variance du taux de change réel par rapport à son niveau d'équilibre tout en maintenant la valeur moyenne du taux de change réel à un niveau proche de sa position d'équilibre pendant la période de référence.

On obtient alors une formule qui permet de calculer le panier optimal. En règle générale, la pondération optimale de la monnaie figurant dans le panier différera de la pondération fondée sur des élasticités fixées d'avance (laquelle traduit l'importance de la monnaie dans l'indice du taux de change réel) car les variances et covariances des taux de change et des prix relatifs ont un effet important sur l'indice du taux de change réel. Les pondérations du panier optimal sont précisément choisies afin de maximiser la contribution de cet effet à la stabilité. Divers cas particuliers de la formule générale sont examinés, l'accent étant mis sur les conditions dans lesquelles l'adoption d'un taux de change fixe, mais ajustable, par rapport à une seule monnaie représente la solution optimale.

Un exemple de calcul numérique est présenté et une comparaison est faite, en termes de stabilité relative, entre la fixation du taux par rapport à un panier optimal et sa fixation par rapport à un panier dans lequel on utilise de simples pondérations fondées sur des élasticités. Reste à savoir si les variances et covariances requises pour calculer les pondérations optimales sont stables dans le temps et aident, de ce fait, à définir pour l'avenir une règle en matière de taux de change. Ces paramètres ayant le caractère de coefficients de régression, il est possible de tester leur stabilité, et les résultats de ces tests sont présentés. Les auteurs soutiennent que, dans la mesure où ces paramètres peuvent être estimés à partir de données antérieures et où l'on peut s'attendre à ce qu'ils soient stables, il est possible de calculer, pour le panier optimal, des coefficients de pondération utiles.

Pourquoi le compte courant a-t-il de l'importance? — JOANNE SALOP et ERICH SPITÄLLER (pages 101-34)

La présente étude met l'accent sur le compte courant en tant qu'indicateur du besoin d'ajuster, son rôle dans le processus d'ajustement et sur les conséquences d'incompatibilités possibles dans le compte courant recherché par les pays pour la surveillance des taux de change. Fondamentalement, le compte courant représente la différence entre l'épargne et les investissements d'une économie. Ainsi, tout critère de détermination du caractère approprié de mesures d'ajustement, tel qu'un écart avec la durabilité ou l'optimalité, dépend d'une évaluation correspondante des niveaux d'épargne et d'investissement qui sous-tendent le compte courant. Il est probable, à la longue, que les possibilités de conflit au sujet du compte courant que les pays chercheront à réaliser seront faibles, mais il est plus vraisemblable que les objectifs arrêtés par les pays en matière de compte courant feront apparaître des incompatibilités mutuelles dans la période allant du court au moyen terme durant lequel l'ajustement s'effectue. Cela est dû aux relations qui existent entre le compte courant et le niveau de l'emploi qui peut exister à ce moment-là. En conséquence, au cours d'une période pendant laquelle la demande est insuffisante, il se peut qu'un pays juge souhaitable de maintenir, à l'aide d'une dévaluation, le niveau de la demande globale et de l'emploi assuré par le biais du compte courant. L'efficacité de la poursuite de cette stratégie — et, par

extension, l'importance de la surveillance — dépend de la question de savoir si le modèle keynésien caractérise de façon appropriée le secteur de l'offre de l'économie. Certains des aspects plus intéressants de l'étude sont : 1) une analyse du concept de durabilité, 2) la description du secteur de l'offre en fonction d'un cadre de salaires réels rigides par opposition aux salaires monétaires rigides, et les conséquences pour le besoin de surveillance et l'opportunité d'une expansion globale, et 3) l'inclusion d'une enquête présentant des points de vue officiels sur le compte courant.

Estimation de l'asymétrie chronologique dans le commerce international —
WILLIAM L. HEMPHILL (pages 135-60)

Compte tenu du délai de transport et des formalités de douane, les exportations d'un pays ou d'une région, dans une période donnée, ne seront pas toutes réceptionnées et comptabilisées comme des importations par les partenaires durant la même période. Le présent article décrit une méthode d'estimation du retard intervenant dans le transport et de simulation de l'asymétrie correspondante dans les comptes internationaux. L'asymétrie chronologique étant indiquée comme une portion importante et variable de l'asymétrie totale des marchandises, les résultats servent principalement à expliquer l'écart statistique entre les sommes globales des exportations et des importations — notamment pour définir la différence qu'on doit prévoir dans une série compatible de prévisions commerciales globales. En outre, le modèle fournit une estimation indirecte de la proportion du commerce facturée en dollars E.U.

Lorsqu'on estime le retard, les données disponibles imposent un choix entre la désagrégation en régions géographiques plus petites et la "désagrégation" en unités de temps plus faibles. Les régressions des données annuelles donnent des estimations plausibles pour les groupements régionaux de pays, mais on constate que les séries chronologiques sont extrêmement colinéaires; ces résultats sont écartés. Les données mensuelles pour l'ensemble du monde indiquent qu'environ 3 pour 100 des exportations annuelles ne sont pas réceptionnées et comptabilisées comme des importations jusqu'à l'année suivante — un retard moyen d'environ 0,6 mois. Cette estimation étant plutôt plus faible que la grandeur souvent supposée, on rassemble certaines preuves directes à son appui. On constate alors que l'asymétrie chronologique globale a varié entre zéro et 6 milliards de dollars durant le début des années 70. La proportion du commerce non facturée en dollars E.U. est censée être de l'ordre de la moitié, mais avec une forte marge d'erreur, notamment si la constatation provisoire d'une diminution de l'utilisation véhiculaire du dollar, commençant vers 1974, est confirmée par des observations futures.

L'influence de la sécurité sociale sur l'épargne des ménages : analyse par groupes de pays —
GEORGE KOPITS et PADMA GOTUR (pages 161-90)

Le présent article examine le rôle des régimes de sécurité sociale dans les différences qui existent entre les pays dans la propension à épargner des ménages. Pour ce faire, un modèle éclectique du comportement à long terme de l'épargne des ménages, incorporant les effets des prestations sociales (pen-

sions de vieillesse ou versements forfaitaires, transferts visant à couvrir les risques courants et prêts) et des impôts (cotisations salariales), est construit sur la base des hypothèses du revenu absolu, du revenu permanent et du cycle de vie. A un niveau théorique, trois types d'effets sont identifiés. L'effet de revenu décrit la répercussion éventuelle des variations des taux de prestation ou d'imposition, qui se transmet par l'intermédiaire du niveau de revenu disponible et du degré d'inégalité des revenus. L'effet de patrimoine reflète, soit la diminution de l'épargne sous l'effet d'une augmentation des prestations si les ménages estiment que ces prestations sont suffisantes pour remplacer l'épargne individuelle, soit l'accroissement de l'épargne si les régimes de sécurité sociale rendent les ménages davantage conscients de la nécessité d'augmenter leur patrimoine pour se protéger contre certains imprévus. Enfin, l'effet de retraite décrit l'influence positive que les prestations-vieillesse exercent sur le taux d'épargne par l'intermédiaire des variations de l'offre de la main-d'œuvre composée de personnes âgées; une augmentation des prestations-vieillesse peut encourager les retraites anticipées, qui peuvent, à leur tour, accroître la propension à épargner en prévision d'une retraite plus longue.

Le modèle est estimé à partir de moyennes d'observations effectuées pendant la période 1969-71, sur deux échantillons distincts pour les pays industriels et pour les pays en développement. Les résultats montrent que, dans les pays industriels, l'effet de retraite l'emporte sur l'effet de remplacement du patrimoine qu'exercent les pensions de vieillesse, alors que c'est l'effet de remplacement du patrimoine qui domine pour les autres transferts. Un autre test, effectué à partir de l'hypothèse que les ménages considèrent les cotisations salariales comme une approximation de leurs prestations futures, révèle aussi que l'effet de retraite l'emporte sur les autres effets. Toutefois, l'effet de remplacement du patrimoine paraît se renforcer à mesure que le système de sécurité sociale vieillit. Dans les pays en développement, l'effet net exercé par les prestations sur l'épargne est nul, sauf dans les pays les plus peuplés figurant dans l'échantillon étudié, où les transferts autres que ceux effectués au titre de la vieillesse semblent exercer un effet de patrimoine net négatif sur le taux d'épargne. Dans l'ensemble, la qualité des données et la couverture statistique, de même que le pouvoir explicatif des estimations de régression, sont plus faibles pour les pays en développement que pour les pays industriels.

A partir de là, on peut déduire que l'augmentation du taux ou l'élargissement de la couverture des pensions de vieillesse et des cotisations salariales n'ont pas d'incidence défavorable sur l'épargne des ménages. Ces prestations et ces cotisations sont même davantage de nature à encourager l'épargne dans les pays industriels — quoique cette incitation puisse disparaître à mesure que les institutions de sécurité sociale atteignent leur plein développement. Toutefois, dans les pays industriels comme dans les pays en développement les plus peuplés, il semble que les autres transferts de la sécurité sociale se substituent à l'épargne.

RESUMENES

Los programas de estabilización y la distribución del ingreso en los países en desarrollo—OMOTUNDE JOHNSON y JOANNE SALOP (páginas 1-23)

En este trabajo se presentan los resultados de estudios preliminares sobre la repercusión que tienen en la distribución del ingreso los programas de estabilización vinculados al uso de los recursos del Fondo en los tramos superiores de crédito. En la primera sección se analiza la relación entre la balanza de pagos y la distribución del ingreso desde el punto de vista teórico. En esta sección el objetivo general es determinar si el ajuste influye en la distribución del ingreso de manera sistemática, mientras que el objetivo específico es determinar las circunstancias que harían necesaria una disminución del salario real para que tenga lugar el ajuste. Mediante un análisis neoclásico se deduce que debe disminuir la relación entre el salario nominal y el precio de las exportaciones, pero la posibilidad de que esto traiga aparejada o no una disminución del salario real global depende de numerosas variables, entre ellas la proporción relativa que tengan los productos que son objeto de comercio, y los que no lo son, en la cesta utilizada para calcular el índice de precios al consumidor. Además, se presenta un análisis cualitativo del efecto que ejercen en la distribución del ingreso las medidas que se tiende a incluir en dichos programas, como la imposición de topes a la expansión neta del crédito, la depreciación de la moneda, y la liberalización y simplificación de las restricciones y controles cambiarios. Finalmente se analiza, en base a estudios inéditos de casos, la influencia que tuvieron en la distribución del ingreso los programas de estabilización aplicados en Bolivia (1972-73), Filipinas (1970-76), Ghana (1966-70) e Indonesia (1966-74).

Análisis de la oferta para la reforma cambiaria en países en desarrollo: La experiencia de Sudán—KARIM NASHASHIBI (páginas 24-79)

En este trabajo se examina la determinación del tipo de cambio en un país en desarrollo que tiene un desequilibrio estructural, restricciones cuantitativas al comercio y un amplio grado de administración pública de los precios y la producción. En el trabajo se aduce que, cuando existen distorsiones generalizadas de los precios y costos, la teoría de la paridad del poder adquisitivo aplicado a la reforma cambiaria, unida a políticas de regulación de la demanda que la respalden, resulta inadecuado para determinar la magnitud del ajuste del tipo de cambio que se necesita y para reorientar la economía hacia el equilibrio. Tomando por base la experiencia de Sudán durante el último decenio, en este trabajo se obtiene la estructura del costo de las principales exportaciones y sustitutos de importaciones del país para los períodos 1972/73 y 1976/77. Se calculó la competitividad —definida como las divisas netas obtenidas o ahorradas por unidad de recursos internos usada en el proceso de producción, después de efectuar las rectificaciones correspondientes a todas las dis-

torsiones de los precios y deducir los impuestos y subsidios— de siete cultivos de regadío y tres cultivos de secano. Los resultados indicaron que Sudán tenía una gran ventaja comparativa en el cultivo del algodón y el maní en áreas regadas y en el de semillas oleaginosas en las zonas de secano. Se determinó que el cultivo de cereales en zonas regadas era muy ineficiente. El análisis demostró que fue necesario efectuar la devaluación de 1972 para restablecer la competitividad de algunos cultivos de exportación, pero tuvo muy poco efecto en lo que respecta a estimular las exportaciones y corregir el desequilibrio estructural de la economía. La devaluación se vio menoscabada por la reorientación de los cultivos, con lo cual aumentaron los cultivos ineficientes, y por la política fiscal y monetaria expansionista que redujo rápidamente la mejora de competitividad lograda, como lo indican los resultados de 1976/77. Esto dio origen a una nueva devaluación en 1978. Se calculó una curva de oferta hipotética de productos exportables como función del tipo de cambio y se dedujeron las repercusiones de la depreciación del tipo de cambio en la distribución del ingreso en Sudán.

En este trabajo se aduce que cuando una depreciación sirve de instrumento de un cambio estructural, al mismo tiempo que se reorientan las prioridades de inversión hay que corregir las distorsiones y las variaciones de los precios relativos a fin de garantizar la disponibilidad de todos los servicios auxiliares que constituyen el vínculo entre un aumento de producción y un aumento de la exportación. Esto repercute en las políticas de regulación de la demanda, que deben aplicarse de manera selectiva, para permitir el resurgimiento de la inversión y el crédito en el sector externo competitivo y la deflación de otros sectores. Además, el período de ajuste previsto debe ser suficientemente largo para permitir que se concreten los cambios de orientación de la producción y del consumo causados por la depreciación y las políticas que la hayan respaldado.

La cesta óptima en un mundo de flotación generalizada—LESLIE LIPSCHITZ y V. SUNDARARAJAN (páginas 80–100)

Ultimamente, los rectores de la política económica han estado tratando de decidir cuál es la mejor cesta para vincular la moneda de un país que busque la estabilidad en un mundo de flotación generalizada. En este trabajo se mantiene que el tipo de cambio *real* es la variable de política importante y que, si bien se dispone diariamente de los datos sobre tipos de cambio, los datos sobre precios se obtienen con desfase. Por consiguiente, es imposible aquilatar de forma continua y discrecional el tipo de cambio real, y se necesita una regla para fijar el tipo de cambio nominal de tal forma que quede estabilizado el real. Esta regla, o cesta óptima, es la que minimice la varianza del tipo de cambio real en torno al equilibrio, manteniendo al propio tiempo cerca de su punto de equilibrio durante el período de referencia el valor medio de tipo de cambio real.

Se obtiene una solución para la cesta óptima. En general, la ponderación óptima de la moneda de la cesta diferirá de la ponderación previamente asignada a la elasticidad (la cual indica la importancia de la moneda en el índice del tipo de cambio real) porque las varianzas y covarianzas de los tipos de cambio y precios relativos tienen un efecto importante en el índice del tipo de cambio real. Se eligen las ponderaciones de la cesta óptima de forma que se maximice

la contribución de dicho efecto a la estabilidad. Se examinan varios casos de la solución general, dando importancia especial a las condiciones en las cuales resulta óptima la vinculación a una sola moneda.

Se presenta un ejemplo numérico de la solución, y se efectúa una comparación, en cuanto a la estabilidad relativa, entre la vinculación a una cesta óptima y la vinculación a una cesta en la que se utilicen ponderaciones sencillas de la elasticidad. Lo que queda por resolver es si son estables a lo largo del tiempo, y por lo tanto útiles para fijar una regla del tipo de cambio para el futuro, las varianzas y covarianzas que se necesitan para obtener las ponderaciones óptimas. Como estos parámetros tienen carácter de coeficiente de regresión, puede someterse a prueba la estabilidad de los mismos y se presentan los resultados de dicha prueba. Se aduce que, dado que pueden estimarse estos parámetros basándose en datos históricos, y que lo probable es que sean estables, es factible obtener ponderaciones útiles para la cesta óptima.

¿Por qué importa la balanza en cuenta corriente? — JOANNE SALOP y ERICH SPITÄLLER (páginas 101-34)

En el presente trabajo se estudia la balanza en cuenta corriente como indicador de la necesidad de ajuste, su función en el proceso de ajuste y las implicaciones de las posibles incongruencias en las cuentas corrientes deseadas por los países en cuanto a la supervisión de los tipos de cambio. Fundamentalmente, la balanza corriente es la diferencia entre el ahorro y la inversión de una economía. Por tanto, los criterios para determinar si son apropiadas las medidas de ajuste, tales como una desviación con respecto al punto en que son sostenibles u óptimos, dependen de una evaluación correspondiente de los niveles de ahorro e inversión a los cuales se mide la balanza corriente. Si bien, a largo plazo, lo probable es que la posibilidad de conflicto con motivo de la balanza corriente deseada por los países sea pequeña, lo más probable es que las incongruencias mutuas en los objetivos de balanza en cuenta corriente surjan durante el largo o mediano plazo durante el cual se lleva a cabo el ajuste. Esto se debe a la relación entre la balanza corriente y el nivel de empleo que exista en ese momento. Por tanto, durante un período de demanda insuficiente, puede que a un país le parezca conveniente mantener su nivel de demanda agregada y empleo a través de la balanza corriente mediante una devaluación. La eficacia de seguir esta estrategia —y, por extensión, la importancia de la supervisión de los tipos de cambio— depende de que el modelo keynesiano constituya una caracterización apropiada del sector de oferta de la economía. Algunos de los aspectos más interesantes del trabajo son: 1) un análisis del concepto de “carácter sostenible”; 2) la presentación del sector de oferta conforme a un marco de salarios reales rígidos frente a salarios monetarios rígidos y las implicaciones de la necesidad de supervisión de los tipos de cambio y la conveniencia de expansión global, y 3) la inclusión de una enumeración de opiniones oficiales sobre la balanza en cuenta corriente.

Estimación de la asimetría cronológica en el comercio internacional—WILLIAM L. HEMPHILL (páginas 135-60)

Debido al tiempo requerido para el transporte y los trámites aduaneros, no

toda la exportación de un país o región correspondiente a un determinado período será recibida y considerada como importación por los países destinatarios durante ese mismo período. En el presente artículo se expone un método para estimar el desfase debido al transporte y simular la correspondiente asimetría de las cuentas internacionales. Como la asimetría cronológica es, según se indica, una parte importante y variable de la asimetría total atribuible a mercancías, los resultados obtenidos sirven principalmente para explicar la diferencia existente entre las sumas globales de importación y exportación, y en especial para determinar las diferencias que cabe esperar en una serie coherente de previsiones del comercio mundial. Además, el modelo permite una estimación indirecta de la parte del comercio que viene facturada en dólares de EE.UU.

Habida cuenta de los datos disponibles, al estimar el desfase es necesario elegir entre desagregar en regiones geográficas menores y “desagregar” en unidades de tiempo menores. Las regresiones de datos anuales arrojan estimaciones verosímiles respecto a grupos regionales de países, pero se observa que las series cronológicas son sumamente colineales, razón por la cual se desechan esos resultados. Los datos mensuales relativos a la totalidad de los países indican que aproximadamente el 3 por ciento de la exportación anual no se recibe ni se considera como importación hasta el año siguiente, con un desfase medio de alrededor de 0,6 meses. Como esta estimación arroja una magnitud inferior a la que suele suponerse, se exponen algunas pruebas directas en su apoyo. Los resultados indican que la asimetría cronológica global ha oscilado entre cero y \$6.000 millones durante los primeros años de la década de los setenta. Se calcula que la parte del comercio no facturada en dólares de EE.UU. es del orden del 50 por ciento, pero con un gran margen de error, en especial si llegara a confirmarse, gracias a observaciones futuras, la conclusión provisional según la cual a partir de 1974 aproximadamente el dólar se ha venido utilizando menos como moneda vehículo.

La influencia de los seguros sociales sobre el ahorro de los hogares: un análisis transversal de países—GEORGE KOPITS y PADMA GOTUR (páginas 161-90)

En este artículo se examina la función que desempeñan los sistemas de seguros sociales en la determinación de las diferencias entre países en cuanto a la propensión al ahorro de los hogares. Para ello, se construye un modelo ecléctico del comportamiento a largo plazo del ahorro de los hogares basado en las hipótesis del ingreso absoluto, el ingreso permanente, y el ciclo vital, incorporando los efectos de las prestaciones de los seguros sociales (pensión de vejez o pago de suma global, transferencias para contingencias corrientes y préstamos) y los impuestos (aportaciones con cargo a las nóminas). Al nivel teórico, se identifican tres clases de efectos. El efecto ingreso consiste en las repercusiones posibles de las variaciones en las tasas de prestación o tributarias transmitidas a través del nivel de ingreso disponible y el grado de desigualdad del ingreso. El efecto patrimonio representa, o bien la disminución del ahorro como reacción ante un aumento de las prestaciones si los hogares conciben estas últimas como un sustituto adecuado del ahorro personal, o un aumento del ahorro si los sistemas de seguros sociales hacen a los hogares más conscientes de la necesidad de acumular un mayor patrimonio como protección contra diversas contingencias. El efecto jubilación indica la influencia

positiva de las prestaciones de vejez sobre la tasa de ahorro a través de variaciones en la oferta de trabajo de los ancianos; un aumento en las prestaciones de vejez puede originar la jubilación anticipada, lo cual a su vez puede elevar la propensión al ahorro en previsión de un período de retiro más largo.

Se estima el modelo en secciones transversales de observaciones medias para 1969-71, agrupadas en muestras de países en desarrollo e industriales. Los resultados indican que en los países industriales el efecto de la jubilación compensa con creces el efecto sustitución del patrimonio de las pensiones de vejez, mientras que en otras transferencias predomina el efecto sustitución del patrimonio. Otra comprobación, realizada bajo el supuesto de que los hogares consideren los impuestos sobre la nómina como una aproximación de las prestaciones futuras, indica también que el efecto jubilación domina a los otros efectos. No obstante, el efecto sustitución del patrimonio parece fortalecerse al aumentar la antigüedad del sistema de seguros sociales. En los países en desarrollo, el efecto neto de las prestaciones queda neutralizado, salvo en los países más poblados de la muestra, en los que las transferencias distintas de las de vejez parecen tener un efecto patrimonio neto negativo sobre la tasa de ahorro. En conjunto, la calidad y la amplitud de los datos, así como la potencia estadística de las estimaciones de regresión son bastante más débiles para los países en desarrollo que para los industriales.

Con estas pruebas puede inferirse que la ampliación de la tasa o cobertura de las pensiones de vejez y de los impuestos sobre la nómina no tiene un impacto adverso en el ahorro de los hogares. Si acaso, lo más probable es que dichas prestaciones e impuestos alienten el ahorro en los países industriales, aunque pueda disminuir este incentivo con la antigüedad de las instituciones de seguros sociales. Sin embargo, parece haber una sustitución del ahorro por otras transferencias de los seguros sociales en los países industriales y en los países en desarrollo más poblados.

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